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of Basic Education

These workbooks have been developed for the children of South Africa under the leadership of the Minister of Basic Education, Mrs Angie Motshekga, and the Deputy Minister of Basic Education, Mr Enver Surty.

The Rainbow Workbooks form part of the Department of Basic Education's range of interventions aimed at improving the performance of South African learners in the first six grades. As one of the priorities of the Government's Plan of Action, this project has been made possible by the generous funding of the National Treasury. This has enabled the Department to make these workbooks, in all the official languages, available at no cost.

We hope that teachers will find these workbooks useful in their everyday teaching and in ensuring that their learners cover the curriculum. We have taken care to guide the teacher through each of the activities by the inclusion of icons that indicate what it is that the learner should do.

We sincerely hope that children will enjoy working through the book as they grow and learn, and that you, the teacher, will share their pleasure.

We wish you and your learners every success in using these workbooks.

Rainbow WORKBOOKS

MATHEMATICS IN ENGLISH
GRADE 8 – BOOK 1
TERMS 1 & 2
ISBN 978-1-4315-0222-6

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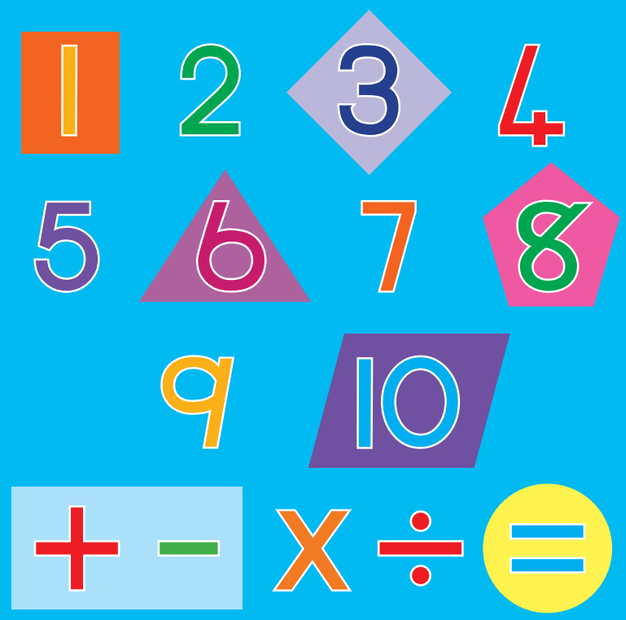

MATHEMATICS IN ENGLISH – Grade 8 Book 1

ISBN 978-1-4315-0222-6



MATHEMATICS IN ENGLISH

Book 1
Terms 1 & 2

Name:

Class:

basic education
Department:
Basic Education
REPUBLIC OF SOUTH AFRICA



Published by the Department of Basic Education
222 Struben Street
Pretoria
South Africa

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Third edition 2013

ISBN 978-1-4315-0222-6

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4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80
5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120
7	14	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140
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9	18	27	36	45	54	63	72	81	90	99	108	117	126	135	144	153	162	171	180
10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200
11	22	33	44	55	66	77	88	99	110	121	132	143	154	165	176	187	198	209	220
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14	28	42	56	70	84	98	112	126	140	154	168	182	196	210	224	238	252	266	280
15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240	255	270	285	300
16	32	48	64	80	96	112	128	144	160	176	192	208	224	240	256	272	288	304	320
17	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	289	306	323	340
18	36	54	72	90	108	126	144	162	180	198	216	234	252	270	288	306	324	342	360
19	38	57	76	95	114	133	152	171	190	209	228	247	266	285	304	323	342	361	380
20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	380	400

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39

Grade 8

Rainbow WORKBOOKS

Mathematics in ENGLISH



ENGLISH Book 1

Name:

0 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

1 Doing calculations

To solve problems we need to know that we can use different words for addition, subtracting, multiplication and division. Think of some of them.

+	-	X	÷



Note that the first 16 worksheets will be revision activities.

1. Solve:

a. 27 835 + 32 132

b. 45 371 + 12 625

c. 51 832 + 32 749

2. Solve:

a. 457 834 - 325 613

b. 788 569 - 123 479

c. 384 789 - 325 894

3. Solve:

a. 14 815 x 38

b. 29 783 x 24

c. 38 765 x 36

4. Solve:

a. $22\overline{)36842}$

b. $63\overline{)96431}$

c. $45\overline{)76593}$

5. Give an example of each:

Commutative:
Means that when combining numbers you can change or swap the order in which you count or multiply the numbers and still get the same answer.

_____

Associative:
Means that when adding it doesn't matter how you group the numbers you are adding.

_____

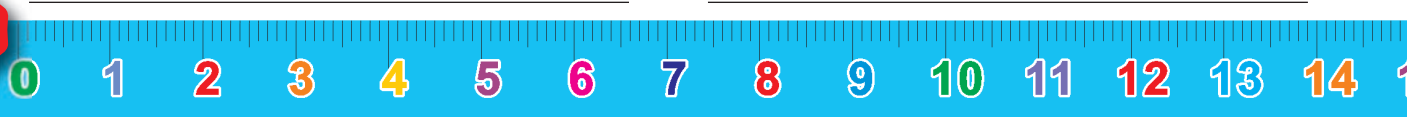
What is **arithmetic**?

Arithmetic is the oldest and most basic part of mathematics.

It deals with the properties of numbers and the handling of numbers and quantity.

It is used by almost everyone for both simple and complex tasks, from simple everyday counting tasks to complicated business and scientific calculations.

In common usage, arithmetic refers to the basic rules for the operations of addition, subtraction, multiplication and division with smaller values of numbers.



6. Use the commutative property to make the equation equal.

Example: 4 + 6 =
4 + 6 = 6 + 4
10 = 10

a. 3 + 4 =

b. 8 + 4 =

7. Use the commutative property to make the equation equal.

Example: a + b =
a + b = b + a

a. c + d =

b. f + g =

8. Use the commutative property to make the equation equal.

Example: 2 x 3 =
2 x 3 = 3 x 2
6 = 6

a. 4 x 5 =

b. 7 x 9 =

9. Use the commutative property to make the equation equal.

Example: a x b
a x b = b x a
ab = ab

a. x x c =

b. m x n

10. Use zero as the identity of addition, or one as the identity of multiplication to solve the following:

a. a x 1 =

b. b x __ = b

c. e + 0 =

Problem solving

Either change the question into a number sentence or solve it.

What should I add to a number so that the answer will be the same as the number?

What should I multiply a number by so that the answer will be the same as the number?

If a x (b + c) = (a x b) + (a x c), and a = -3, b = -5 and c = -2. Substitute and solve the equation.

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

2 Multiples and factors

What did we learn before?

Multiples are the result of multiplying by an integer.
E.g. 3 x 4 = 12. The multiples of 3 are: 3, 6, 9, ...

Factors are the numbers you multiply together.
E.g. 3 and 4 are factors of 12. All the factors of 12 are 1, 2, 3, 4, 6, 12.
The multiples of 3 are: 3, 6, 9, ...



LCM stands for lowest common multiple

HCF stands for highest common factor

1. What are the first 5 multiples for: **Example:** 3: 3, 6, 9, 12, 15

a. 5 _____ b. 11 _____ c. 8 _____

d. 10 _____ e. 25 _____ f. 50 _____

2. Write down the first 12 multiplies and circle all the common multiples of each of the following pairs of numbers and also identify the lowest common multiple (LCM).

Example: Multiples of 4: {4, 8, 12, 16, (20), 24, 28, 32, 36, (40), 44, 48}
Multiples of 5: {5, 10, 15, (20), 25, 30, 35, (40), 45, 50, 55, 60}
The lowest common multiple is 20.

a. Multiples of 2: {_____}
Multiples of 3: {_____}
LCM: _____

b. Multiples of 8 {_____}
Multiples of 7 {_____}
LCM: _____

c. Multiples of 6: {_____}
Multiples of 5: {_____}
LCM: _____

d. Multiples of 9 {_____}
Multiples of 10 {_____}
LCM: _____

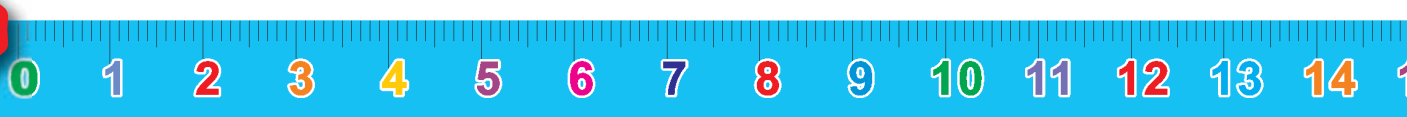
e. Multiples of 12: {_____}
Multiples of 13: {_____}
LCM: _____

f. Multiples of 4 {_____}
Multiples of 12 {_____}
LCM: _____

3. What are the factors of: **Example:** 12: 1, 2, 3, 4, 6 and 12

a. 15 _____ b. 64 _____ c. 24 _____

d. 72 _____ e. 80 _____ f. 45 _____



4. What are the common factors and the highest common factor (HCF) for these pairs of numbers?

Example: Factors of 12 are (1), (2), (3), 4, (6), 12
Factors of 18 are (1), (2), (3), (6), 18
i. 1, 2, 3, 6 ii. HCF = 6

a. Factors of 8: {_____}
Factors of 7: {_____}
HCF: _____

b. Factors of 7 {_____}
Factors of 12 {_____}
HCF: _____

c. Factors of 9: {_____}
Factors of 18: {_____}
HCF: _____

d. Factors of 11 {_____}
Factors of 10 {_____}
HCF: _____

e. Factors of 5: {_____}
Factors of 6: {_____}
HCF: _____

f. Factors of 9 {_____}
Factors of 8 {_____}
HCF: _____

5. Explain the following in your own words:

a. Multiples _____

b. Factors _____

6. How to use multiples and factors in mathematics is a very important skill. Here are some statements. Explain each statement and give examples of your own.

It is useful to break large numbers into smaller ones when you are asked to simplify a fraction.

Sometimes I want to check if my calculator results make sense. I then use factors and multiples to reduce the numbers to their simplest form and get an approximate answer.

Problem solving

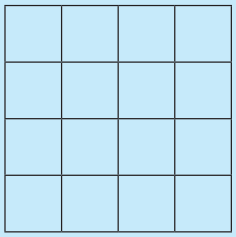
Give all the prime numbers from 0 to 100.

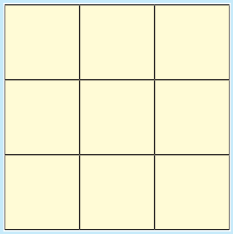
15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

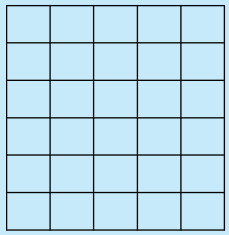
3 Exponents

What square number and root does the diagram represent? Which diagram will this be?

3 x 3 = 9, so the square root of 9 is 3. $\sqrt{9}$

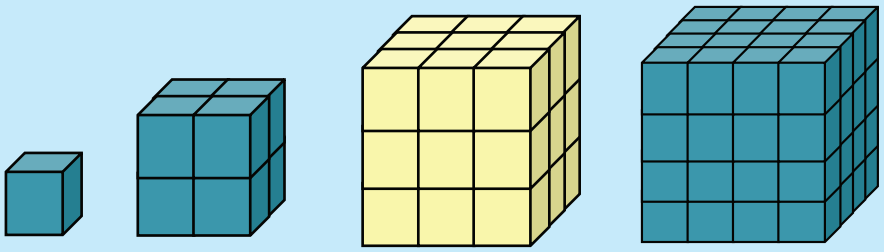






What is a cube root? Which diagram will this be?

3 x 3 x 3 = 27, so the cube root of 27 is 3



The concepts of the square root and the cube root are the prerequisite for many other mathematical concepts. Can you think of a few?



In this activity we revise all the basic concepts you need to know in Grade 8.

You can complete this activity at home.

1. Write the following as square numbers:

Example: 13 x 13 = 13^2 a. 2 x 2 = _____ b. 7 x 7 = _____

2. Write the following as a multiplication sentences:

Example: 15^2 = 15 x 15 a. 12^2 = _____ b. 7^2 = _____

3. Identify the following: a. the base number. b. the exponent. 3^2

_____

4. Write the following as cube numbers:

Example: 6 x 6 x 6 = 6^3 a. 3 x 3 x 3 = _____ b. 2 x 2 x 2 = _____

5. Write the following as multiplication sums:

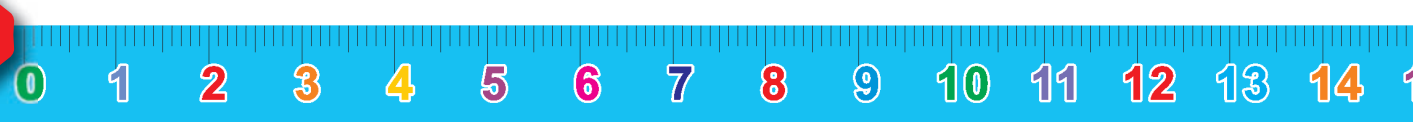
Example: 6^3 = 6 x 6 x 6 a. 2^3 = _____ b. 4^3 = _____

6. First estimate and then calculate the answers:

Example: $5^2 + 3^2 = 25 + 9 = 34$

a. $2^2 + 10^2$ = _____

b. $6^2 - 3^2$ = _____



7. First estimate and then calculate the answers:

Example: $5^2 + 3^2 = 125 + 27 = 152$

a. $6^3 - 5^2 =$

b. $2^2 + 3^3 =$

8. Calculate the cube root:

Example: $\sqrt[3]{27}$
$= \sqrt[3]{3 \times 3 \times 3}$
$= 3$

a. $\sqrt[3]{8}$

b. $\sqrt[3]{164}$

9. Calculate:

Example: $\sqrt{16} + \sqrt{25}$
$= 4 + 5$
$= 9$

a. $\sqrt{9} + \sqrt{16} =$

b. $\sqrt{100} + \sqrt{81} =$

10. Calculate:

Example: $\sqrt[3]{64} + \sqrt[3]{27}$
$= 4 - 3$
$= 1$

a. $\sqrt[3]{216} + \sqrt[3]{27} =$

b. $\sqrt[3]{27} - \sqrt[3]{8} =$

11. Calculate:

Example: $\sqrt[3]{125} + \sqrt{16}$
$= 5 + 4$
$= 9$

a. $\sqrt{25} + \sqrt[3]{8} =$

b. $\sqrt{27} - \sqrt[3]{27} =$

12. Calculate:

Example: $\sqrt[3]{27} + \sqrt[3]{3} - \sqrt{25}$
$= 3 + 9 - 5$
$= 7$

a. $\sqrt[3]{216} + 4^2 - \sqrt{16} =$

b. $9^2 - \sqrt[3]{27} + \sqrt{4} =$

13. How fast can you calculate the following?

Example: $10 \times 10 \times 10 \times 10 = 10\,000$

a. $10 \times 10 =$ _____

b. $10 \times 10 \times 10 \times 10 \times 10 =$ _____

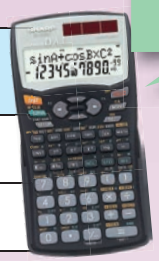
continued ☛

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

3b Exponents (continued)

14. Complete the table:

Sum	Exponential format	Answer
a. 10 x 10	10^2	100
b. 10 x 10 x 10 x 10 x 10 x 10		



You can check your answers using a scientific calculator.

15. Calculate:

Example: $10^4 + 10^3$
$= 10\,000 + 1\,000$
$= 11\,000$

a. $10^3 + 10^2 =$

b. $10^4 + 10^6 =$

16. Calculate:

Example: $4 + 10^3$
$= 4 + 1\,000$
$= 1\,004$

a. $5 + 10^4 =$

b. $10^5 \times 9 =$

17. Calculate:

Example: $2 \times 10^4 + 3 \times 10^5$
$= 2 \times 10\,000 + 3 \times 100\,000$
$= (2 \times 10\,000) + (3 \times 100\,000)$
$= 20\,000 + 300\,000$
$= 320\,000$

a. $3 \times 10^3 + 4 \times 10^4 =$

b. $8 \times 10^4 + 3 \times 10^2 =$

18. Calculate:

Example: $2 \times 10^4 + 3 \times 10^3 + 4 \times 10^5$
$= 2 \times 10\,000 + 3 \times 1\,000 + 4 \times 100\,000$
$= (2 \times 10\,000) + (3 \times 1\,000) + (4 \times 100\,000)$
$= 20\,000 + 3\,000 + 400\,000$
$= 423\,000$

a. $1 \times 10^2 + 8 \times 10^5 + 3 \times 10^6 =$

19. Estimate then calculate:

Example: $2^2 + 2^3 = 4 + 8 = 12$

a. $2^2 + 12^2 =$ _____

b. $4^2 + 10^2 =$ _____



20. Estimate then calculate:

Example: $2^2 + 3^3 + 4^2 = 4 + 27 + 16 = 47$

a. $2^2 + 4^3 + 3^2 =$

_____

21. How fast can you calculate the following?

a. $4^2 =$ _____ b. 6^2 _____

22. Calculate:

Example: $(12 - 9)^3$
$= (3)^3$
$= 27$

a. $(8 - 4)^3 =$

b. $(7 + 1)^2 =$

23. Write a sum for and use your calculator to calculate the answer.

Example: 18
$= 18 \times 18 \times 18 \times 18$
$= 104\,976$

a. 22^3

b. 81^2

24. Write a sum for:

Example: m^4
$= m \times m \times m \times m$

a. x^5

b. 7^7

Problem solving

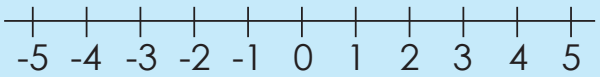
Add the smallest square number and the smallest cube number that is smaller than 100.

Write down all the two-digit square root numbers.
Write down all the three-digit cube root numbers.

Write one billion in exponential notation.

4 Integers

What is an integer?
Integers are the set of positive and negative natural numbers (including 0). A number line can be used to represent the set of integers.

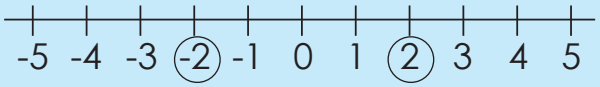


Positive integers
Whole numbers greater than zero are called positive integers. These numbers are to the right of zero on the number line.

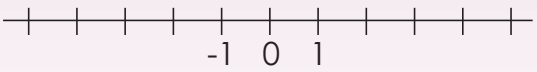
Negative integers
Whole numbers less than zero are called negative integers. These numbers are to the left of zero on the number line.

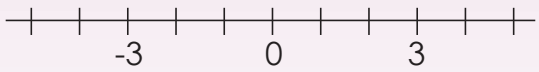
Zero
The integer zero is neutral. It is neither positive nor negative.

The sign
The sign of an integer is either positive (+) or negative (-), except zero, which has no sign. Two integers are opposites if they are each the same distance away from zero, but on opposite sides of the number line. One will have a positive sign, the other a negative sign. In the number line below, +2 and -2 are circled as opposites.



1. Complete the number lines:

a. 

b. 

2. Write an integer to represent each description.

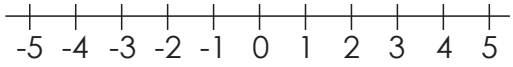
a. 8 units to the right of -3 on a number line. _____
b. 16 above zero. _____
c. 14 units to the right of -2 on a number line. _____
d. The opposite of -108. _____
e. 15 below zero. _____

3. Put the integers in order from smallest to greatest.

a. -41, 54, -31, -79, 57 _____
b. 43, -54, 44, -55, -37, 22, 52, -39, -43, -56, 18 _____

4. Calculate the following: Use the number line to guide you.

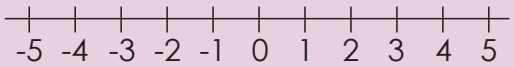
Example: -4 + 2 = -2





5. Calculate the following:

Example: -2 + 3 – 5 = -4

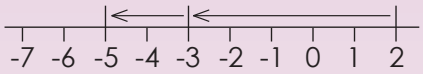


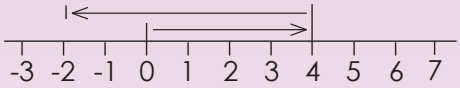
a. -6 + 8 – 7_____ b. 9 – 11 + 2 = _____

6. Complete the following:

a. Find -8 + (-3) b. Find 3 + (-16)

7. Write a sum for:

a. 

b. 

8. Calculate the following:

a. 4 + -5 = b. 5 + -7 = c. 5 + -7 =

9. Calculate the following:

a. 2 - -4 = b. 3 - -6 = c. 5 - -6 =

10. Calculate the following:

Example: 11 + -23
= 11 – 23
= -12

a. 33 + -44 = b. 5 + -43 = c. -15 + -20 =

11. Calculate the following:

Example: -14 - -20
= -14 + 20
= 6

a. -16 – 22 = b. 49 – 19 = c. 47 - -10 =

12. Calculate the following:

a. _____ + 24 = -11 b. _____ + 10 = 33 c. _____ + 49 = 18

Problem solving

Temperature is a nice way to explain positive and negative integers. Explain integers through temperature to your family.

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

5 Common fractions

Look at these examples and give five more examples of each.

Proper fraction $\frac{3}{4}$

Improper fraction $\frac{8}{3}$

Mixed number $1\frac{1}{2}$

Improper fraction to mixed number

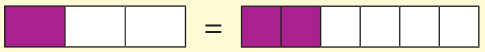
$\frac{8}{3} = 2\frac{2}{3}$

Mixed number to improper fraction

$1\frac{1}{4} = \frac{5}{4}$

1. What fraction equals: Draw a diagram to show it.

Example: $\frac{1}{3} = \frac{2}{6}$

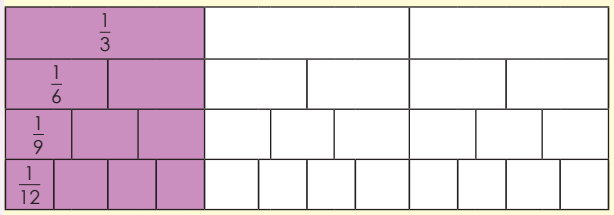


a. $\frac{1}{2}$ = _____

b. $\frac{1}{7}$ = _____

2. Write the next or previous equivalent fraction for:

Example: $\frac{1}{3} = \frac{2}{6}$

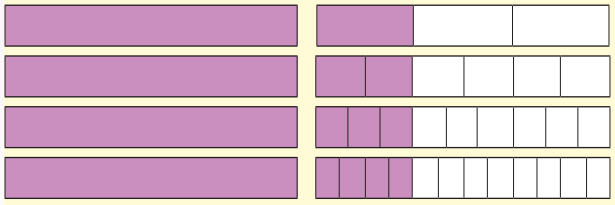


a. _____ $= \frac{2}{5}$

b. _____ $= \frac{4}{5}$

3. Write down three equivalent fractions for: Make a drawing.

Example: $1\frac{1}{3} = 1\frac{2}{6} = 1\frac{3}{9} = 1\frac{4}{12}$



a. $1\frac{1}{2}$ _____

b. $3\frac{2}{5}$ _____

What happened to the denominators and numerators? Always start with the given number.

$1\frac{1}{3}\ \frac{\times 2}{\times 2} = 1\frac{2}{6}$

$1\frac{1}{3}\ \frac{\times 3}{\times 3} = 1\frac{3}{9}$

$1\frac{1}{3}\ \frac{\times 4}{\times 4} = 1\frac{4}{12}$

4. What is the highest common factor?

Example:

Highest common factor (HCF)

Factors of 4 = {1, 2, 4}

Factors of 6 = {1, 2, 3, 6}

HCF = 2

So 2 is the biggest number that can divide into 4 and 6.

a. Factors of 3:
Factors of 4:

b. Factors of 5:
Factors of 6:

5. Write in the simplest form.

Example: $\frac{12}{16}$

$= \frac{12}{16} \div \frac{4}{4}$

$= \frac{3}{4}$

HCF:
Factors of 3: {1, 2, 3, (4), 6, 12}
Factors of 4: {1, 2, (4), 8, 12}

a. $\frac{6}{18}$

b. $\frac{5}{25}$

6. Add the two fractions, write it as a mixed number and simplify if necessary.

Example: $\frac{1}{3} + \frac{4}{3}$

$= \frac{5}{3}$

$= 1\frac{2}{3}$

When we add fractions the denominators should be the same.

a. $\frac{2}{5} + \frac{4}{5}$

b. $\frac{5}{9} + \frac{6}{9}$

7. Calculate and simplify if necessary.

Example: $\frac{1}{2} \times \frac{2}{2} + \frac{1}{4}$

$= \frac{2}{4} + \frac{1}{4}$

$= \frac{3}{4}$

Remember when we add fractions the denominators should be the same.

To do that we can find the LCM (Lowest common multiple)

Multiples of 2 = { 2, (4), 6, 8, ...}
Multiples of 4 = {(4), 8, 12, 16, ...}

... or in this case the denominators are multiples of each other.

2 is a multiple of 4. See on the left how we do this



a. $\frac{1}{4} + \frac{1}{2} =$

b. $\frac{1}{5} + \frac{1}{10} =$

continued ☛

5b Common fractions (continued)

8. First add and then multiply the two fractions.

Example: $\frac{1}{2}$, $\frac{1}{3}$

Addition

$\frac{1}{2} + \frac{1}{3}$

LCM = 6

$\frac{3}{6} + \frac{2}{6}$

$= \frac{5}{6}$

Multiplication

$\frac{1}{2} \times \frac{1}{3}$

$= \frac{1}{6}$



I see that when I multiply fractions the answer gets smaller, but when I multiply integers the number gets bigger.



That is true. Think of when you multiply a six pack of juice with 2 you get 12 but when you take half ($\frac{1}{2}$) <u>of</u> a six ($\frac{6}{1}$) pack it is 3.

a. $\frac{1}{2} \times \frac{1}{12} =$

b. $\frac{1}{2}$ *of* $\frac{1}{11} =$

9. Calculate:

Example: $\frac{1}{2} \times \frac{1}{3} \times \frac{1}{4}$

$= \frac{1}{24}$

a. $\frac{1}{3} \times \frac{1}{5} \times \frac{1}{2} =$

b. $\frac{1}{2} \times \frac{1}{5} \times \frac{1}{9} =$

10. Calculate:

Example 1: $\frac{6}{7} \times \frac{5}{7}$

$= \frac{30}{49}$

Example 2: $\frac{6}{7} \times \frac{5}{6}$

$= \frac{30}{41}$

a. $\frac{7}{8} \times \frac{2}{4} =$

11. How many different answers can you get to these? Give them all. State what fractions are you multiplying with each other.

Example: ____ x ____ = $\frac{12}{18}$

$\frac{3}{3} = 1$

$\frac{3}{3} \times \frac{4}{6} = \frac{12}{12}$

A whole number x a proper fraction.

$\frac{2}{9} \times \frac{6}{3} = \frac{12}{12}$

A proper fraction x improper fraction.

a. ____ x ____ = $\frac{2}{4}$

b. ____ x ____ = $\frac{8}{4}$

12. Calculate:

Example: $8 \times \frac{1}{4}$

$= \frac{8}{1} \times \frac{1}{4}$

$= \frac{8}{4}$

$= 2$

$= \frac{8}{4}$

$= 8 \div 2$

$= 4$

a. $2 \times \frac{3}{5} =$

b. $4 \times \frac{5}{6} =$

13. What whole number and fraction will give you the following answer?

Example: ____ x ____ = $\frac{2}{3}$

$\frac{2}{1} \times \frac{1}{3}$

$= 2 \times \frac{1}{3}$

a. ____ x ____ = $\frac{7}{21}$

14. Simplify the following:

Example: $\frac{15}{20}$

$= \frac{15}{20} \div \frac{5}{5}$

$= \frac{3}{4}$

a. $\frac{4}{12}$

b. $\frac{8}{16}$

15. Multiply and simplify if possible.

Example: $\frac{1}{3} \times \frac{3}{4}$

$\frac{3}{12} = \frac{3}{12} \div \frac{3}{3}$

$= \frac{1}{4}$

a. $\frac{1}{2} \times \frac{4}{8} =$

b. $\frac{1}{2} \times \frac{2}{7} =$

Problem solving

Name five fractions that will be between one fifth and four fifths.

What is $\frac{1}{8} + \frac{3}{8}$ in its simplest form?

What is $\frac{3}{9} \times \frac{3}{4}$ in its simplest form?

Can two unitary fractions give you an unitary fractions if you:
- add it?
- multiply it?

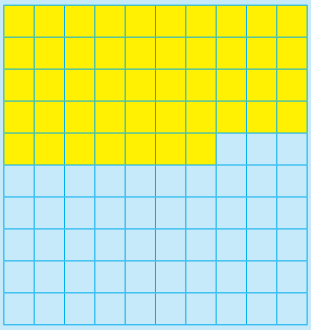
If the answer is $\frac{42}{72}$, what are two fractions that have been multiplied?

If ____ (whole number) x ____ (fraction) = $\frac{24}{36}$, how many possible solutions are there for this sum?

Multiply any two improper fractions and simplify your answer if necessary.

6 Percentages and decimal fractions

Look at the following. What does it mean?



$$\frac{47}{100} = 0{,}47 = 47\%$$

Where in everyday life do we use:

- Decimal fractions?
- Percentages?

1. Write the following percentage as a fraction and a decimal fraction.

Example: 18% or $\frac{18}{100}$ or 0,18

$= \frac{9}{50}$

a. 37%

b. 83%

2. Calculate

Example: 40% of R40

$= \frac{40}{100} \times \frac{R40}{1}$

$= \frac{R1600}{100}$

= R16

a. 20% of R24

b. 70% of R15

3. Calculate

Example:

$\frac{60}{100} \times \frac{R300}{1}$

$= \frac{3}{5} \times \frac{R300}{1}$

$= \frac{R900}{5}$

= R180



I can write 60% as $\frac{60}{100}$



$\frac{60}{100}$ simplified is $\frac{6}{10} = \frac{3}{5}$



You may use a calculator

a. 80c of R1,60

b. R24 of R72



4. Calculate the percentage *increase*.

Example:

Calculate the percentage increase if the price of a bus ticket of R60 is increased to R84.

$\frac{24}{60} \times \frac{100}{1}$

$= \frac{240}{60}$

= 40%

We first need to say how much was the bus ticket increased by.

It was increased by R24 because R84 minus R60 is R24.

Then to work out the **percentage increased** we need to multiply $\frac{24}{60}$ by 100 (percentage).

$\frac{24}{60}$ the price is increased by.

a. R80 to R96

Price increase: _____

5. Calculate the percentage *decrease*.

Example:

Calculate the percentage decrease if the price of petrol goes down from 20 cents a litre to 18 cents. Amount decreased is 2 cents.

$\frac{2}{20} \times \frac{100}{1}$

$= \frac{200}{20}$

= 10%

We first need to say how much was the bus petrol decreased by.

It was decreased by 2c because 18 c + 2c gives you 20c.

Then to work out the **percentage increased** we need to multiply $\frac{2}{20}$ by 100 (percentage).

$\frac{2}{20}$ the price is decreased by.

b. R50 of R46

Price decrease: _____

6. Write the following in expanded notation:

Example: 6,745
= 6 + 0,7 + 0,04 + 0,005

a. 3,983 _____ b. 8,478 _____

7. Write the following in words:

Example: 5,854
= 5 units + 8 tenths + 5 hundredths + 4 thousandths

What is the difference between 5 units and 5 hundredths?

a. 9,764 _____

b. 7,372 _____

8. Write down the value of the underlined digit:

Example: 9,6<u>9</u>4
= 0,09 or 9 hundredths

a. 8,<u>3</u>78 _____ b. 4,3<u>2</u> _____

9. Write as a decimal fraction:

Example: $\frac{40}{100}$
= 0,05

a. $\frac{6}{10}$ ☐ b. $\frac{7}{10}$ ☐

continued ☛

6b Percentages and decimal fractions (continued)

10. Write as a decimal fraction:

Example: $\frac{73}{100} = 0,73$

a. $\frac{45}{100}$ ____ b. $\frac{76}{100}$ ____

11. Write as a decimal fraction:

Example: $\frac{85}{10} = 8,5$

a. $\frac{36}{10}$ ____ b. $\frac{6\,705}{100}$ ____

12. Write as a common fraction:

Example: 4,3 $\frac{43}{10}$

a. 9,5 ____ b. 15,15 ____

13. Write the following as a decimal fraction.

Example: $\frac{2}{5} = \frac{4}{10} = 0,4$

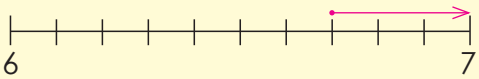
$\frac{1}{25} = \frac{4}{100} = 0,04$

a. $\frac{1}{5}$ ____ b. $\frac{1}{4}$ ____

Rounding off symbol is ≈.

14. Round off to the nearest unit:

Example: 6,7 ≈ 7

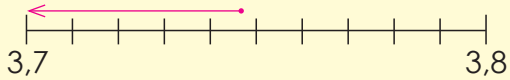


a. 5,1 _____

b. 14,8 _____

15. Round off to the nearest tenth:

Example: 3,745 ≈ 3,7



a. 6,14 _____

b. 3,578 _____

16. Calculate using both methods.

Example 1: 2,37 + 4,53

= (2 + 4) + (0,3 + 0,5) + (0,07 + 0,03)

= 6 + 0,8 + 0,1

= 6,9

Example 2:

2,37
+ 4,53
6,90

Make sure the decimal commas are under each other.

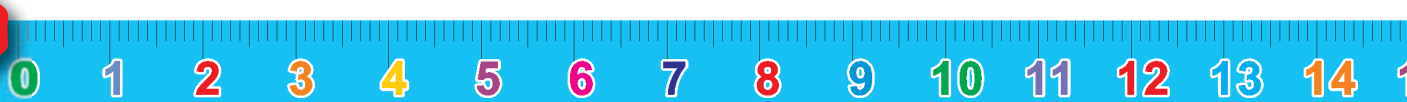
Note that 6,9 and 6,90 are the same.



a. 6,89 + 3,67 =

b. 4,694 + 3,578 =

You can check your answer using the inverse operation of addition that is subtraction.



17. Calculate. Check your answers using a calculator.

Example 1:

- 0,2 x 0,3 = 0,06
- 0,02 x 0,3 = 0,006
- 0,02 x 0,03 = 0,0006

Do you notice the pattern? Describe it.

a. 0,4 x 0,2 = _____

b. 0,3 x 0,1 = _____

18. Calculate. Check your answers using a calculator.

Example 1: 0,3 x 0,2 x 100
= 0,06 x 100
= 6

Example 2: 0,3 x 0,2 x10
= 0,06 x 10
= 0,6

a. 0,4 x 0,2 x 10 =

b. 0,5 x 0,02 x 10 =

19. Calculate. Check your answers using a calculator.

Example 1: 5,276 x 30
= (5 x 30) + (0,2 x 30) + (0,07 x 30) + (0,006 x 30)
= 150 + 6 + 2,1 + 0,18
= 150 + 6 + 2 + 0,1 + 0,1 + 0,08
= 158 + 0,2 + 0,08
= 158,28

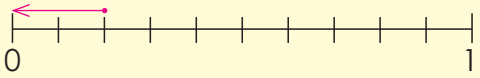
a. 1,123 x 10 =

b. 4,886 x 30 =

20. Calculate the following:

Example: 0,4 ÷ 2
= 0,2

0,2 rounded off to the nearest whole number is 0.

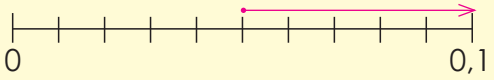


a. 0,8 ÷ 4 = _____ b. 0,6 ÷ 3 = _____

21. Calculate the following:

Example: 0,25 ÷ 5
= 0,05

0,05 rounded off to the nearest tenth is 0,1.



a. 0,81 ÷ 9 = _____ b. 0,85 ÷ 5 = _____

Problem solving

Multiply the number that will be exactly between 2,25 and 2,26 with the number that equals to ten times three.

You need nine equal pieces from 54,9 m of rope. How long will each piece be?

My mother bought 32,4 m of rope. She has to divide it into four pieces. How long will each piece be?

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

7 Input and output

Add to the diagram to complete it is as a flow diagram. Complete it.

Input		Output
2		
4		
7	x 9	
8		
5		
9		

The rule is x 9.

Use the flow diagram on the left.

What will the output be, if the **rule** is:

- x 5
- x 7
- x 8
- x 4
- x 12



Why is it important to know your times tables?

Explain the words:

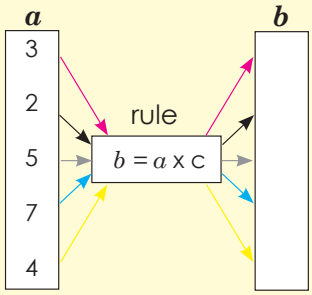
Input

Output

Rule

1. Use the given rule to calculate the value of *b*.

Example:

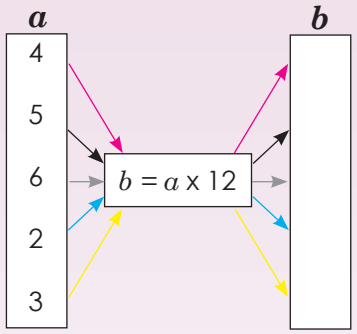


If c = 5

b = a x 5

so:

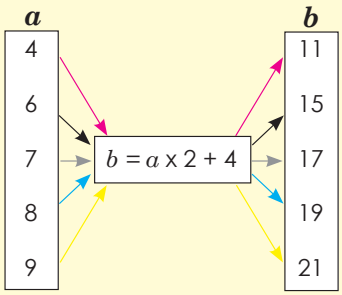
- 3 x 5 = 15
- 2 x 5 = 10
- 5 x 5 = 25
- 7 x 5 = 35
- 4 x 5 = 20



The rule is _____.

2. Complete the spider diagrams. Show all your calculations.

Example:



a is the input,

b is the output,

b* = *a x 2 + 4 is the rule.

b = 4 x 2 + 4 = 12

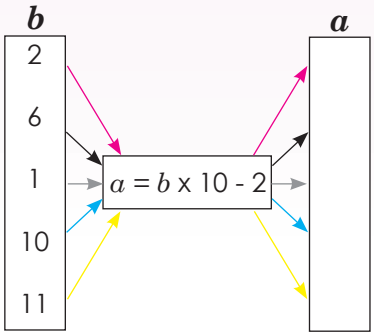
b = 6 x 2 + 4 = 16

b = 7 x 2 + 4 = 18

b = 8 x 2 + 4 = 20

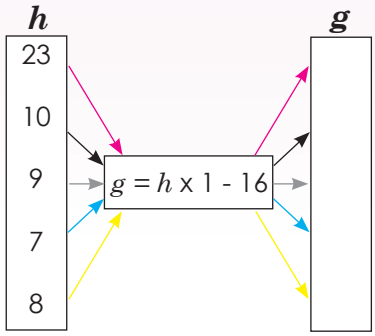
b = 9 x 2 + 4 = 22

a.



The rule is _____.

b.



The rule is _____.

3. Complete the tables.

Example: $x = y + 2$

y	2	4	6	8	10	20
x	4	6	8	10	12	22

$x = 2 + 2$
$x = 4$

$x = 4 + 2$
$x = 6$

$x = 6 + 2$
$x = 8$

$x = 8 + 2$
$x = 10$

$x = 10 + 2$
$x = 12$

$x = 20 + 2$
$x = 22$

$a = b + 9$

b	1	2	3	4	5	10
a						

4. Solve for m and n.

Example:

x	1	2	3	4		14	m	25
y	6	7	8	9		19	22	n

Determine the rule:
E.g. $y = x + 5$

n?
$y = x + 5$
$y = 25 + 5$
$y = 30$
n is 30

m?
$x = m$ and $y = 22$
$y = x + 5$
$22 = m + 5$
$22 - 5 = m + 5 - 5$
$17 = m$
$m = 17$

x	1	2	3	4		25	m	51
y	10	11	12	13		n	39	60

Rule:

n?

m?

Problem solving

Draw a spider diagram where x = y + 9.

Draw your own spider diagram where x = y x 4 + 8.

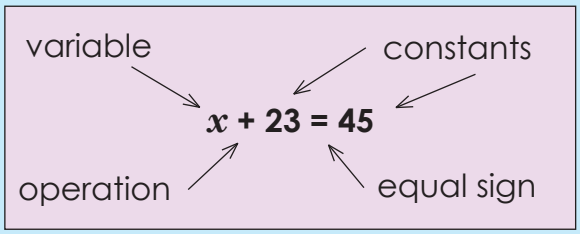
If x = 2y + 4 and y = 2, 3, 4, 5, 6. Draw a table to show it.

What is the 10th pattern? 2 x 11, 3 x 11, 4 x 11, ...

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

8 Algebraic expressions and equations

Revise the following:



Say if the following is an expression or an equation and why?

$x + 23 = 45$

$x + 23$

1. Say if it is an expression or an equation.

Example: 8 + 3 (It is an expression.)
8 + 3 = 11 (It is an equation.)

a. 9 + 7 = 16 ☐

b. 7 + 6 = ☐

c. 3 + 5 = 8 ☐

d. 11 + 2 = ☐

2. Describe the following.

Example: 6 + 3 = 9
This is an **expression**, 6 + 3, that is equal to the value on the right-hand side, 9.
6 + 3 = 9 is called an **equation**. The left-hand side of an equation equals the right-hand side.

a. 12 + 5 = 17

b. 9 + 8 = 17

3. Describe the following in words.

Example: 4, 8, 12, 16, 20 …
Adding 4 to the previous pattern.

a. 2, 5, 8, 11 …

b. 11, 20, 29, 38 …

4. Describe the following sequence using an expression.

Example: 4, 8, 12, 16, 20 … Expression or rule: $4(n) + 1$

Position in sequence	**1**	**2**	**3**	**4**	**5**	**n**
Term	5	9	13	17	21	

a. 6, 11, 16, 21 …

b. 5, 9, 13, 17 …

5. What does the rule mean?

Example: the rule 2n – 1 means for the following number sequence: 1, 3, 5, 7, 9 …

Position in sequence	**1**	**2**	**3**	**4**	**5**	**n**
Term	1	3	5	7	9	

The rule 6n - 2 = means for the following number sequence 4, 10, 16, 22 …

Position in sequence						
Term						

continued ☛

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

Algebraic expressions and equations
continued

6. Solve for x.

Example 1: $x + 5 = 9$

$x + 5 - 5 = 9 - 5$

$x = 4$

a. $x + 18 = 26$

b. $x + 6 = 12$

Example 2: $x - 5 = 2$

$x - 5 + 5 = 2 + 5$

$x = 7$

c. $x - 15 = 12$

d. $x - 28 = 13$

Example 3: $x + 4 = -7$

$x + 4 - 4 = -7 - 4$

$x = -11$

e. $x + 7 = -12$

f. $x + 24 = -34$



7. Solve for x.

Example: $5x = 20$

$\frac{5x}{5} = \frac{20}{5}$

$x = 4$

a. $6x = 72$

b. $7x = 84$

8. Solve for x.

Example: $2x - 1 = 8$

$2x - 1 + 1 = 8 - 1$

$\frac{2x}{2} - = \frac{7}{2}$

$x = 3\frac{1}{2}$

a. $5x - 6 = 18$

b. $3x + 4 = -5$

9. Substitute.

Example: if $y = x^2 + 2$,
calculate y when $x = 4$

$y = 4^2 + 2$

$y = 16 + 2$

$y = 18$

Test

$y = x^2 + 1$

$18 = 4^2 + 2$

$18 = 16 + 2$

$18 = 18$

a. $y = p^2 + 7; p = 8$

b. $y = c^2 + 4; c = 8$

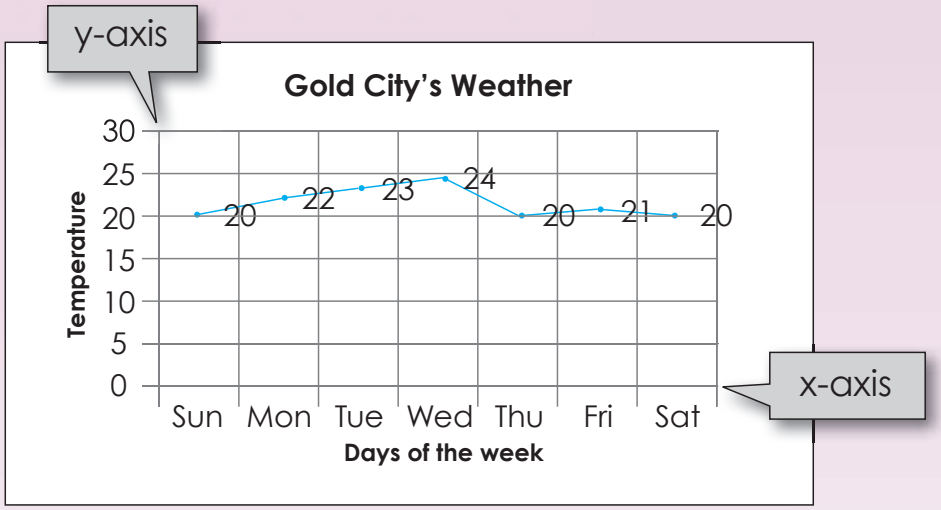
Problem solving

Write down five different equations where x will be equal to 5.

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

9 Graphs

A line graph is a graph that uses points connected by lines to show how something changes in value over time.



1. Look at the graph and answer the following questions.

a. What is the title of the graph? _____

b. What is the x-axis telling us? _____

c. What is the y-axis telling us? _____

d. What is this graph telling us? _____

e. What can you add to the word "temperature" on the y-axis? _____

f. What was the temperature on?

i. Sunday? _____

ii. Monday? _____

iii. Wednesday? _____

g. Identify the grid lines on the graph that helped you to answer the previous question? _____

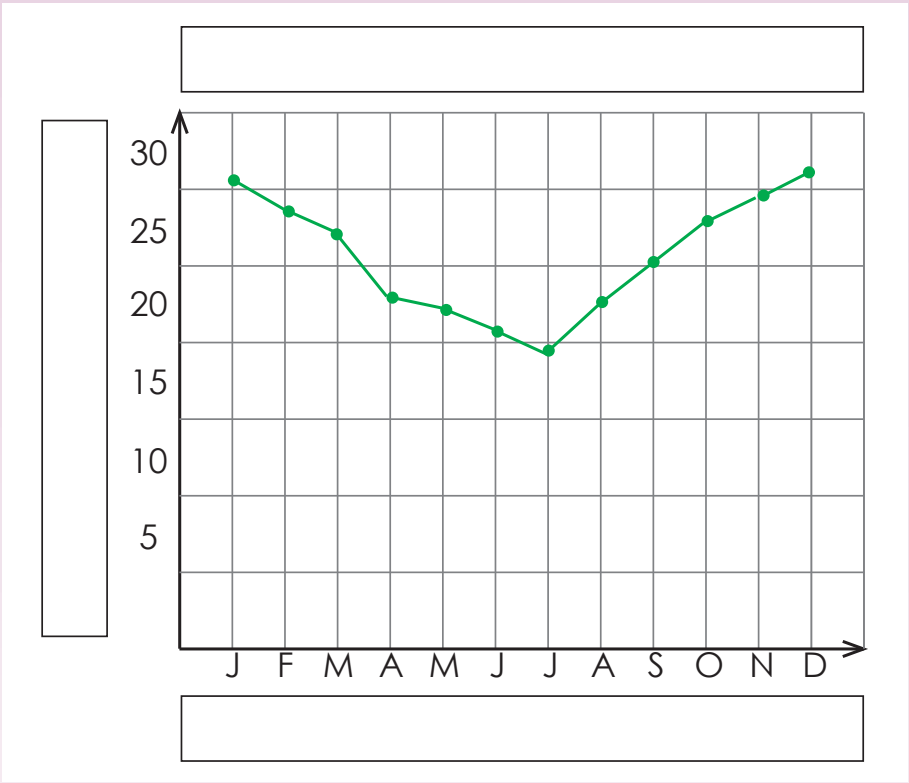
h. Look at the temperature on Sunday and Monday. What do you notice?

_____

j. What happened from Wednesday to Thursday? _____

2. Look at the graph and label it.

title	x-axis	y-axis	points	grid lines



3. Fill in the missing words (lines, title, label, vertical scale, points or dots, horizontal scale)

a. The _____ of the graph tells us what the graph is about.

b. The horizontal _____ across the bottom and the vertical _____ along the side tell us what kinds of facts are listed.

c. The _____ across the bottom and the _____ along the side tell us how much or how many.

d. The _____ on the graph show us the facts.

e. The _____ connecting the points give estimates of the values between the points.

Problem solving

Find a graph in a newspaper write down five points on the graph.

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

10 Financial mathematics

Can you remember the meaning of the following?



Profit is the surplus remaining after total costs are deducted from total revenue.
Loss is the excess of expenditure over income.
Discount is the amount deducted from the asking price before payment.

Budget is the estimate of cost and revenues over a specified period.

A budget is like a scale where you try to balance your income and your expenses.

Important: Your income should always outweigh your expenses.

A **loan** is sum of money that an individual or a company lends to an individual or company with the objective of gaining profits when the money is paid back.

Interest is the fee charged by a lender to a borrower for the use of borrowed money, usually expressed as an annual percentage of the amount borrowed, also called the interest rate.

1. Are you making a profit or a loss? How much? Circle the correct answer and calculate the amount.

a. You are buying ice creams for R4,50 each and selling them for R6,00 each.
I made a profit / loss of _____ (amount) per ice cream.

b. You bought 150 pencils for R1,00 each and sold them for R1,35 each. You had to give your mother R60 for transport costs.
I made a profit / loss of _____ (amount).

Profit can be calculated by different methods. Normally when we talk about 10% profit we calculate it on the cost price. We sometimes also refer to a 10% mark-up.

Example: If my tennis racquet costs me R400 and I want to sell it and make a 10% profit, I need to sell it for R440.

R400 + (R400x 10%) = R440



Spend less than you earn !

2. Answer the questions on profit.

a. You are buying sweets for 80c each and you want to make a 25 % profit. How much must you sell them for? _____ (amount).

b. You are buying sweets in large packets of 100 for R25,50 per packet. You are selling to your friends for 50c per sweet. If they buy 10 sweets or more at a time you give them 20% discount. During the first break you sold 40 loose sweets and 20 sweets at discounted price. What will your profit be? _____ (amount).

Creating a budget is the most important step in controlling your money.
The first rule of budgeting is: **Spend less than you earn!**
Example: If you received R100 allowance per month (pocket money) and another R40 for your birthday, you cannot spend more than R140 for the entire month.

Net income is what remains after all the costs are deducted from total revenue. If the costs or expenses exceed the income we call it a **shortage**.



3. Track your budget.

Using the example below, draw a budget in your writing book, make sure you make a net income.

Income	Actual amount	Estimated amount	Difference
Estimated total income			
Expenses			
Estimated total expenses			
Net income			

When someone lends money to someone else, the borrower usually pays a fee to the lender. This fee is called 'interest', '**simple**' interest, or '**flat rate**' interest. The amount of simple interest paid each year is a fixed percentage of the amount borrowed or lent at the start.

The simple interest formula is as follows:
Interest = Principal × Rate × Time
where:
'Interest' is the total amount of interest paid,
'Principal' is the amount lent or borrowed,
'Rate' is the percentage of the principal charged as interest each year.
'Time' is the time in years to pay back the loan.

4. I borrowed R10 000 from the bank and they charged me 10% interest per year. The total amount I had to repay was R15 000. How long was the loan for?

Sharing

Make notes of the important financial tips you have learned, and share it with a family member.

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

11 Geometric figures

Symbols you need to revise or learn:

Triangle △	Angle ∠	Perpendicular ⊥	Parallel ∥	Degrees o	Right angles
Line segments $\overline{AB}$	Line $\overleftrightarrow{AB}$	Ray $\overrightarrow{AB}$	Congruent ≅	Similar ~	Therefore ∴

Geometric figures to remember:

Geometric figures

Triangles	Quadrilaterals	More polygons
Equilateral triangle	Parallelogram	Pentagon
Isosceles triangle	Rectangle	Hexagon
Scalene triangle	Square	Heptagon
	Rhombus	Octagon
	Trapezium	Nonagon
	Kite	Decagon, etc.

These are also polygons



A ***polygon*** is a geometric figure with three or more straight sides.

Angles to remember:

Acute angle: An angle that is less than 90°

Right angle: An angle that is 90°

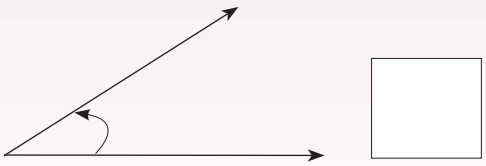
Obtuse angle: an angle that is greater than 90° but less than 180°

Straight angle: an angle that is 180° exactly

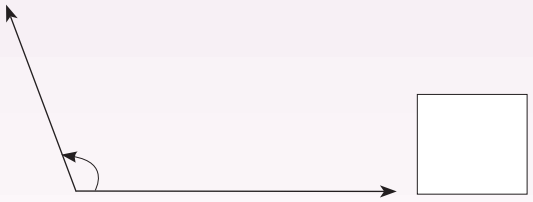
Reflex angle: an angle that is greater than 180°

1. **Measure each angle.** (You might need to extend it depending on the size of your protractor.)

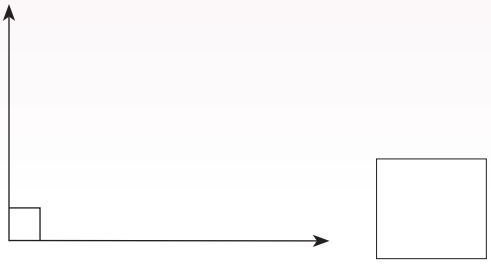
a.



b.



c.



d.





2. Estimate and draw an angle:

a. Smaller than 90 degrees. Measure it.

b. Bigger than 90 degrees. Measure it.

3. Use a ruler and a protractor to draw and label geometric figures. Write down the steps you take to construct it.

A 60° angle ABC.

continued ☛

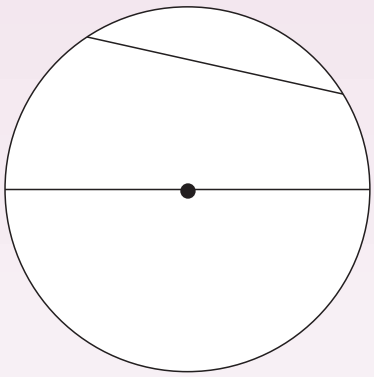
15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

Geometric figures continued

4. Using a compass, go through the steps to construct a line labeled CD perpendicular to both sides of a line labeled AB using a compass.

5. Label the circle.

a. Use the following words: chord, diameter, radius and centre.



b. Draw a circle with a diameter of 2,3 cm.

6. Construct an equilateral, isosceles and scalene triangle. Label each triangle.

a.

b.

c.



7. Construct a parallelogram, rectangle, square, rhombus, trapezium and kite. Label each.

a.

b.

c.

d.

e.

f.

8. How do I know when triangles are congurent of similar?

a. Congruent:

b. Similar:

Problem solving

The most common angle we get in everyday life is a 90^0 angle. Name at least five everyday life examples of angles smaller than 45^0. Make drawings to show your answers.

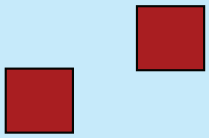
12 Transformations

Look at the transformations and describe it.

Transformation: to transform something is to change it in some way.

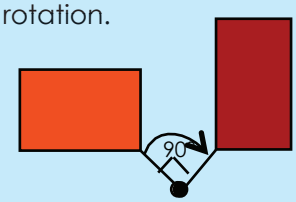
A transformation is what brings about the change. There are many kinds of geometric transformations, ranging from translations, rotations, reflections and enlargements.

Translation: a translation is the movement of an object to a new position without changing its shape, size or orientation.



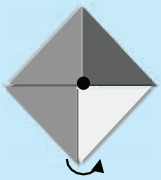
When a shape is transformed by sliding to a new position, without turning, it is said to have been translated.

Rotation: a rotation is a transformation that moves points so that they stay the same distance from a fixed point, the centre of rotation.

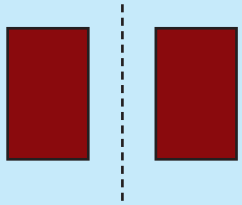


Rotational symmetry
A figure has rotational symmetry if an outline of the turning figure matches its original shape.

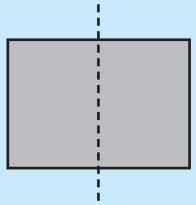
Order of symmetry
This is how many times an outline matches the original in one full rotation.



Reflection: a reflection is a transformation that has the same effect as a mirror.



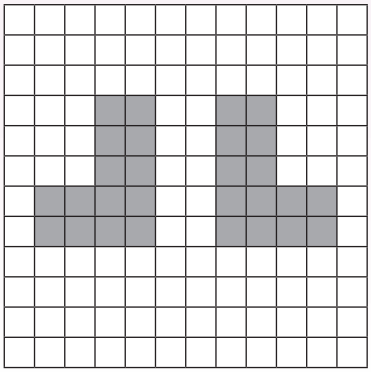
Reflective symmetry
An object is symmetrical when one half is a mirror image of the other half.



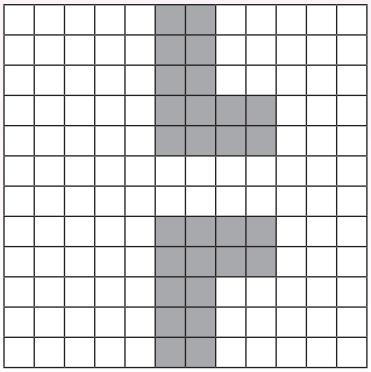
1. Describe each reflection. The words below may help you.

Mirror image	Shape	Original shape	Line of reflection	Vertical	Horizontal

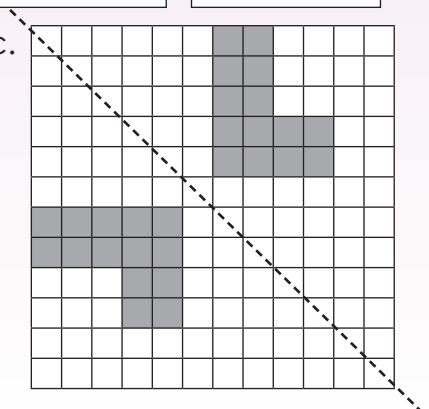
a.



b.

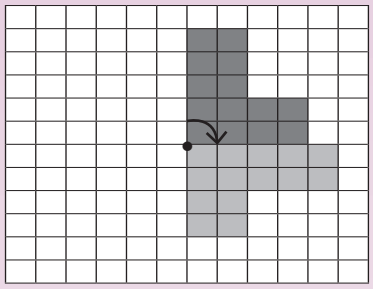


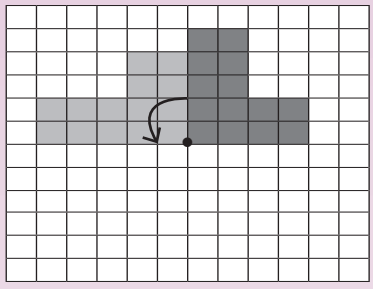
c.

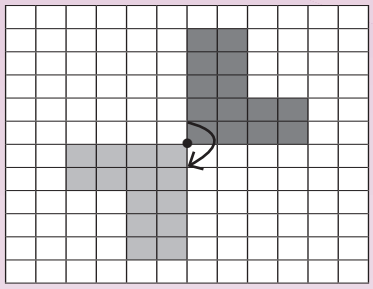


2. Describe each rotation. The words below may help you.

Rotate	Clockwise	Anti-clockwise	Centre of rotation	Degrees	Horizontal

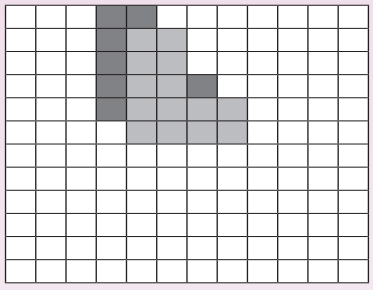
a. 

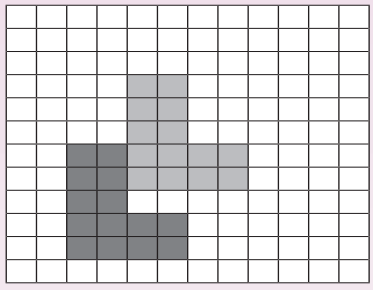
b. 

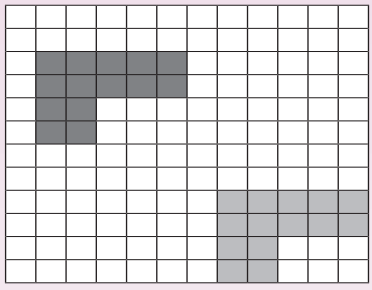
c. 

3. Describe each translation. The word below may help you.

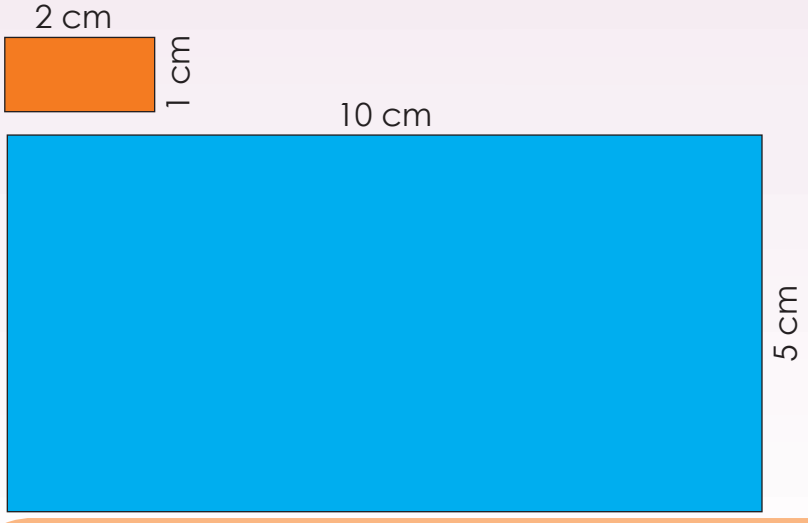
slide	left	Right	Up	Down	Place

a. 

b. 

c. 

4. Fill in the answers:



Orange rectangle:

a. The length = ____

b. The width = ____

Blue rectangle:

c. The length = ____

d. The width = ____

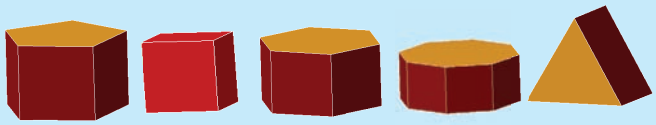
e. The blue rectangle is enlarged ____ times.

Problem solving

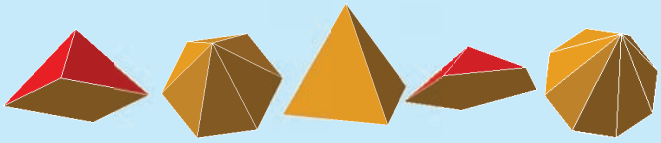
Find a translated, rotated and reflected patterns in nature and explain it in words.

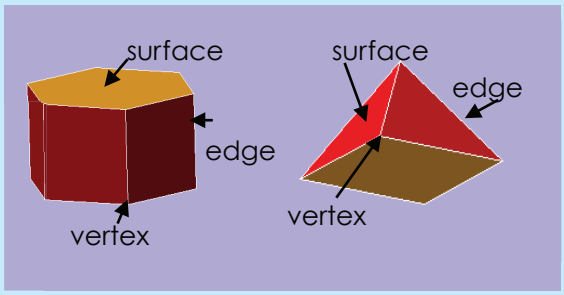
15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

Why are these called prisms?



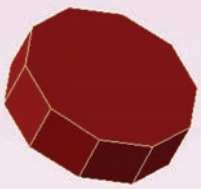
Why are these called pyramids?



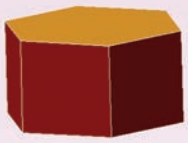


1. Label the following using the words: surface (face), edge and vertex.

a.



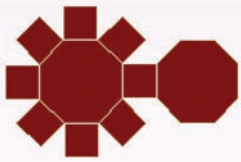
b.



2. Write a comparison of geometric figures and solids.

3. Describe the net of this geometric solid.





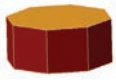
a. Name the geometric solid. _____

b. Identify the faces. _____

c. Identify and count the vertices and edges. _____

Euler's formula

3. Complete the table:

	Solid	Vertices	Edges	Faces	Formula V – E + F
a. Triangular prism		6	9	5	6 – 9 + 5 =2
b. Rectangular prism					
c. Pentagonal prism					
d. Hexagonal prism					
e. Octagonal prism					
f. Triangular pyramid					
g. Square pyramid					
h. Pentagonal pyramid					
i. Hexagonal pyramid					
j. Octagonal pyramid					

Problem solving

Which geometric objects do you see most in your everyday life?

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

14 Perimeter and area

Revise:

Perimeter of a **rectangle**: $2\,l$ x $2\,b$

Area of a rectangle: l x b

Perimeter of a **square**: $4\,l$

Area of a square: l x l

The area of **a triangle** is: $\frac{1}{2}\,b$ x h

1 cm = 10 mm
1 cm² (1 cm x 1 cm) = 100 mm² (10 mm x 10 mm)

1 m = 1 000 mm
1 m² (1 m x 1 m) = 1 000 000 mm² (1 000 mm x 1 000 mm)

1 km = 1 000 m
1 km² (1 km x 1 km) = 1 000 000 m² (1 000 m x 1 000 m)

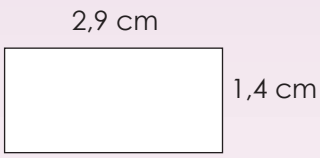
1. Calculate the perimeter and the area of the following polygons:

Example:
Double 4,5 cm + double 3,2 cm
(2 x 4,5 cm) + (2 x 3,2 cm)
= 9 cm + 6,4 cm
= 15,4 cm

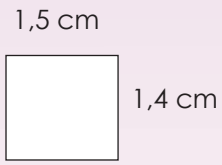
Double 4,5 cm is the same as 2 x 4,5

Example:
4,5 cm x 3,2 cm
= 14 cm²

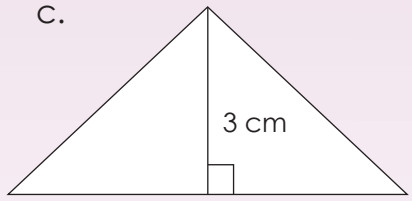
a.



b.



c.



Area:	Area:	Area:
Perimeter:	Perimeter:	

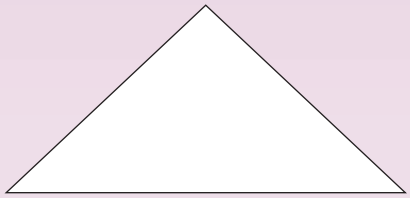


2. Construct the triangle and then calculate the area.

Height 5 cm
Base 8 cm

Drawing	Area

3. Measure and calculate the area in mm and mm² .



4. Work out the area and give your answer in m², cm² and mm² .

Example: Length = 2m, breadth = 1m

l x b
= 2 m x 1 m
=2 m^2

l x b
= 200 cm x 100 cm
=20 000 cm^2

l x b
= 2 000 mm x 100o mm
=200 000 m^2





a. In m^2 b. In cm^2 c. In mm^2

5. If the area is 9 000 000 mm², what is the length and breadth in cm and m?

63 000 000 mm^2

Example:
3 000 mm x 3 000 mm
= 9 000 000 mm^2
= 300 cm x 3 00 cm
= 90 000 cm^2
= 3 m x 3 m
= 9 m^2

Calculation:

Possible drawing

Problem solving

If a square has a perimeter of 10 m what will the area be? Give your answer in mm and cm. If you change it to a rectangle will the area change?

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

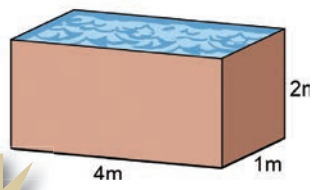
15 Volume and surface area

What is the difference between volume and capacity?

DEFINITION The volume of a solid is the amount of space it occupies.

DEFINITION Capacity is the amount of liquid a container can hold.

We know that:
10 cm x 10 cm x 10 cm
= 1 000 cm^3
= 1 000 ml
= 1 l

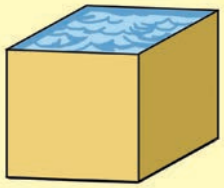


This container will take 8 000 litres.

1. Use a formula to calculate the volumes of the cubes. How much water can each cube hold?

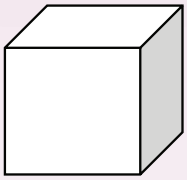
Example:

The formula for the volume of a cube is l^3.



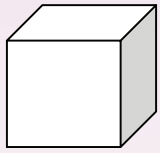
2 cm x 2 cm x 2cm
= 8 cm^3
= 8 ml
= 0,008 l

a.



5 cm

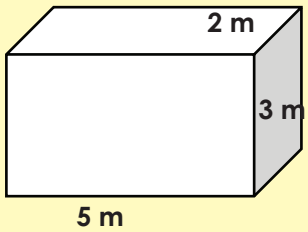
b.



4,5 cm

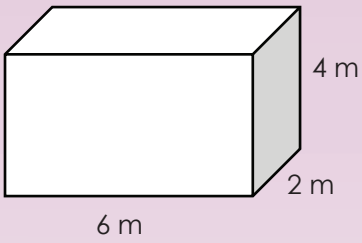
2. Calculate the volume of these containers and give your answer in m^3, cm^3 and mm^3. Also say what the capacity of each container is when filled with water.

Example:



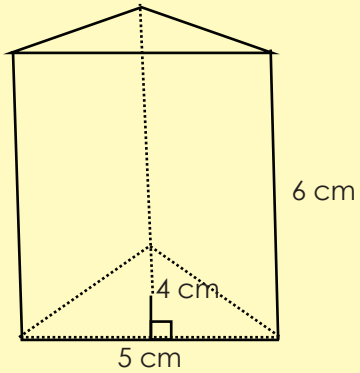
This container will hold 30 000 000 ml or 30 000 l water

m^3	cm^3	mm^3
l x b x h	l x b x h	l x b x h
= 5 m x 2 m x 3 m	= 5 00 cm x 200 cm x 300 cm	= 5 000 mm x 2 000 mm x 3 000 mm
= 30 m^3	= 30 000 000 cm^3	= 30 000 000 000 mm^3



3. Calculate the volume:

Example:



Volume of a triangular prism:
The area of the base x height

$= (\frac{1}{2} \text{ b x h}) \text{ x h}$

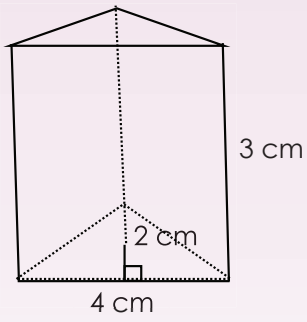
$= (\frac{1}{2} 5 \text{ cm x } 4 \text{ cm}) \text{ x } 6 \text{ cm}$

$= (\frac{5}{2} \text{ cm x } \frac{4}{1} \text{ cm}) \text{ x } 6 \text{ cm}$

$= \frac{20}{2} \text{cm}^2 \text{ x } 6 \text{ cm}$

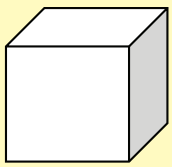
$= 10 \text{ cm}^2 \text{ x } 6 \text{ cm}$

$= 60 \text{ cm}^3$



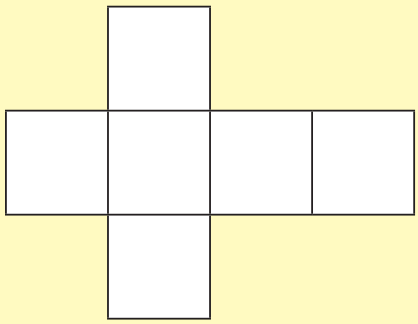
4. Calculate the surface area of the following cubes.

Example:



The surfae area of a cube is l x l x total faces

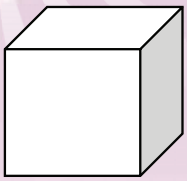
$= l^2$ x total faces
$= (4 \text{ cm})^2$ x total faces
$= 16 \text{ cm}^2 \text{ x } 6$
$= 96 \text{ cm}^2$



continued ☛

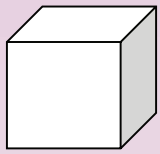
Volume and surface area continued

a.



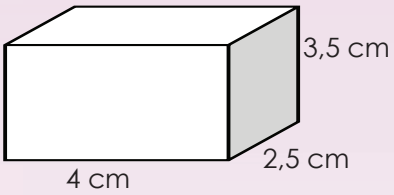
3 cm

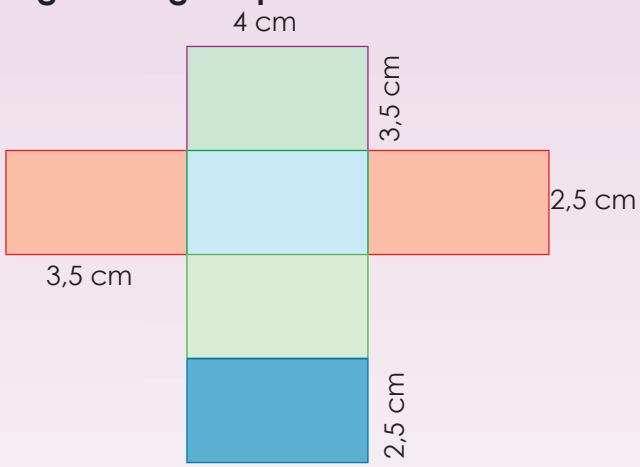
b.



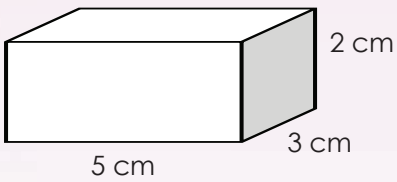
4,2 cm

5. Calculate the surface area of the following rectangular prisms:

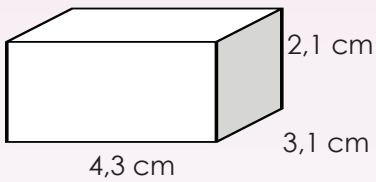




a.



a.



6. Calculate the volume of the prisms below.

Example: **Volume = area of base x length**
Area = $\frac{1}{2}$ breadth x height (perpendicular)

($\frac{1}{2}$ x 4 cm) x 2 cm

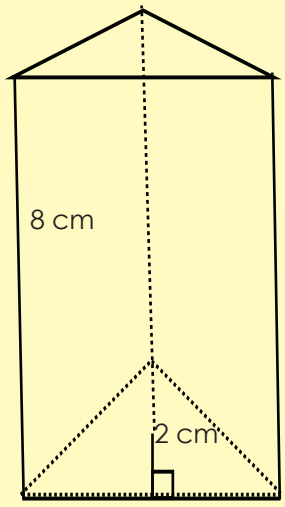
= 2 cm x 2 cm

= 4 cm^2

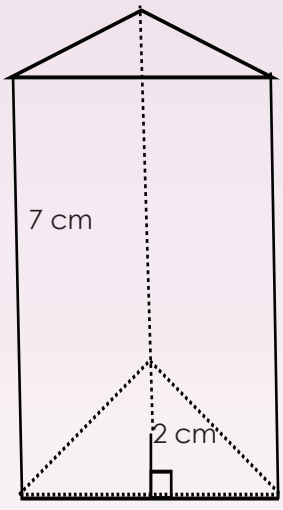
Volume = 4 cm^2 x length

= 4 cm^2 x 8 cm

= 32 cm^3



a.



With a family member think of five everday life objects that are cubes.



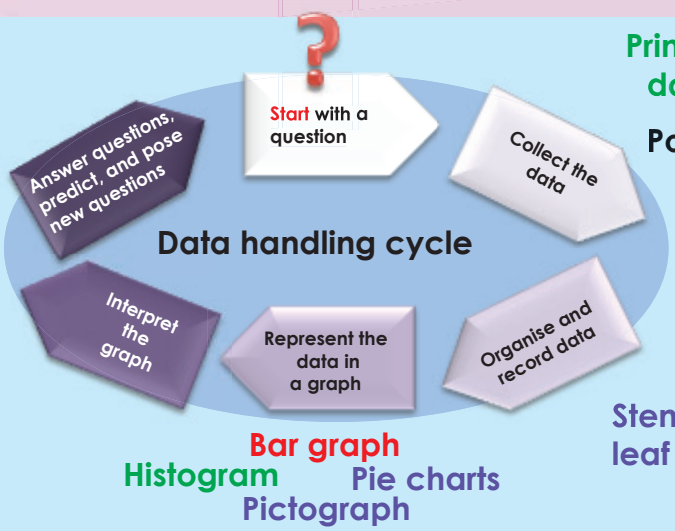
Problem solving

If the volume of a cube is 106cm^3, what is its dimension in mm and m?

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

16 Data

Look at the data handling cycle and describe it.



Primary data
Secondary data
Population
Survey
Questionnaire
Tables
Tallies
Stem and leaf table
range
mean
median
mode
Bar graph
Histogram
Pie charts
Pictograph

1. Answer the questions on collecting data.

How much water do we drink in the school?

a. How will you find the data?

b. Who should we ask?

c. What will the data tell us?

d. Do you think the data can help us to solve a problem?

e. Why will the data help us solving the possible problem?

f. Find data on this topic.

g. Pose ten questions on it.

Continue on an extra sheet of paper

h. Write a hypothesis for your questionnaire

Continue on an extra sheet of paper

i. Compile a simple questionnaire which includes yes/no type responses and multi choice responses.

Continue on an extra sheet of paper



2. You collected data by interviewing children in your class regarding their favourite sport. The results are as follows:

Name	Favourite colour	Name	Favourite colour
Denise	Rugby	**Elias**	Soccer
John	Golf	**Simon**	Rugby
Jason	Soccer	**Edward**	Cricket
Matapelo	Cricket	**Susan**	Soccer
Beatrix	Cricket	**Philip**	Golf
Opelo	Rugby	**Ben**	Rugby
Lisa	Soccer	**Lauren**	Tennis
Gugu	Golf	**Tefo**	Rugby
Sipho	Rugby	**Alicia**	Soccer
Lerato	Rugby	**Masa**	Tennis

a. Compile a table showing tally and frequency.

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

b. Draw a bar graph using your frequency table.

c. Interpret your graph and write at least 5 conclusions.

3. Use the data collected from a survey of the favourite subjects in your class. You will need extra paper to do this activity.

Name	Favourite subject	Name	Favourite subject
Denise	Maths	Elias	History
John	Arts	Simon	Maths
Jason	History	Edward	Sciences
Mathapelo	Sciences	Susan	History
Beatrix	Sciences	Philip	Arts
Opelo	Maths	Ben	Maths
Lisa	History	Lauren	Language
Gugu	Arts	Tefo	Maths
Sipho	Maths	Alicia	History
Lorato	Maths	Masa	Language

Maths
History
Physical science
Biology
Language
Art
Life orientation

a. Compile a frequency table using tallies, splitting the results for boys and girls.

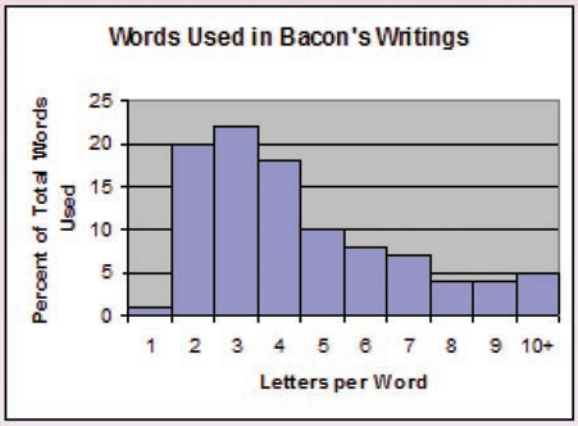
b. Draw a double bar graph using your frequency table, comparing the preferences of the boys and girls.

c. Interpret your graph and write at least 5 conclusions.

d. How do your conclusions compare with the previous problem solving activity on sport?

4. Write a short report on your findings.

5. Why is this a histogram? Write two sentences on this histogram.



6. Currently every person in South Africa generates about 2 kg of solid waste per day.

Draw a pie chart to display this information.

This table shows the different categories of solid waste and the amount in grams generated per day.

Waste category	Waste generated per person per day (in grams).
Plastic	240
Glass	120
Paper	600
Metal	200
Organic	600
Non-recyclables	240

Problem solving

Make your own drawing of the data handling cycle. Present it to the class or a family member.

17 Natural numbers, whole numbers and integers

Explain the difference between:



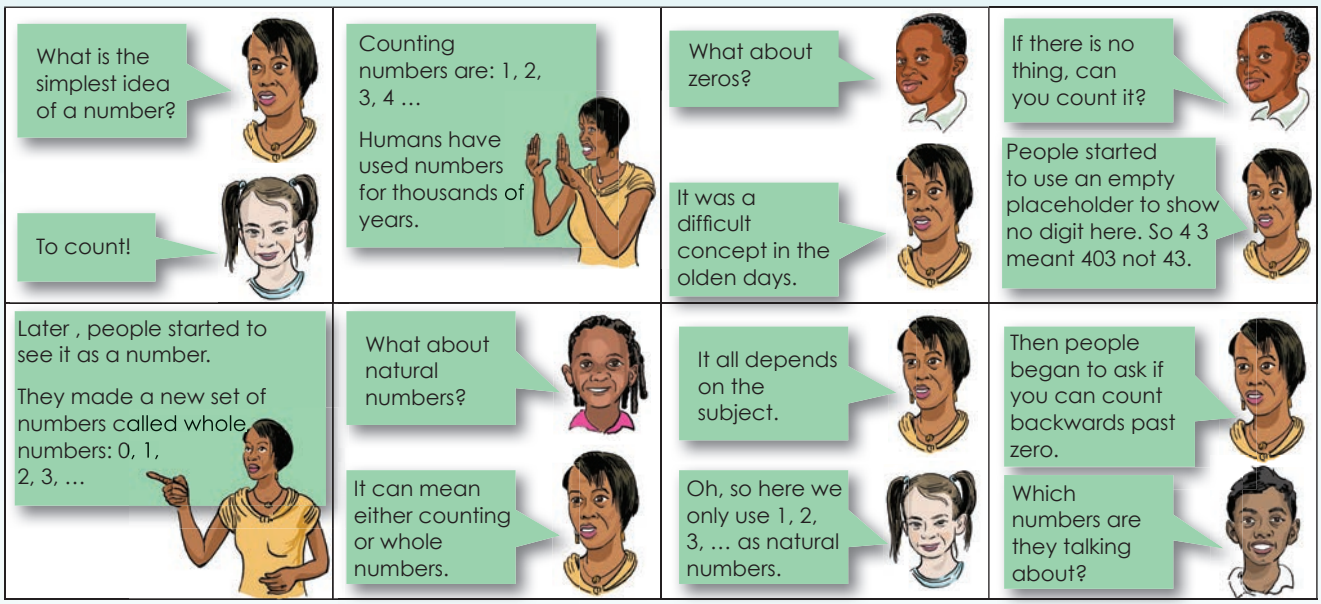
Natural numbers:
{1, 2, 3, 4, …}No negative numbers and no fractions.

Whole numbers:
{0, 1, 2, 3, …} Not negative numbers and no fractions. Zero included.

Integers:
{… -3, -2, -1, 0, 1, 2, 3, …} Positive and negative numbers. Includes zero (which is neither positive nor negative). No fractions.

The symbol for each: **N** **W** **Z**

1. Read the cartoon and discuss it.



2. Draw number lines explaining the following:

a. Natural numbers b. Whole numbers c. Integers

Write a set for each group of numbers.

d. Natural numbers _____

e. Whole numbers _____

f. Integers _____



3. **Say if the following numbers are natural numbers and/or whole numbers and/or integers.**

a. 15 _____

b. -8 _____

c. -6 _____

d. 100 _____

e. 200 _____

4. **Complete the following:**

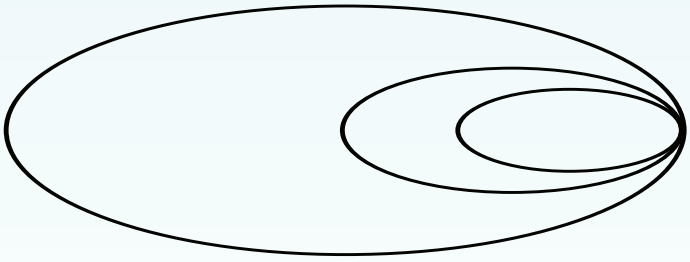
a. A = {1, 2, 3, …} is the set of _____ numbers.

b. B = {0, 1, 2, …} is the set of _____ numbers.

c. C = {… -3, -2, -1, 0, 1, 2, 3, …} is the set of _____ numbers.

d. Sometimes we say positive and negative integers. Write a set for each

5. **Label the Venn diagram using the words, integers, naturals and whole numbers**





A Venn Diagram is a way to show the relationship between two or three sets of numbers. The diagram is made up of two or three overlapping circles.

6. **Do you know of any other types of numbers. Write them down.**

Problem solving

Explain a Venn diagram to your family.

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

18 Commutative, associative and distributive properties

Revise these properties of numbers. Give an example of each

Commutative property of number:	Associative property of number:	Zero as the property of addition. One as the property of multiplication
	Distributive property of number:	

1. Make use of the associative property to prove the equation equal:

Example:
(6 + 3) + 4 =
(6 + 3) + 4 =6 + (3 + 4)
9 + 4 = 6 + 7
13 = 13

a. (2 + 5) + 3 =

b. (4 + 6) + 2 =

c. (7 + 8) + 1 =

2. Use the associative property to prove the equation equal.

Example:
(a + b) + c =
(a + b) + c = a + (b + c)
a + b + c = a + b + c

a. (m + n) + p =

b. (x + y) + z =

c. (c + d) + e =



3. Use the commutative property to make the equation equal.

Example: 2 x3 =
2 x 3 = 3 x 2
6 = 6

a. 5 x 10 =

b. 4 x 5 =

c. 7 x 9 =

4. Use the commutative property to make the equation equal.

Example: a x b
a x b = b x a
ab = ab

a. x x c =

b. m x n =

c. p x q =

5. Make use of the associative property to prove the equation equal:

Example: (6 + 3) + 4 =
(6 + 3) + 4 =6 + (3 + 4)
9 + 4 = 6 + 7
13 = 13

a. (2 + 5) + 3 =

b. (4 + 6) + 2 =

c. (7 + 8) + 1 =

continued ☛

18b Commutative, associative and distributive properties continued

6. Use the associative property to prove the equation equal.

Example: (a + b) + c =
(a + b) + c = a + (b + c)
a + b + c = a + b + c

a. (m + n) + p =

b. (x + y) + z =

c. (c + d) + e =

7. Use the associative property to prove the equation equal.

Example: (2 x 4) x 3 = 2 x (4 x 3)
8 x 3 = 2 x 12
24 = 24

a. (3 x 4) x 3 = 3 x (4 x 3)

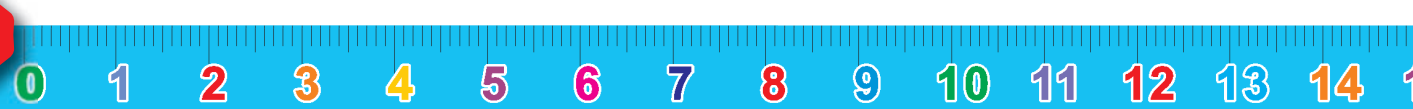
b. (7 x 4) x 2 = 7 x (4 x 2)

8. Use the associative property to prove the equation equal.

Example: a x b x c = (a x b) c
abc = ab x c
abc = abc

a. (c x d x e) = c(d x e)

b. $x \times y \times z = x\,(y \times z)$



Before attempting questions 9 and 19, working in pairs, come up with your own example. Making use of the distributive property.

9. Prove the following equations equal, by making use of the distributive property.

a. $3 \times (2 + 6) = (3 \times 2) + (3 \times 6)$

b. $5 \times (3 + 3) = (5 \times 3) + (5 \times 3)$

c. $3 \times (7 + 4) = (3 \times 7) + (3 \times 4)$

10. Prove the following equations equal, by making use of the distributive property.

a. $m \times (n + p) = (m + n) \times (m + p)$

b. $d \times (g + h) = (d + g) + (d + h)$

c. $r \times (s + t) = (r \times s) + (r \times t)$

11. Use zero as the identity of addition and as the identity of multiplication to write sums for the following:

		Zero as the identity of addition	One as the identity of multiplication
		$\frac{1}{2} + 0 = \frac{1}{2}$	$\frac{1}{2} \times 1 = \frac{1}{2}$
a.	3,5		
b.	56		
c.	$\frac{1}{5}$		

Problem solving

If a x (b + c) = (a x b) + (a x c) and a = -5, b = -2 and c = -3, substitute and solve the equation.

- What should I add to a number so that the answer will be the same as the number?
- What should I multiply a number by so that the answer will be the same as the number?

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

19 Factors, prime factors and factorising

Definitions of:



Factor: A factor is a number that divides exactly into another number. E.g. 8 is a factor of 32.



Prime factor: A factor of a number that is itself a prime number. E.g. The factors of 12 are 1, 2, 3, 4 and 6. Only 2 and 3 are prime factors..



Prime number: A number that has only two factors, 1 and itself.

1. What is a factor? Give an example.

2. Write the factors for:

Example: Factors of 16 = {1, 2, 4, 8, 16}

a. Factors of 8 = [...]

b. Factors of 24 = {...}

c. Factors of 21 = {...}

3. What is a prime number? Give five examples.

4. Revision: complete the table:

	Factors	Common factors	Highest common factors
Example: 4 and 8	1, 2, 4, 1, 2, 4, 8	1, 2, 4	4
a. 6 and 12			
b. 7 and 28			
c. 9 and 36			
d. 8 and 24			
e. 3 and 21			

5. What does HCF stand for?



6. What is the HCF for:

Example: Factors of 12: {1, 2, 3, (4) 6, 12} **Factors of 16: {1, 2, (4) 8, 16}**

a. 7 and 11

b. 23 and 19

c. 3 and 13

d. 31 and 2

7. Determine the highest common factors using the ladder method (factorising) and tree factorisation.

Example: Factors of 24 and 36

24	2
12	2
6	2
3	3
1	

36	2
18	2
9	3
3	3
1	

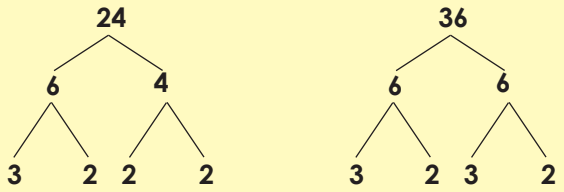
Only select the common factors once.

2 x 2 x 3 = 12

Check your answer: 24 ÷ 12 = 2

36 ÷ 12 = 3

Tree factorisation



a. Factors of 24 and 32

b. Factors of 64 and 32

c. Factors of 48 and 36

d. Factors of 72 and 32

Problem solving

Factorise 358.

What is the sum of the highest factor of 100 and 150 together with the highest factor of 200 and 250?

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

20 Multiples and the lowest common multiple

Look at the definitions. Give five examples of each.



Multiple:
A number made by multiplying two numbers together. They can be positive or negative whole numbers or zero.



LCM
(Lowest common multiple):
The smallest number that is a multiple of two or more numbers.

1. Write the first 12 multiples for:

Example: Multiples of 9: {9, 18, 27, 36, 45, 54, 63, 72, 81, 90, 99, 108}

a. Multiples of 2: {…}

b. Multiples of 4: {…}

c. Multiples of 7: {…}

d. Multiples of 3: {…}

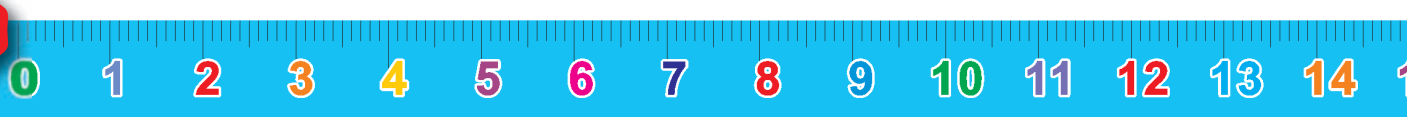
2. What does LCM stand for?

3. Determine the lowest common multiple.

Example: Multiples of 4: {4, 8, 12, 16, (20)} ∴ LCM is 20 Multiples of 5: {5, 10, 15, (20)}

a. Multiples of 8: {…}
Multiples of 5: {…}

b. Multiples of 5: {…}
Multiples of 12: {…}



c. Multiples of 7: {…}

Multiples of 4 {…}

d. Multiples of 8: {…}

Multiples of 4 {…}

e. Multiples of 2: {…}

Multiples of 4 {…}

f. Multiples of 6: {…}

Multiples of 8 {…}

4. Determine the LCM using the ladder method (factorising):

Example: Multiples of 12 and 8

12	2
6	2
3	3
1	

8	2
4	2
2	2
1	

2 x 2 x 2 x 3

= 8 x 3

= 24

The lowest common multiple is 24.

First determine the factors and then select ALL the factors from both numbers, but only select the common factors once.

a. Multiples of 22 and 28

b. Multiples of 38 and 72

c. Multiples of 32 and 36

d. Multiples of 74 and 48

e. Multiples of 27 and 81

f. Multiples of 68 and 88

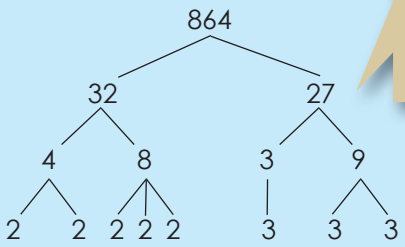
Problem solving

What is the sum of the first 20 multiples of 3 and 5?

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

21 Highest common factor and lowest common multiple of three-digit numbers

Explain the factor tree and ladder method by using the examples below.



Why do you think we call this a factorisation tree?

384	3
128	2
64	2
32	2
16	2
8	2
4	2
2	2
1	

Start by working out if it is divisible by one of the prime numbers 2, 3, 5, 7, etc.

- If the number ends on an even number it is divisible by 2.
- If the sum of the digits are divisible by 3 the numbers is divisible by 3.
- If the number ends on 0 or 5 it is divisible by 5.

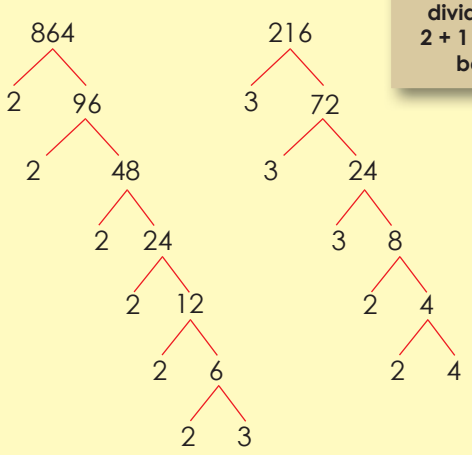
1. Calculate the HCF of two numbers using factorisation or inspection:

Example: Factors of 192 and 216

192	(2)
96	(2)
48	(2)
24	2
12	2
6	2
3	(3)
1	

216	(2)
108	(2)
54	(2)
27	3
9	3
3	(3)
1	

Factor trees



I know that 216 can be divided by 3 because 2 + 1 + 6 = 9, and 9 can be divided by 3.

192 = (2) x (2) x (2) x 2 x 2 x 2 x 3

216 = (2) x (2) x (2) x (3) x 3 x 3

Common factors are = 2, 2, 2, 3

HCF = 2 x 2 x 2 x 3 = **24**

a. 72 and 188

b. 205 and 315

c. 456 and 572

d. 208 and 234

e. 275 and 350

f. 204 and 252

2. Calculate the LCM using factorisation or inspection.

Example: 123 and 141

123	3
41	41
	1

141	3
47	47
	1

LCM = 3 x 41 x 47 = 5 781

a. 128 and 256

b. 243 and 729

c. 125 and 625

d. 200 and 1 000

e. 225 and 675

f. 162 and 486

Problem solving

Explain to a member of your family how you calculate the HCF using factorisation.

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

22 Sequences that involve integers

Think about what you know about integers. Look at these integers. Which integers come before and after each number.

-9	10	-1	-12
1	-7	-2	-15

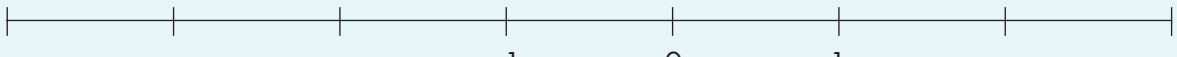


Integers includes the counting numbers {1, 2, 3, ...}, zero {0}, and the negative of the counting numbers {-1, -2, -3, ...}

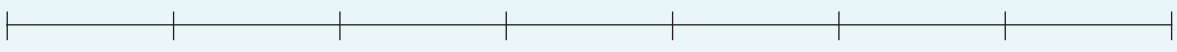
Place the integers above in ascending and then descending order.

1. Complete these number lines.

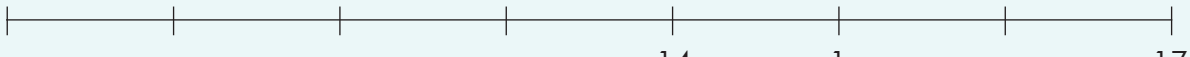
a.



b.



c.



d.



Think carefully what your intervals will be.

2. Complete these number lines. We have given you the integers for the first interval and the last interval.

a. -5 and 1

b. -2 and 6

c. -10 and -3

Think carefully what your intervals will be.

d. -100 and - 0

3. Complete the following.

a. -8 → -6 → -4 → ☐ → ☐ → ☐ → ☐ → ☐ → ☐

b. -64 → -56 → -48 → ☐ → ☐ → ☐ → ☐ → ☐ → ☐

c. -50 → -45 → -42 → ☐ → ☐ → ☐ → ☐ → ☐ → ☐



4. Identify the last term in each pattern. What is the rule?

Example: Example: -8, -7, -6, -5, -4, -3, -2 = 7th term. The rule is + 1.

a. -7, –6, -5, -4, -3, -2, -1, 0, 1 ____ th term. ____

b. -20, -18, -16, -14, -12, -10, ____ th term. ____

c. -25, -16, -9, -4, -1 ____ th term. ____

5. Circle the fifth term in each pattern. What is the rule?

a. -8, -6, -4, -2, 0, 2, 4, 6, 8 ____

b. -15, -12, -9, -6, -3, 0, 3, 6 ____

c. -80, -75, -70, -65, -60, -55, -40 ____

6. Determine the 10th term in each pattern. What is the rule?

a. -10, -9, -8, ____

b. -28, -26, -24, ____

c. -31, -28, -25, ____

d. -99, -94, -89, ____

e. -82, -78, -74, ____

f. -84, -77, -70, ____

7. Write the following in ascending order:

a. 6, -4, 4, 2, -2, 0, -6

b. -8, 0, 8, -24, 16, -16, 24

c. -5, 5, 15, 55, 10, -15, -10, -55

d. -100, -50, -200, -150, 0, -300

8. Fill in <, > or =

a. 4 ____ -4

b. -18 ____ -8

c. -2 ____ 2

d. -3 ____ 3

e. -10 ____ 10

f. -26 ____ -62

Problem solving

The rule for a number sequence is plus five;.
Using this rule, make a ten-term sequence including positive and negative integers.

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

23 Calculations with multiple operations

BODMAS stands for:

B =

O =

D =

M =

A =

S =

What do you notice?

(-3 - 2) x (7 - 2)
= -5 x 5
= -25

(-3 - 2) x (7 - 2)
= -3 - 2 x 7 - 2
= -3 -14 - 2
= -19

Which one is correct? Why?

Try it on a normal calculator and then a scientific calculator. What do you notice?





1. Solve the following:

Example: **(-7) + (5)**
= -7 + 5
= -2

a. (-2) + (-3) =

b. (2) - (-3) =

c. (-6) - (8) =

d. (-8) + (-4) =

e. (4 + 2) + (8 - 3) =

f. (6 - 8) + (3 + 4) =

2. Solve the following:

Example: **(–5 – 4) x (6 – 2)**
= –9 x 4
= –36

a. (2 + 3) x (4 x 2)

b. (–2 + 3) x (–4 + 2)

c. (2 – 3) ÷ (4 – 2)

d. (–2 – 3) ÷ (–4 – 1)

e. (5 + 6) x (8 + 7)

f. (5 – 6) x (8 – 7)

3. Solve the following:

Example: **(–3 + 2) + (5 – 3) x (8 – 9)**
= (–1) + (2) x (–1)
= –1 + (–2)
= –1 – 2
= –3

a. (–6 + 8) + (–3 – 4) x (7 – 9) =

b. (–9 + 4) – (–6 + 5) x (–3 + 2)=

c. (6 – 5) x (–3 + 9) ÷ (3 + 3) =

d. (–7 + 5) x (–2 – 7) + (–5 + 3)=

e. (–9 + 5) ÷ (–6 +4) – (10 – 11) =

f. Create a number sentence. Solve it.

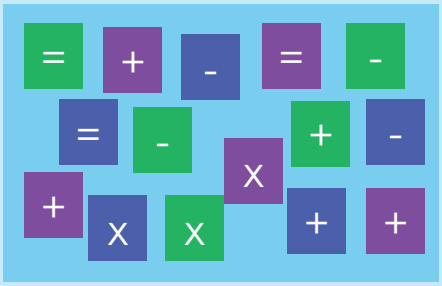
Problem solving

If the answer is 20 and the calculation has three operations, give an example of what the calculation could be.

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

24 Properties of numbers and integers

Make equations using the same coloured symbols. What do you notice.



Commutative property:
a+ b = b + a
a x b = b x aa

What will happen if you make all the "a" s negative?

Associative property:
a + (b + a) = (a + b) + c
a x (b x a) = (a x b) x c

... make all the "a" s and "b" s negative?

Distributive property
a × (b + c) = a × b + a × c or
a × (b + c) = (a × b) + (a × c)

... make all the "a" s, "b" s and "c" s negative?

1. Commutative property: use the example to guide you to solve the following:

Example: 8 + (-3) = (-3) + 8 = 5 8 x (-3) = (-3) x 8 = -24

a. 4 + (-2) = ____ = ____

b. 6 + (-4) = ____ = ____

c. 10 + (-2) = ____ = ____

d. 33 + (-14) = ____ = ____

e. . 7 x (-6) = ____ = ____

f. Make your own sum.

2. Use subtraction to check addition or vice versa.

Example: 8 + (-3) = 5 then
5 - 8 = -3 or
5 - (-3) = 8

a. 6 + (-2) = ____ = ____

b. 8 + (-9) = = ____ = ____

c. 3 + (-2) = ____ = ____

d. 17 + (-8) = ____ = ____

e. 9 + (-5) = ____ = ____

f. Make your own sum

3. Associative property: use the example to guide you to solve the following:

Example: [(-6) + 4] + (-1) = (-6) + [4 + (-1)] = -3

a. [(-3) + 2] + (-4) = _____ = _____

b. [(-6) + 7] + (-8) = _____ = _____

c. [(13) + (-3)] + (-2) = _____ = _____

d. [(-4) + (-10)] + 5 = _____ = _____

e. [(-12) + (-9)] + 18 = _____ = _____

4. Use division to check or vice versa.

Example: 5 x (-6) = -30 then
-30 ÷ 5 = -6 and
-30 ÷ (-6) = 5

a. 8x (-3) = _____

b. (-7) x (9) = _____

c. 5 x (-7) = _____

d. 6 x (-8) = _____

e. 4 x (-2) = _____

5. Complete the pattern.

Example: (+5) x (+5) = 25
(-5) x (-5) = 25
(+5) x (-5) = -25
(-5) x (+5) = -25

a. (+2) x (+2) = _____
(-2) x (-2) = _____
(+2) x (-2) = _____
(-2) x (+2) = _____

b. (+1) x (+1) = _____
(-1) x (-1) = _____
(-1) x (-1) = _____
(-1) x (-1) = _____

c. (-12) x (-12) = _____
(-12) x (-12) = _____
(-12) x (-12) = _____
(-12) x (-12) = _____

d. (+7) x (+7) = _____
(-7) x (-7) = _____
(+7) x (-7) = _____
(-7) x (+7) = _____

e. (+4) x (+4) = _____
(-4) x (-4) = _____
(+4) x (-4) = _____
(-4) x (+4) = _____

f. (+5) x (+5) = _____
(-5) x (-5) = _____
(+5) x (-5) = _____
(-5) x (+5) = _____

Problem solving

If the answer is -30 and the calculation has three operations, what could the calculation be?

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

25 Square numbers, cube numbers and more exponents

Write your definition of square numbers. Make a drawing.



Square numbers:

$2 = 2^1 = 2$
$2 \times 2 = 2^2 = 4$
$2 \times 2 \times 2 = 2^3 = 8$
$2 \times 2 \times 2 \times 2 = 2^4 = 16$
What wil the 10th pattern be?

1. Revision: calculate the following:

Example: 5^2
$= 5 \times 5$
$= 25$

a. 2^2 b. 7^2 c. 4^2

d. 6^2 e. 10^2 f. 9^2

2. Revision: calculate the following:

Example: 4^3
$= 4 \times 4 \times 4$
$= 64$

a. 2^3 b. 1^3 c. 4^3

d. 3^3 e. 3^3

3. Revision: calculate the following using a calculator:



Example: 11^3
$= 11 \times 11 \times 11$
$= 1\,331$

a. 17^3 b. 14^3 c. 16^3

d. 6^3 e. 7^3 f. 8^3



4. Write these numbers in exponential form:

Example: 12^2
$= 12 \times 12$
$= 144$

a. 64 ☐ b. 9 ☐ c. 25 ☐

d. 100 ☐ e. 36 ☐ f. 4 ☐

5. Write these numbers in exponential form:

Example: $81 = 3 \times 3 \times 3 \times 3 \times = 3^4$

a. 27 ☐ b. 8 ☐ c. 125 ☐

6. Write the following in exponential form:

Example: $64 + 8$
$= 8^2 + 2^3$

a. $125 + 25 =$ ☐ b. $64 + 125 =$ ☐ c. $1 + 9 =$ ☐

d. $1 + 81 =$ ☐ e. $25 + 36 =$ ☐

7. Write the following in exponential form.

Example: Example: $50 \times 50 \times 50 \times 50 \times 50 \times 50 \times 50 = 50^7$

a. $30 \times 30 \times 30 \times 30 \times 30$ ☐

b. $40 \times 40 \times 40 \times 40 \times 40 \times 40 \times 40 \times 40 \times 40 \times 40 \times 40 =$ ☐

c. $60 \times 60 \times 60 \times 60 =$ ☐

d. $70 \times 70 \times 70 \times 70 \times 70 \times 70 \times 70 \times 70 =$ ☐

e. $90 \times 90 \times 90 =$ ☐

f. $200 \times 200 \times 200 \times 200 =$ ☐

8. Look at the examples and calculate:

Example: $3^1 = 3$, $25^1 = 25$, $m^1 = m$, $9^1 = 9$

a. x^1 ☐ b. $a^2 =$ ☐ c. 250^1 ☐

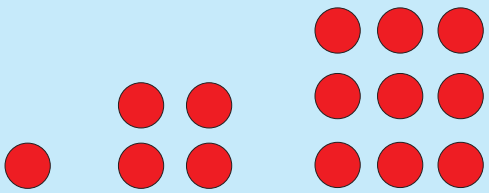
d. 12^1 ☐ e. 7^1 ☐ f. 47^1 ☐

Problem solving

Add the first 10 square numbers.

26 Square numbers and square roots

If the first pattern is 1, the second pattern is 4, and the third pattern is 9, what will the tenth pattern be?





It is important to know your time tables. Why?

1. Complete the table:

Number	Square the number	Answer
a. 6	**6^2 (6x6)**	**36**
b. 8		
c. 9		
d. 10		
e. 11		
f. 16		
g. 21		
h. 34		
i. 48		
j. 57		

2. Without calculating, say whether the answer will be a positive or negative number.

Example: $(-15)^2$ will be positive
$(15)^2$ will be positive

a. $(-9)^2$ ☐ b. $(18)^2$ ☐ c. $(19)^2$ ☐ d. $(-21)^2$ ☐

3. Calculate:

Example: a x b x a x b
= $a^2 \times b^2$

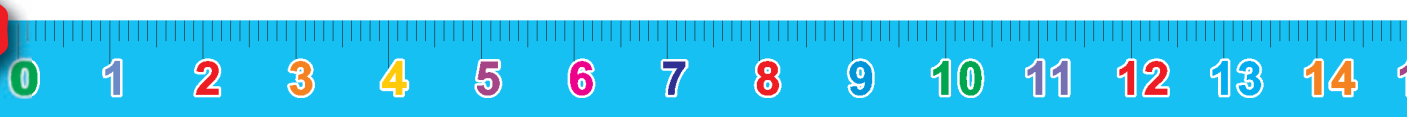
$b^2 \times c^2 \times c^2 \times b^2$
= $b^4 \times c^4$

a. g x g x h x h

b. a x a x b x b

c. z x z x c x c

d. d x d x s x s



4. Revision. Calculate the square root:

Example: $\sqrt{9}$
$= \sqrt{3 \times 3}$
$= 3$

Area of the room is $9m^2$



a. $\sqrt{64}$

b. $\sqrt{25}$

c. $\sqrt{1}$

d. $\sqrt{81}$

e. $\sqrt{49}$

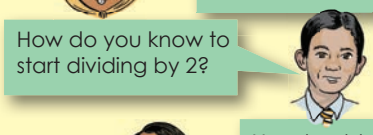
f. $\sqrt{121}$

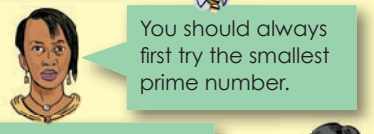
5. Calculate the square root using the example to guide you:

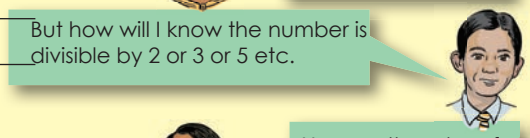
Example: $\sqrt{256}$
$= \sqrt{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2}$
$= 2 \times 2 \times 2 \times 2$
$= 16$

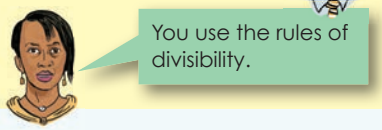
256	2
128	2
64	2
32	2
16	2
8	2
4	2
2	2
1	











Test your answer: 16 x 16 = 256

a. $\sqrt{36}$

b. $\sqrt{144}$

c. $\sqrt{324}$

d. $\sqrt{1296}$

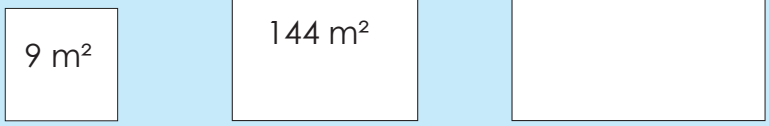
Problem solving

Add together the first 10 cube numbers.

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

27 Representing square roots

How quickly can you calculate the sides of these rooms? You may use a calculator.





1. Say whether the following are true or false. Make any false statements true.

a. $\sqrt{7^2} = 7$

b. $\sqrt{7^2} = 49$

c. $\sqrt{16 + 9} = 25$

d. $\sqrt{16 + 9} = 5$

e. $\sqrt{6^2} = 36$

f. $\frac{\sqrt{16}}{9} = \frac{4}{3}$

2. Revise: calculate.

Example: $\sqrt{12.12} = 12$

Note: We have used the . symbol for multiplication, instead of the usual x, to save space.

a. $\sqrt{2 \cdot 2}$

b. $\sqrt{3 \cdot 3}$

c. $\sqrt{4 \cdot 4}$

d. $\sqrt{5 \cdot 5}$

e. $\sqrt{6 \cdot 6}$

f. $\sqrt{8 \cdot 8}$

g. $\sqrt{10 \cdot 10}$

h. $\sqrt{7 \cdot 7}$

i. $\sqrt{9 \cdot 9}$

j. $\sqrt{11 \cdot 11}$

3. Represent the square root differently.

Example: $\sqrt{2 \cdot 2 \cdot 2} = 2\sqrt{2}$



a. $\sqrt{3.3.3}$ b. $\sqrt{6.6.6}$ c. $\sqrt{8.8.8}$

d. $\sqrt{9.9.9}$ e. $\sqrt{5.5.5}$ f. $\sqrt{4.4.4}$

g. $\sqrt{3.3.3.3.3}$ h. $\sqrt{4.4.4.4.4}$ i. $\sqrt{7.7.7.7.7}$

j. $\sqrt{8.8.8.8.8}$

k. Write down what you did. Share it with a family member.

4. Represent the square root differently:

Example: $\sqrt{8}$
$= \sqrt{2 \times 2 \times 2}$
$= 2\sqrt{2}$

a. $\sqrt{12}$ b. $\sqrt{45}$ c. $\sqrt{28}$

d. $\sqrt{20}$ e. $\sqrt{24}$ f. $\sqrt{18}$

5. Look at the example and complete the following:

Example: $3^2 = 9$ therefore $\sqrt{9} = 3$

a. 5^2 b. 9^2 c. 7^2

d. 2^2 e. 100^2 f. $\sqrt{36}$

g. $\sqrt{81}$ $\sqrt{625}$ i. $\sqrt{1}$

j. $\sqrt[3]{8}$

k. Write down what you did. Share it with a family member.

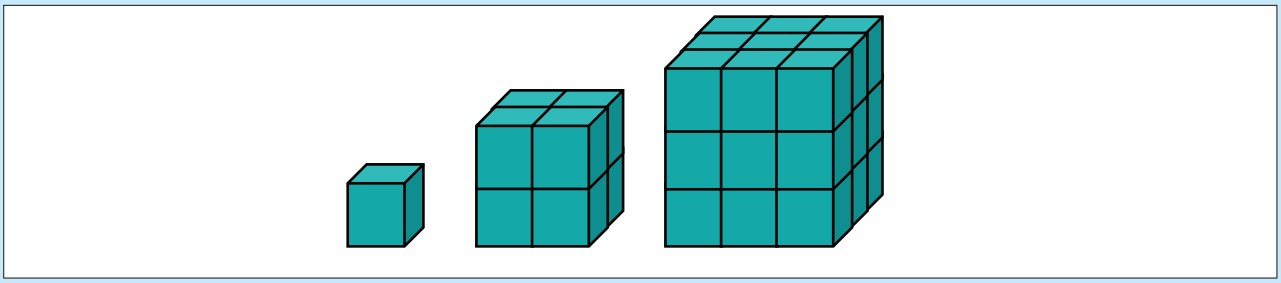
Problem solving

Represent the square root of any four-digit number using prime factorisation.

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

28 Cube numbers and roots

If the first pattern is 1, the second pattern is 8, and the third pattern is 27, what is the tenth pattern?



1. Complete the table:

Number	Cube the number	Answer
a. 2	23 (2 x 2 x 2)	8 (2 x 2 x 2 =
b. 3		
c. 5		
d. 4		
e. 1		
f. 7		
g. 9		
h. 8		
i. 10		
j. 12		

2. Answer positive or negative without calculating:

Example: $(-3)^3$ is negative
$(3)^3$ is positive

a. $(4)^3$

b. $(16)^3$

c. $(-9)^3$

d. $(27)^3$

e. $(-13)^3$

f. $(-6)^3$

3. Calculate:

Example: $a \times a \times a \times b \times b \times b$
$= a^3 \times b^3$

a. $b \times b \times b \times m \times m \times m$

b. $3 \times 3 \times 3 \times c \times c \times c$

c. $2 \times 2 \times 2 \times n \times n \times n \times n$

d. $m \times m \times m \times n \times n \times n$

e. $4 \times 4 \times 4$

4. Calculate:

Example: $\sqrt[3]{27}$
$= \sqrt[3]{3 \times 3 \times 3}$
$= 3$

a. $\sqrt[3]{125}$ b. $\sqrt[3]{64}$ c. $\sqrt[3]{1}$

d. $\sqrt{8}$ e. $\sqrt[3]{0}$

5. Calculate the cube root using the example to help you:

Example: $\sqrt[3]{729}$
$= \sqrt{3.3.3.3.3.3}$
$= 27$

729	3
243	3
81	3
27	3
9	3
3	3
1	

Is 729 divisible by 3?
Yes ,
7 + 2 + 9 = 18,
18 is divisible by 3

a. 216

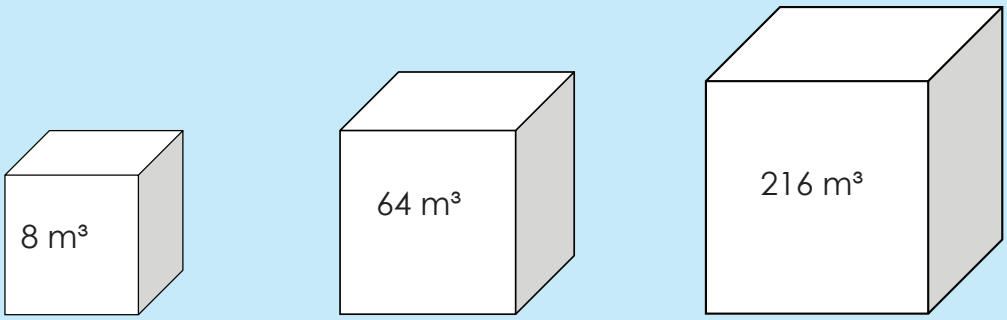
b. 19 683

Problem solving

Represent the cube root of any four-digit number using prime factorisation.

29 Representing cube roots

What is the length, height and width of these cubes?



1. Say if the following is true or false:

a. $\sqrt[3]{2^3} = 2$

b. $\sqrt[3]{7^3} = 49$

c. $\sqrt[3]{27} = 27$

d. $\sqrt[3]{27} = 3$

e. $\sqrt[3]{9^3} = 3$

2. Revise: calculate:

Example: $\sqrt[3]{12.12.12}$
$= 12$

a. $\sqrt[3]{10.10.10}$

b. $\sqrt[3]{5.5.5}$

c. $\sqrt[3]{3.3.3}$

d. $\sqrt[3]{11.11.11}$

e. $\sqrt[3]{7.7.7}$

f. $\sqrt[3]{4.4.4}$

3. Calculate:

Example: $\sqrt[3]{8.2}$
$= \sqrt[3]{2.2.2.2}$
$= 2\sqrt[3]{2}$

a. $\sqrt[3]{9.3}$

b. $\sqrt[3]{25.5}$

c. $\sqrt[3]{49.7}$

d. $\sqrt[3]{64.8}$

e. $\sqrt[3]{4.16}$

f. $\sqrt[3]{10.100}$

4. Calculate:

Example: $\sqrt[3]{16}$

$= \sqrt[3]{8 \times 2}$

$= \sqrt[3]{8} \times 2$

$= 2\sqrt[3]{2}$

a. $\sqrt[3]{24}$

b. $\sqrt[3]{54}$

c. $\sqrt[3]{72}$

d. $\sqrt[3]{81}$

e. $\sqrt[3]{80}$

f. $\sqrt[3]{80}$

5. Look at the example and complete the following:

Example: $2^2 = 8$ therefore $\sqrt[2]{8} = 2$

a. 2^3

b. 4^3

c. 7^3

d. 9^3

e. 1^3

f. $\sqrt[3]{64}$

Problem solving

Find a three-digit cube number that is between 500 and 600.

30 Scientific notation

Read the following:



Write the last speech bubble for this conversation.

1. Complete the following, using the example to guide you:

Example: 10 x 10 x 10 x 10 x 10 x 10 x 10
= 10 000 000
= 10^7

a. 10 x 10 =

b. 10 x 10x 10 x 10 =

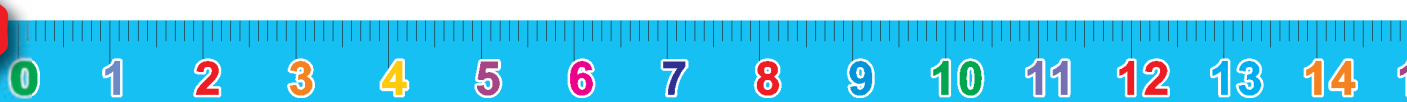
c. 10 x 10 x 10 x 10 x 10 x 10 =

d. 10 x 10 x 10 x 10 x 10 =

e. 10 x 10 x 10 =

2. Write as a natural number:

a. 10^6 b. 10^4 c. 10^8 d. 10^3 e. 10^5



3. Write the following numbers in scientific notation:

Example: 76 430 202
= $7{,}6430202 \times 10^{7}$

a. 2 567 389

b. 32 876 843

c. 35 784 321

d. 99 999 999

e. 126 589 543

f. 101 101 101

4. Write the following in standard notation:

Example: $7{,}6430202 \times 10^{7}$
= 76 430 202

a. $7{,}834561 \times 10^{6}$ =

b. $8{,}4762 \times 10^{4}$ =

c. $8{,}99945671 \times 10^{8}$ =

d. $9{,}9345678 \times 10^{7}$ =

e. $5{,}8384567 \times 10^{7}$ =

f. $11{,}34529 \times 10^{5}$ =

Problem solving

Write a number sentence, using scientific notation, for one hundred thousand plus one million multiplied by ten to the power of two.

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

31 Laws of exponents: $x^m\ x^n = x^{m+n}$

The exponent of a number says how many times to use the number in a multiplication.
E.g. $2^3 = 2 \times 2 \times 2$



An exponent is an easy way to write a lot of multiples.

The laws of exponents are also called the laws of powers or indices. What do you think this means? In this worksheet you will learn that.
$x^m\ x^n = x^{m+n}$

1. Solve:

Example:
$2^3 \times 2^2$
$= 2^{3x2}$
$= 2^5$
$= 32$

Test:
$2^3 \times 2^2$
$= 8 \times 2$
$= 32$



You can use a calculator.

a. $3^3 \times 3^7 =$

b. $9^4 \times 9^2 =$

c. $1^9 \times 1^9 =$

d. $10^2 \times 10^6 =$

e. $7^2 \times 7^3 =$

f. $8^5 \times 8^9 =$

2. Solve and test your answer:

Example:	***Test: your answer. $x = 2$***	
$x^3 \times x^4$	$2^3 \times 2^4$	2^{3+4}
$= x^{3+4}$	$= 8 \times 16$	$= 2^7$
$= x^7$	$= 128$	$= 128$

a. $c^2 \times c^4 =$
test if $c = 2$

b. $m^4 \times m^5 =$
test if $m = 3$

c. $p^7 \times p^3 =$
test if $p = 2$

d. $q^3 \times q^7 =$
test if $q = 3$

e. $x^5 \times x^8 =$
test if $x = 4$

f. $s^9 \times s^2 =$
test if $s = 5$

3. Why can we say: $a^m \times a^n = a^{m+n}$. Give three examples.

a.

b.

c.

Problem solving

If the answer is d^{4+2}, write a sum and the rule for the answer

32 Law of exponents: $x^m \div x^n = x^{m-n}$

Can you still remember what the answer for this law of exponents is?

$x^m \, x^n =$ ☐



Did you study the laws of exponents?

Today we are going to learn that:

$\frac{x^m}{x^n} = x^{m-n}$ or $x^m \div x^n = x^{m-n}$

1. Solve:

Example:

$3^5 \div 3^2$
$= 3^{5-2}$
$= 3^3$
$= 27$

Test:

$3^5 \div 3^2$
$= 243 \div 9$
$= 27$



You can use a calculator.

a. $7^5 \div 7^2 =$

b. $3^{10} \div 3^7 =$

c. $2^9 \div 2^3 =$

d. $8^{12} \div 8^8 =$

e. $1^{10} \div 1^{10} =$

f. $4^{15} \div 4^4 =$

2. Solve and test your answer:

Example:

$x^5 \div x^3$
$= x^{5-3}$
$= x^2$

Test: your answer. $x = 2$

$2^5 \div 2^3$
$= 2^{5-3}$
$= 2^2$
$= 4$

$2^5 \div 2^3$
$= 32 \div 8$
$= 4$

a. $p^5 \div p^3 =$
test if $p = 2$

b. $z^7 \div z^4 =$
test if $z = 3$

c. $e^8 \div e^3 =$
test if $e = 2$

d. $x^7 \div x^6 =$
test if $x = 3$

e. $s^9 \div s^5 =$
test if $s = 2$

f. $g^{20} \div g^{15} =$
test if $g = 3$

Problem solving

If the answer is c^{b-d}, write a sum for it.

33 More laws of exponents: $(x^m)^n = x^{mn}$

Revise the following:

$x^m . x^n =$ ____

$x^m . x^n =$ ____



Did you study the laws of exponents?

Today we are going to learn that:

$(x^m)^n = x^{mn}$

1. Solve:

Example:

$(2^3)^2$
$= 2^{3+2}$
$= 2^6$
$= 64$

Test:

$(2^5)^2$
$= (8)^2$
$= 64$



You can use a calculator.

a. $(2^2)^7$

b. $(1^4)^1$

c. $(7^9)^4$

d. $(3^5)^2$

e. $(15^2)^5$

f. $(12^7)^{11}$

2. Solve

Example:

$(x^3)^2$
$= x^{3x2}$
$= x^6$

Test: your answer. $x = 2$

$(3^3)^2$
$= (3)^{3 \times 2}$
$= 3^6$
$= 729$

$(3^3)\ (3^3)$
$= 27 \times 27$
$= 729$

a. $(x^2)^3$

b. $(p^2)^6$

c. $(p^5)^5$

d. $(a^2)^3$

e. $(x^3)^4$

f. $(v^3)^3$

3. Solve

Example:

$(3x^2)^3$

$= 3.\ x^{2 \times 2}$

$= 27x^6$

a. $(2e^4)^1$

b. $(4g^3)^5$

c. $(9f^6)^6$

d. $(10k^9)^4$

e. $(23e^{10})^2$

f. $(14t^5)^3$

4. Solve

Example:

$(a \times t)^n$

$= a^n \times t^n$

a. $(r\ x\ s)^4$

b. $(b\ x\ c)^y$

c. $(x\ x\ y)^t$

d. $(a\ xd)^n$

e. $(a\ x\ c)^k$

f. $(e\ x\ g)^k$

Problem solving

If the answer is $a^c \times b^c$, write a sum for the answer.

34 Laws of exponents: $(x^0) = 1$

Revise the following:

$x^m \, x^n$ = ____

$x^m \div x^n$ = ____

$(x^m)^n$ = ____



Did you study the laws of exponents?

Today we are going to learn that:

$(x^0) = 1$

1. Solve: What will each number to the power of 1, 2 and 3 be?

Example:

$3^0 = 1$ $3^1 = 1$ $3^2 = 9$ $3^3 = 27$



You can use a calculator.

a. 12^0 b. 8^0 c. 4^0

d. 13^0 e. 9^0 f. 7^0

2. Solve: What will each number to the power of 1 be?

Example:

$a^0 = 1$ $a^1 = a$

a. x^0 b. q^0 c. r^0

d. m^0 e. p^0 f. y^0

3. Solve

Example:

$(4x^2)^0$

$= 1$

a. $(6x^7)^0$

b. $(4y^3)^0$

c. $(7k^9)^0$

d. $(9t^5)^0$

e. $(8s^{10})^0$

f. $(13p^{10})^0$

4. Solve using both methods.

Example:

$a^n \div a^4$

$= \frac{a.a.a.a}{a.a.a.a}$

$= 1$

a^4 means a x a x a x a (which is the same as a.a.a.a

$= a^{4-4}$

$= a^0$

$= 1$

a. $a^6 \div a^6$

b. $v^3 \div v^3$

c. $m^3 \div m^3$

d. $w^2 \div w^2$

e. $y^7 \div y^7$

f. $z^{10} \div z^{10}$

Problem solving

If the answer is 1, write a sum and the rule for the answer.

35 Calculations with exponents

In the next 3 worksheets we are going to apply what we learned about exponents. Write down 3 examples of each of these.

Square number	Square root	Cube number	Cube root

1. Calculate the following:

Example: (-6^2)

$= (-6)(-6)$

$= 36$



a. (-8^2)

b. (7^2)

c. (-9^2)

d. (-10^2)

e. (6^2)

f. (-11^2)

2. Calculate the following:

Example: (-63)

$= (-6)(-6)(-6)$

$= -216$

a. (-3^3)

b. (1^3)

c. (-9^3)

d. (2^3)

e. (-7^3)

f. (-10^3)



3. Calculate the following:

Example: $-\sqrt{9}$

$= -\sqrt{3 \times 3}$

$= -3$

a. $-\sqrt{36}$

b. $-\sqrt{49}$

c. $\sqrt{16}$

d. $\sqrt{81}$

e. $\sqrt{4}$

f. $-\sqrt{64}$

4. Calculate the following:

Example: $\sqrt[3]{-8}$

$= -2$

a. $\sqrt[3]{8}$

b. $\sqrt[3]{-27}$

c. $\sqrt[3]{-125}$

d. $\sqrt[3]{64}$

e. $\sqrt[3]{125}$

f. $\sqrt[3]{-64}$

Problem solving

Square negative fifteen.

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

36 Calculations with multiple operations (square and cube numbers, square and cube roots)

Revision: What does BODMAS mean? Write it down

B _____

O _____

D _____

M _____

A _____

S _____

1. Calculate:

Example: (7 + 6) + (23)
= 13 + 8
= 21

a. $(8 + 5) + (2^2) =$

b. $(2^3) - (3 + 2) =$

c. $(7 + 6) + (7^2) =$

d. $(4 + 2) - (5^2) =$

e. $(3^2) - (3 + 2) =$

f. $(5 - 1) + (4^3) =$

2. Calculate:

Example: (32) - (4 - 5)
= 9 - (-1)
= 10

a. $(1^3) + (3 - 5) =$

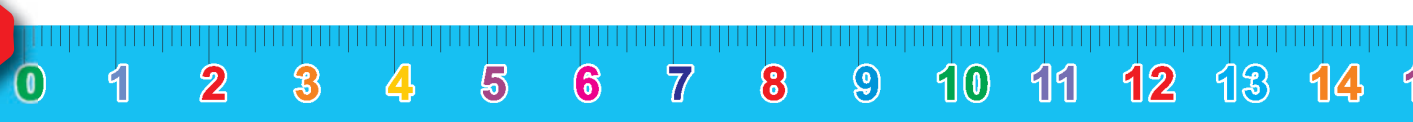
b. $(6^2) - (6 - 8) =$

c. $(4^2) - (5 - 7) =$

d. $(8 - 7) - (4^3) =$

e. $(9 - 10) + (2^3) =$

f. $(5 - 7) + (7^2) =$



3. Calculate:

Example: $\sqrt{9} + (5 + 1)$
$= 3 + 6$
$= 9$

a. $\sqrt{4} + (2 + 3)$

b. $\sqrt{36} + (5 + 6)$

c. $(8 + 4) + \sqrt[3]{27}$

d. $\sqrt[3]{64} - (2 + 1)$

e. $(6 + 8) + \sqrt{144}$

f. $(4 - 3) + \sqrt{16}$

4. Calculate:

Example: $\sqrt[3]{125} - (-3 - 2)$
$= 5 - (-5)$
$= 10$

a. $\sqrt{4} + (5 - 6)$

b. $\sqrt{64} - (5 - 6)$

c. $(8 - 10) + \sqrt{36}$

d. $(9 - 12) + \sqrt[3]{8}$

e. $\sqrt[3]{125} - (6 - 9)$

f. $(-4 - 7) + \sqrt{9}$

5. Calculate:

a. $(\sqrt{25}) + (5 + 4) + (6^2) =$

b. $(9^2) + (\sqrt{36}) - (6 + 2) =$

c. $(\sqrt[3]{125}) + (2) + (5 - 6) =$

d. $(5 + 4) - (5^3) - (\sqrt[3]{8}) =$

e. $(10 - 5) + (\sqrt{81}) - (6^2) =$

f. $(1^3) - (3 - 4) - (\sqrt{144}) =$

Problem solving

If the answer is one hundred and the calculation has three operations, with a cube root and a square number, what could the calculation be?

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

37 More calculating with exponents

Write down all the things you know about exponents and calculating exponents.

1. Solve:

Example:

$$\frac{2^3}{2^2}$$

$$= \frac{2 \times 2 \times 2}{2 \times 2} \quad \text{or} \quad = 2^{3-2}$$

$$= \frac{8}{4} \qquad = 2^1$$

$$= 2 \qquad = 2$$

Remember

$$\frac{x^m}{x^n} = x^{m-n}$$

a. $\frac{4^4}{4^1}$

b. $\frac{7^4}{7^3}$

c. $\frac{11^9}{11^7}$

d. $\frac{10^3}{10^2}$

e. $\frac{8^4}{8^2}$

f. $\frac{9^{10}}{9^4}$

2. Solve:

Example:

$$\left(\frac{3}{4}\right)^2$$

$$= \frac{3^2}{4^2}$$

$$= \frac{3 \times 3}{4 \times 4}$$

$$= \frac{9}{16}$$

You did it like this.

... and your friend like this.

Talk about it.

$$\left(\frac{3}{4}\right)^2$$

$$= \frac{3^2}{2^{2+2}}$$

$$= \frac{3}{4^4}$$

$$= \frac{9}{16}$$

a. $\left(\frac{3}{8}\right)^4$

b. $\left(\frac{4}{9}\right)^5$

c. $\left(\frac{7}{10}\right)^3$

d. $\left(\frac{6}{8}\right)^2$

e. $\left(\frac{9}{13}\right)^3$

f. $\left(\frac{2}{14}\right)^4$

3. Solve:

Example:

$\sqrt{\frac{9}{25}}$

You did it like this.

$= \frac{\sqrt{9}}{\sqrt{25}}$

$= \frac{3}{5}$

... and your friend like this.

$= \frac{\sqrt{3.3}}{\sqrt{5.5}}$

$= \frac{3}{5}$

Talk about it.

a. $\sqrt{\frac{16}{36}}$

b. $\sqrt{\frac{25}{169}}$

c. $\sqrt{\frac{9}{81}}$

d. $\sqrt{\frac{9}{25}}$

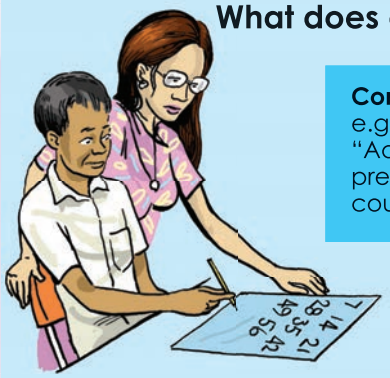
e. $\sqrt{\frac{9}{49}}$

f. $\sqrt{\frac{36}{144}}$

Problem solving

Write an algebraic expression where the numerator and denominator are written in exponential form.

38 Numeric patterns



What does each statement tell you. Give two more examples of each.

Constant difference: e.g. -3; -7; -11; -15 "Add -4" to the previous pattern or counting in "-4s".

Constant ratio: e.g. -2; -4; -8; -16; -32 "Multiply the previous term by 2."

Not having a constant difference or ratio: e.g. 1; 2; 4; 7; 11; 16 "Increase the difference between consecutive terms by 1 each time".

1. What is the constant difference between the consecutive terms?

a. 3, 5, 7, 9

b. 2, 4, 6, 8

c. 9, 6, 3, 0

d. 7, 14, 21, 28

e. 1, 2, 3, 4

f. 6, 12, 18, 24

2. What is the constant ratio between the consecutive terms?

a. 3, 9, 27, 81

b. 9, - 27, 81, -243

c. 5, -25, 125, - 625

d. 8, 16, 32, 64

e. 2, - 8, 32, - 128

f. 10, -100, 1 000, -10 000

3. Why does this pattern not have a constant difference or ratio?

a. 1, 4, 10, 19

b. 2, 4, 8, 16

c. 3, 7, 13, 21

d. 12, 10, 6, 0

e. 2, 6, 13, 23

f. 7, 13, 25, 43

4. What is the constant difference or ratio between the consecutive terms?

a. 5, -15, 45, -135

b. 6, 24, 96, 384

c. 1, 9, 17, 25

d. 4, -20, 100, -500

e. 8, 2, -4, -10

f. 9, 5, 1, -3



5. Complete the table and then state the rule.

Example:

Position	1	2	3	4	5	n
Value of the term	3	6	9	12	15	n x 3

Rule?The term x 3.

i. Complete the table
ii. State the rule.
iii. Solve term value as asked.

a.

Position	2	4	6	8	n
Value of the term	4	8		16	

What will the value of the 20th term be? Rule?

b.

Position	5	15	25	35	n
Value of the term	12	22			

What will the value of the 15th term be? Rule?

c.

Position	1	2	3	4	5	n
Value of the term				-12	-15	

What will the value of the 46th term be? Rule?

d.

Position	1	2	3	4	5	n
Value of the term		4	9		25	

What will the value of the nth term be? Rule?

e.

Position	0	1		3	4	n
Value of the term		2		6	8	

What will the value of the 11th term be? Rule?

Problem solving

a. If the constant ratio is -8, what could a sequence of numbers be?
b. Find five-digit numbers in a newspaper. What does each of them mean?

continued

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

38b Numeric patterns continued

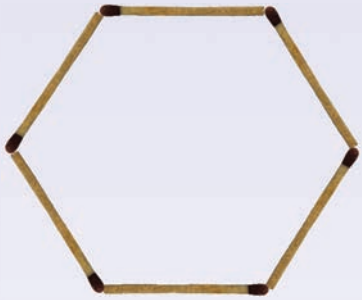
Talk about this.

	1st term	2nd term	3rd term	4th term	5th term	
Position of hexagon in pattern	1	2	3	4	5	n
Number of matches	?	16	24	32	40	
	1 x ?	2 x 8	3 x 8	4 x 8	5 x 8	

Read the top row.
The position: 1st term, 2nd term, 3rd term, 4th term, 5th term, nth term
If the 2nd terms position is 2 and its value is 16 the rule is 2 x 8 = 16. What is the 1st term?

1. Draw more matchsticks to make the next pattern in a sequence of hexagons.

Hexagon pattern 1:



(1 x 6)

What will the next pattern be?
The rule: add one matchstick to each side.

Hexagon pattern 2:

2. Calculate the number of matchsticks used:

a. 1st hexagon = 1 matchstick per side 1 x 6 = 6

b. 2nd hexagon = 2 matchsticks per side

c. 3rd hexagon = 3 matchsticks per side

d. 4th hexagon = 4 matchsticks per side

3. Record your results in this table.

n is the position of the term.

Position	1	2	3	4	5	6	10	n
Value of the term								

10th hexagon =

nth hexagon =

4. Complete the following.

Example: 8, 15, 22, 29, …

Term	**1**	**2**	**3**	**4**	**18**	**n**
Value of the term	8	15	22	29	127	7(n) +1

Add 7 to the previous position.
7 x the position of the term + 1 ___.
7(n) + 1, where "n" is the position of the term.
7(n) + 1, where "n" is a natural number.

a. 13, 25, 37, 49…

Term	1	2	3	4	17	n
Value of the term						

b. 6, 11 16, 20 …

Term	1	2	3	4	22	n
Value of the term						

c. 3, 5, 7, 9 …

Term	1	2	3	4	41	n
Value of the term						

5. Draw and complete your own tables using the following information.

a. 4(n) + 1

Term						n
Value of the term						

b. 6(n) + 1

Term						n
Value of the term						

c. 8(n) + 3

Term						n
Value of the term						

Short assignment

Draw the first three terms.
Identify the rule.
Complete the table.

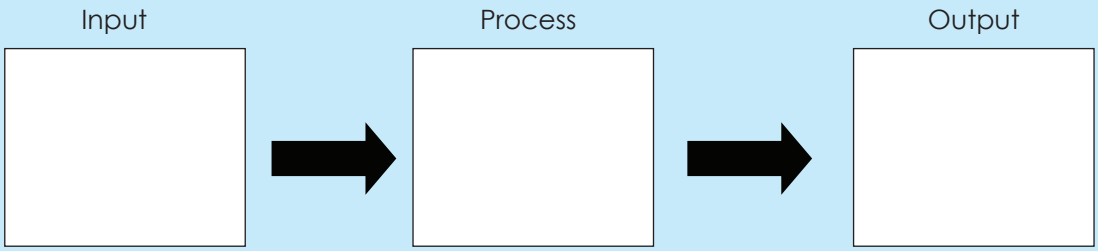
Position of - in pattern	1	2	3	4	5	10	n
Number of matches							

i. Triangle number pattern
ii. Square number pattern
iii. Pentagonal number pattern
iv. Hexagonal number pattern
v. Octagonal number pattern

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

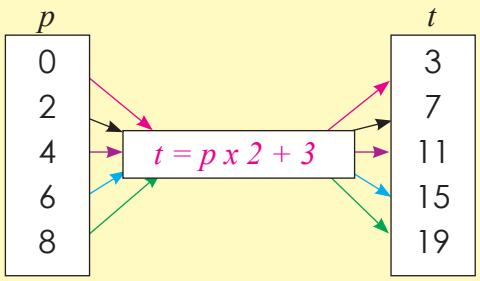
39 Input and output values

In grade 7 you learned about input and output values. Make a drawing to illustrate input and output values.



1. Complete the following:

Example:



t = p x 2 + 3

0 x 2 + 3 = 3 (t = 3)

2 x 2 + 3 = 7 (t = 7)

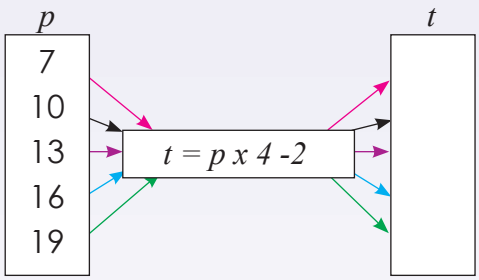
4 x 2 + 3 = 11 (t = 11)

6 x 2 x 3 = 15 (t = 15)

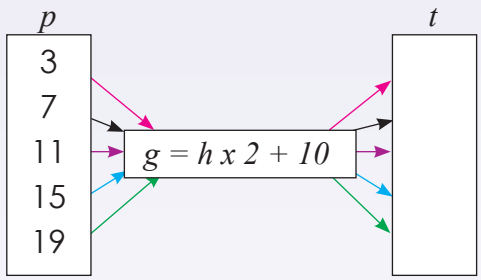
8 x 2 x 3 = 19 (t = 19)

This is the rule for this flow diagram.

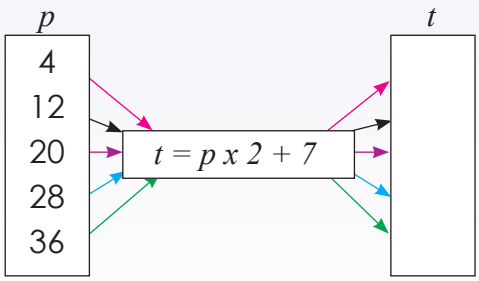
a.



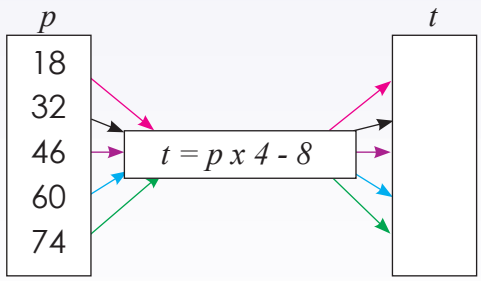
b.



c.

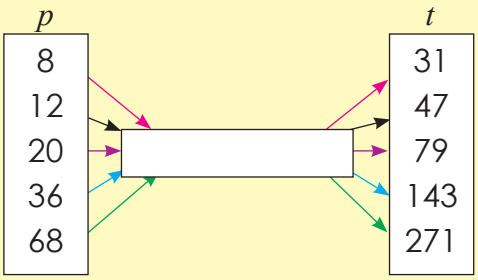


d.



2. What is the rule?

Example:



31 = 4(8) – 1 = 31

43 = 4(12) – 1 = 47

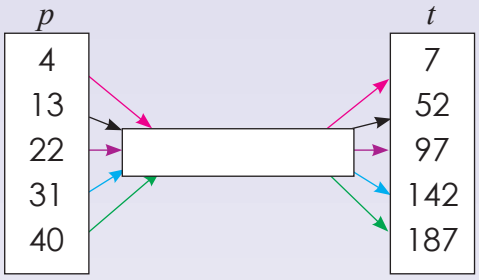
67 = 4(20) – 1 = 79

115 = 4(36) – 1 = 143

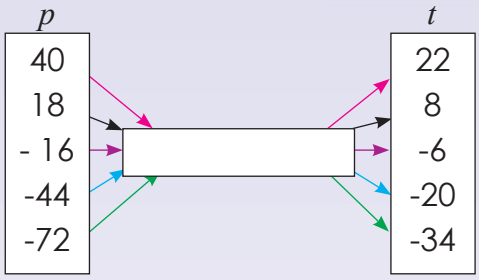
211 = 4(68) – 1 = 271

The rule is: 4(p) – 1 = t

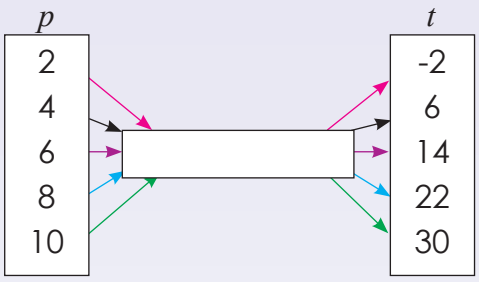
a.



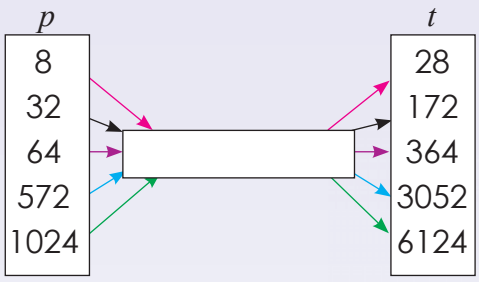
b.



c.



d.



Input and output values

3. Describe the relationship between the numbers in the top row and bottom row in the table. Then write down the values of m and n.

Example:

y	-2	-1	0	m	2	3
x	30	27	n	21	18	15

m = 1 n = 24

Rule is $x = 3y + 24$

a.

y	-3	-2	m	0	1	2
x	-1	0	1	2	3	n

m = n =

Rule is _____

b.

y	1	2	3	4	m	6
x	4			n		

m = n =

Rule is _____

Problem solving

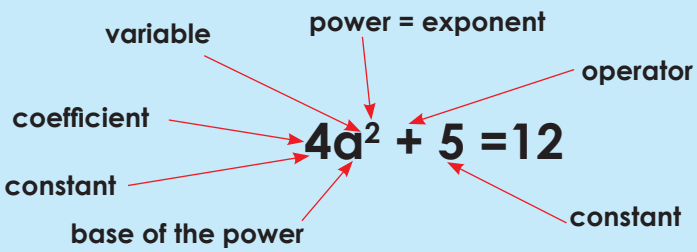
If s = r x 5 - 9, where r = -2, what is s?

y = - x + (- 3) is the rule. Show this in a table with x = to -3, -2, -1, 0, 1, 2

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

40 Algebraic vocabulary

Match the words with the algebraic equation.



This is an algebraic equation



An algebraic expression will look like this: $4a^2 + 5 =$

1. Circle the variable:

a. $x + 7 = 10$ b. $2x + 5 = 9$ c. $8 + x = 10$

2. Circle the constant:

a. $x + 8 = 14$ b. $3x + 10 = 19$ c. $5 + 9 = 20$

3. Circle the coefficient:

a. $8x$ b. $9a$ c. $4x + 2 = 10$

4. Circle the operator:

a. $8x$ b. $9a$ c. $4x + 2 = 10$

5. Circle the power/exponent:

a. 5^2 b. $3^3 + 22 = 31$ c. $4^2 + 1^3 = 17$

6. Circle the equations with "like terms":

a. $6a + 7a =$ b. $2a + 3b =$ c. $7b + 19 =$

7. Circle the equations with "unlike terms":

a. $6a + 3a =$ b. $7x + 2y =$ c. $7x + 2x =$

Like and unlike terms:

We can add "3 apples" and "4" apples", but we cannot add "3 apples" and "4 pears".

8. Circle the algebraic expression:

a. $2a + 7$ b. $7a$ c. $3a + 22$



9. Circle the algebraic equations:

a. 3a + 2 = 10 b. 10b c. 7b + 2 = 16

10. Revision: write on algebraic expression that will symbolise each of the

a. Six more than a certain number.

b. Six less than a certain number.

c. A certain number less than six.

d. A number repeated as a term three times.

e. A certain number times itself: what term do you get?

continued ☛

Algebraic vocabulary continued

11. Write the following in algebraic terms:

a. What does 3^n mean in 3, 9, 27, 81...3^n?

b. What does 2^{n+1} mean in 3, 5, 9, ...2^{n+1} ?

b. What does 3^{n-7} mean in -4, -1, 20, ...3^{n-7}?

d. What does the following mean: 22, 28, 34, 40, …, with the rule 6(n + 1) + 4?

e. What is n in the following sequence: 8, 10, 14, 22, …, with the rule $6 + 2^n$?

f. 7(n)+2 in the sequence 9, 16, 23, 30, …7(n) + 2

Problem solving

Create an algebraic expression with three like and three unlike terms.
What does n mean in 7(n + 2)? (n^{th} term)

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

41 Like terms: whole numbers

Discuss this:

We can add "3 apples" and "4 apples", but we cannot add "3 apples" and "4 pears".

Give 5 examples of like terms

1. Calculate:

Example: $3a + 4a = 7a$

Underline the variable in red.

Underline the constant in blue.

a. $5a + 3a =$

b. $6m - 2m =$

c. $7x - 2x =$

d. $1n + 5n =$

e. $9z + 7z =$

f. $3t + 5t =$

2. Calculate:

Example: $3a^2 + 5a^2 = 8a^2$

Note: $3a^2 + 5a^2$ is not $8a^4$

Underline the variable in red.

Underline the constant in blue.

a. $1a^2 + 2a^2 =$

b. $8r^2 + 5r^2 =$

c. $2x^2 + 4x^2 =$

d. $4t^2 - 3t^2 =$

e. $3m^2 - 2m^2 =$

f. $5b^2 - 2b^2 =$

3. Calculate:

Example 1: $5x^2 + 4x^2 = 9x^2$

Example 2: $5x + 4x^2 = 5x + 4x^2$

a. $4x^2 + 2x^2 =$

b. $5x^2 + 5x =$

c. $8a^2 - 5b^2 =$

d. $8a^3 + 2a =$

e. $3b^3 + 3b =$

f. $8c^3 - 2c^3 =$

4. Calculate:

Example: $3a^2 \times 4a^2$
$= (3a^2)(4a^2)$
$= 12a^4$

a. $2a \times 3a =$

b. $2c^2 \times 5c^2 =$

c. $5b^2 \times 4b^2 =$

d. $7c \times 8c =$

e. $6b \times 2b =$

f. $3a^2 \times 4a^2 =$

5. Calculate:

Example: $3a^2 \div 4a^2$
$= \frac{3a^2}{4a^2}$
$= \frac{3}{4}$

a. $1a \div 7a =$

b. $3f \div 5f =$

c. $4a^2 \div 2a^2 =$

d. $5b^3 \div 2b^3 =$

e. $9c \div 9c =$

f. $3x \div 6x =$

Problem solving

Create a sum with six like terms. Solve it.

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

42 Like terms: Integers

What is an integer? Give some examples.

Revise that:

- a **positive number** x a **positive number** = a **positive number**
- a **negative number** x a **negative number** = a **positive number**
- a **negative number** x a **positive number** = a **negative number**
- a **positive number** + a **positive number** = a **positive number**
- a **negative number** + a **negative number** = a **negative number**
- a **positive number** + a **negative number** = a **positive** or a **negative number**

1. Calculate:

Example: - 3a - 4a
= -7a

Underline the variable in red.

Underline the constant in blue.

a. -5a + 3a =

b. -6m - 2m =

c. -7x - 2x =

d. 1n - 5n =

e. -9z + 7z =

f. -3t + 5t =

2. Calculate:

Example: $-3a^2 - 5a^2 = -8a^2$

Underline the variable in red.

Underline the constant in blue.

a. $1a^2 - 2a^2$ =

b. $-8r^2 - 5r^2$ =

c. $2x^2 - x^2$ =

d. $-4t^2 - 3t^2$ =

e. $3m^2 – 2m^2$ =

f. $-5b^2 – 2b^2$ =

3. Calculate:

Example 1: $5x^2 + 4x^2 = 9x^2$ **Example 2:** $5x + 4x^2 = 5x + 4x^2$

a. $-4x^2 + 2x^2$ =

b. $-5x^2 + 5x$ =

c. $-8a^2 – 5b^2$ =

d. $-8a^3 + 2a$ =

e. $-3b^3 + 3b$ =

f. $-8c^3 – 2c^3$ =



4. Calculate:

Example: $3a^2 \times 4a^2$
$= (3a^2)(4a^2)$
$= 12a^4$

a. $2a \times -3a =$

b. $-2c^2 \times -5c^2 =$

c. $-5b^2 \times 4b^2 =$

d. $-7c \times 8c =$

e. $-6b \times 2b =$

f. $3a^2 \times -4a^2 =$

5. Calculate:

Example: $3a^2 \div 4a^2$
$= -\frac{3a^2}{4a^2}$
$= -\frac{3}{4}$

a. $-1a \div 7a =$

b. $3f \div -5f =$

c. $-4a^2 \div 2a^2 =$

d. $-5b^3 \div -2b^3 =$

e. $-9c \div -9c =$

f. $-3x \div 6x =$

Problem solving

Share with your family what like terms are.

43 Writing number sentences

Read through this problem and underline the key concepts

The relationship between a boy's age (x years old) and his mother's age is given as 25 + x. How can this relationship be used to find the mother's age when the boy is 11 years old?

25 + 11 = 36

Here you must recognise that to find the mother's age, you must substitute the boy's current age into the rule 25 + x. You should also recognise that this rule means that this boy's mother is 25 years older than he is.

1. Write a number sentence for:

a. If Peter is seven years younger than Jabu and Jabu is two years older than Tshepo, how old are Jabu and Tshepo if Peter is 12 years old?

b. Sandra buys three more apples than Lebo bought. Lebo has seven apples left after he has sold 17 apples. If Sandra only sells eight apples, how many does she have left?

c. Thabo is 10 cm taller than Kabelo, and Lebo is 7cm shorter than Mpho. How tall is Mpho if Thabo is 178 cm tall?

d. Tshepo gets x rand more than Alwin. Alwin get R2 less than Lebo. How much more does Tshepo get than Alwin if Lebo gets R20?

e. James weighs 80 kg and Jenny weighs x kg less. How much do they weigh together?

f. Tea company A makes 700 more tea-bags than Tea company B. Tea company B makes 300 tea-bags less than Tea company C. How much more must Tea company A produce to make 5 000 tea-bags per day, if tea company B produces 3 600 tea bags per day?

Problem solving

Create your own word problem and get a friend to try it out.

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

44 Set up algebraic equations

Talk about this:

Altogether

Sipho has seven marbles and John has five. How many do they have altogether?

What is the keyword in the problem telling you which operation to use?

What does "altogether" tell us?

Addition is probably the operation (that is needed)

What are the quantities?

- Sipho's (7) marbles
- John's (5) marbles

What is the **relationship**?

The relationship is Sipho's marbles + John's marbles = total marbles

The **number sentence** is : 7 + 5 = _____

1. Solve the following:

Example:

Sipho has 7n marbles and John has 5n. How many do they have altogether?

Keyword: addition

Relationship: Sipho's marbles + John's marble = total marbles

Number sentence: 7n + 5n = 12n

a. Mpho, Ryna and Gugu have 15 books altogether. Mpho has two books and Gugu has nine books. How many books does Ryna have?

Keyword: _____

Relationship: _____

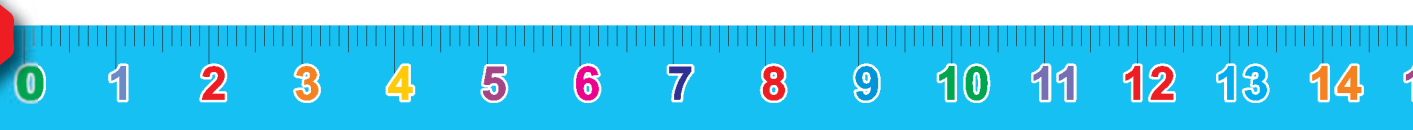
Number sentence: _____

b. Belinda is on page 84 of her book. The book has 250 pages. How many pages does she still have to read?

Keyword: _____

Relationship: _____

Number sentence: _____



c. **Thomas read 64 pages and Linda read 52. How many more pages did Thomas read?**

Keyword: _____

Relationship: _____

Number sentence: _____

d. **Thabo buys x amount of toffees. He has eight left from yesterday, if today he eats half of all the toffees he bought, he will have 3 left for tomorrow. How many did he buy.**

Keyword: _____

Relationship: _____

Number sentence: _____

5. **Write three different number sentences for each. Start by writing your keywords and relationship.**

a. Money earned each month – expenses = money available each month

Keyword:	**Relationship:**

_____

b. Speed x time = distance

Keyword:	**Relationship:**

_____

c. Distance from A + B + distance from B + C = distance A – C.

Keyword:	**Relationship:**

_____

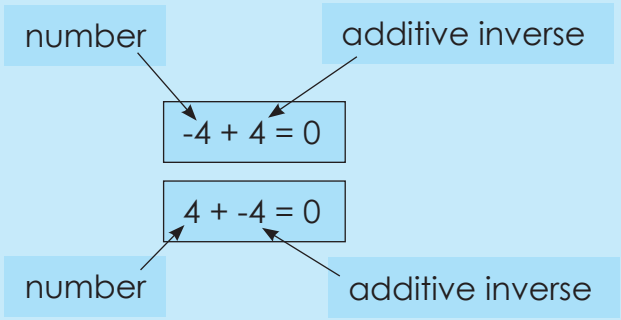
Problem solving

Kabelo has a certain number of computer games. He gets four more for his birthday. How many games did he have before his birthday if he now has 37 games?

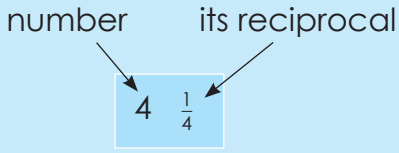
15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

45 Additive inverse and reciprocal

The additive inverse of -4 is 4, and the addition inverse of 4 is -4.



Talk about the reciprocal of a number.



What do you notice? To get the reciprocal of a number, just divide 1 by the number.

1. Revision:

a. What is the inverse operation of addition? _____

b. What is the inverse operation of subtraction? _____

c. What is the inverse operation of multiplication? _____

d. What is the inverse operation of division? _____

2. Complete:

Example: -4 ___ = 0
= -4 + 4 = 0

a. -5 ___ = 0 b. -9 ___ = 0 c. 11 ___ = 0

d. 6 ___ = 0 e. -10 ___ = 0 f. -2 ___ = 0

3. What is the additive inverse? Show your calculation.

Example: -9
-9 + 9 = 0

a. -7

b. -9

c. -10

d. -20

e. 3

f. -15



4. Complete:

Example: 4 x ___ = 1

4 x $\frac{1}{4}$ = 1

a. 5 x ___ = 1

b. 7 x ___ = 1

c. $\frac{1}{15}$ x ___ = 1

d. ___ x $\frac{1}{2}$ = 1

e. ___ x $\frac{1}{12}$ = 1

f. 9 x ___ = 1

5. What is the reciprocal of the following? Show your calculation.

Example: 4 *rec*

4 x $\frac{1}{4}$ = 1

a. 5

b. $\frac{1}{8}$

c. $\frac{1}{10}$

d. 7

e. 3

f. 11

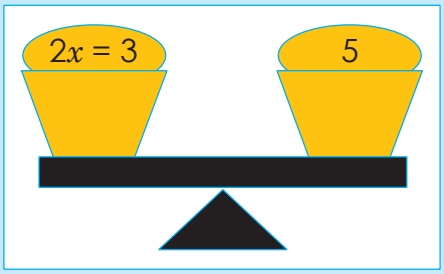
Problem solving

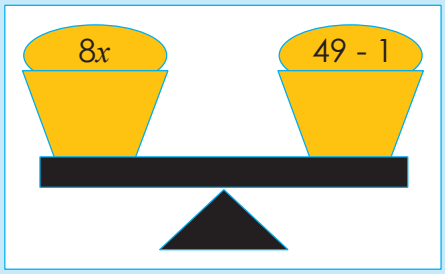
What is the multiplicative and additive inverse of 32?

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

46 Balance an equation

How will you balance these?





Now use an = sign to balance five different calculations.

1. Solve for x:

Example: $x + 5 = -4$
$x + 5 - 5 = -4 - 5$
$x = -9$

a. $x + 3 = 7$

b. $x - 6 = 2$

c. $x - 10 = 5$

d. $x - 8 = 6$

e. $x + 5 = 4$

f. $x - 11 = 7$

2. Solve for x:

Example: $x + 3 + 2 = -8$
$x + 5 = -8$
$x + 5 - 5 = -8 - 5$
$x = -13$

a. $x + 2 - 4 = 6$

b. $x + 7 + 2 - 3 = 9$

c. $x + 5 + -8 = -5$

d. $x - 8 + 3 = 7$

e. $x + 4 - 2 + 6 = -2$

f. $x + 11 - 7 + 9 = 7$



3. Solve for x:

Example: $x - 2 + 3 = -5$
$x + 1 = -5$
$x + 1 - 1 = -5 - 1$
$x = -6$

a. $x + 3 + 2 = 4$

b. $x + 8 + 7 = -8$

c. $x + 6 + 6 = 3$

d. $x - 9 - 8 = -3$

e. $x - 5 - 4 = 7$

f. $x - 11 + 5 = -7$

4. Solve for x:

Example: $2x = 16$
$\frac{2x}{2} = \frac{16}{2}$
$x = 8$

a. $3x = 27$

b. $5x + x = 18$

c. $2x - 4 = 10$

d. $7x = 28$

e. $5m = 25$

f. $15ab = 30$

5. Solve for x:

Example: $\frac{2x}{3} = 12$
$\frac{2x}{3} \times 3 = 12 \times 3$
$\frac{2x}{2} = \frac{36}{2}$
$x = 18$

a. $\frac{4x}{6} = 12$

b. $\frac{x}{5} = 15$

c. $\frac{x}{2} = 30$

d. $\frac{x}{3} = 6$

e. $\frac{x}{3} = 24$

f. $\frac{x}{7} = 7$

Problem solving

Write five different equations where the answers are x = -9
Solve for a, if a divided by 25 equals 100.

15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

47 Substitution

What does it mean to substitute in mathematics?



In algebra, letters such as x or y are used to represent values which are usually unknown.



These letters can be used in equations or expressions to help solve a variety problems.



The value of the variable can be given to you. E.g. for a + b, if a = 2 and b = 3, then a + b = 2 + 3 = 5

1. If x = 2, then:

Example: 2x + 5
= 2(2) + 5
= 4 + 5
= 9



An expression is numbers, symbols and operators (+, -, x and ÷) grouped together to show the value of something.

a. 4x + 8 =

b. 6 + 3x =

c. 5x + 3x =

d. 8x + 3 =

e. 9 + 5x =

f. 7x – 4x =

2. Do the same sums but this time with x = -2

a. 4x + 8 =

b. 6 + 3x =

c. 5x + 3x =

d. 8x + 3 =

e. 9 + 5x =

f. 7x – 4x =

3. If x = 3, then:

Example: $x^2 + 5$
$= (3)^2 + 5$
$= 9 + 5$
$= 14$

a. $x^2 + 2 =$

b. $x^2 + 11 =$

c. $x^3 + 10 =$

d. $x^2 - 3 =$

e. $x^3 + 30 =$

f. $x^2 - 14 =$

Do the same but this time with x = -3

a. $x^2 + 2 =$

b. $x^2 + 11 =$

c. $x^3 + 10 =$

d. $x^2 - 3 =$

e. $x^3 + 30 =$

f. $x^2 - 14 =$

4. If x = 4, then:

Example: (x^2)-x
$= (4^2) - 4$
$= 16 - 4$
$= 12$

a. $x^2 - x =$

b. $-x + x^2 =$

c. $x^2 + x^2 =$

d. $x^3 - x =$

e. $-x^3 - x =$

f. $x - x^3 =$

continued

Substitution (continued)

5. Do the same but this time x = -4.

a. $x^2 - x =$

b. $-x + x^2 =$

c. $x^2 + x^2 =$

d. $x^3 - x =$

e. $-x^3 - x =$

f. $x - x^3 =$

6. Solve for x:

Example: $-5x = 10$

$\frac{-5x}{-5} = \frac{10}{-5}$

$x = -2$

a. $-2x = 10$

b. $-6x = -12$

c. $2x = 4$

d. $-3x = 9$

e. $7x = 14$

f. $-4x = 16$

7. Solve for x:

Example: $2x - 6x = 16$

$-4x = 16$

$\frac{-4x}{-4} = \frac{16}{-4}$

$x = -4$

a. $4x - 5x = 8$

b. $8x + 4x = 4$

c. $-2x - 10x = 3$

d. $3x + 11x = 7$

e. $9x - 4x = 5$

f. $x - 3x = 2$

Problem solving

Create a three-term algebraic expression and then substitute x with -6.

You must use fractions in your equation.

What is the equation if x = 3?

48 Algebraic equations

You know that an **expression** is a collection of quantities linked by operators (+, -, x and ÷) that together show the value of something.

What is an **equation**?



An equation says that two things are the same, using mathematical symbols.

An equation uses the equal (=) sign.



Example:

6 + 4 = 11 - 1



1. Solve for x and test your answer.

Example:

Solve for x if $-2x = 8$

To solve the equation: divide both sides of the equation by -2

$-2x = 8$

$\frac{-2x}{-2} = \frac{8}{-2}$

$x = -4$

Test: $-2x = 8$

$-2(-4) = 8$

$8 = 8$



Note that $-2 \div -2 = \frac{-2}{-2} = 1$ (positive one)

a. 4x – 5x = 8

b. 8x + 4x = 4

c. -2x – 10x = 3

d. 3x + 11x = 7

e. 9x – 4x = 5

f. x – 3x = 2

2. Solve for x and test your answer.

Example:

Solve for x if $3x + 1 = 7$

To solve the equation it requires two steps:

Add -1 to both sides of the equation.

$3x + 1 - 1 = 7 - 1$

$3x = 6$

Then divide both sides of the equation by 3

$\frac{3x}{3} = \frac{6}{3}$

$x = 2$

Test: $3x + 1 = 7$

$3(2) + 1 = 7$

$6 + 1 = 7$

$7 = 7$

a. $4x + 1 = 9$

b. $5x + 2 = 12$

c. $2x - 4 = 6$

d. $2x - 8 = -10$

e. $-2x - 6 = -14$

f. $3x - 6 = -3$

Problem solving

Write an algebraic equation for: twice a number is twenty-four.

Write an algebraic equation for: twice a number, decreased by twenty nine, is seven.

49 Solving problems

Write down the key words you use when solving a problem.

1. Revision: Solve for x.

a. $x + 5 = 13$

b. $x - 8 = 16$

c. $x - 7 = -9$

d. $-2x = 4$

e. $-3x = -6$

f. $3x + 1 = 13$

2. Solve the following:

a. When six is added to four time a number the result is 50. Find the number.

b. The sum of a number and nine is multiplied by -2 and the answer is -8. Find the number.

c. The length of a rectangular map is 37,5 cm and the perimeter is 125 cm. Find the width.



d. Write an equation to find the area of a rectangle with length 2x cm and breadth 2x + 1 cm.

e. If the area of a rectangle is $(4x^2 - 6x)$ cm^2, and its breadth is 2x cm, what will its length be in terms of x?

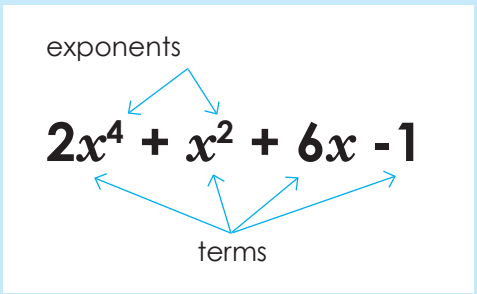
f. If $y = x^3 + 1$, calculate y when x = 4

g. Thandi is six years older than Sophie. In three years Thandi will be twice as old as Sophie. How old is Thandi now?

h. In a given amount of time, Mr Shabalala drove twice as far as Mrs Shabalala. Altogether the dromd 180 km. Find the number of kilometres driven by each.

50 Divide monomials, binomials and trinomials by integers or monomials

Look and discuss



Monomial (1 term)	$8x^4$
Binomial (2 terms)	$3x^2 + 4$
Trinomial (3 terms)	$4x^2 + x^2 + 3$
Polynomial	$4x^2 + 2y^2$

1. Calculate:

Example: $\frac{x^4}{x^2}$

$= \frac{xxxx}{xx}$ This is a monomial

$= x.x$

$= x^2$

Test through substitution:

$x = 2$

$\frac{x^4}{x^2}$

$= \frac{2^4}{2^2}$

$= \frac{16}{4}$

$= -4$

x^2

$= (2)^2$

$= 4$

a. $\frac{x^2}{x}$

b. $\frac{x^3}{x^2}$

c. $\frac{x^3}{x}$

d. $\frac{4x^2}{2x}$

e. $\frac{6x^3}{2x^2}$

f. $\frac{8x^2}{4x}$

2. Calculate:

Example: $\frac{x^4 - x^2}{x^2}$

This is a binomial

$= \frac{x^2(x^2 - 1)}{x^2}$

$= x^2 - 1$

Test through substitution:

$x = 2$

$\frac{x^4 - x^2}{x^2}$

$= \frac{2^4 - 2^2}{2^2}$

$= \frac{16 - 4}{4}$

$= \frac{12}{4}$

$= 3$

$x^2 - 1$

$= (2)^2 - 1$

$= 3$

a. $\frac{x^6 - x^2}{x^2} =$

b. $\frac{x^9 - x^3}{x^3} =$

c. $\frac{x^8 - x^4}{x^4} =$

3. Calculate:

Example: $\frac{x^4 - 6x - 1}{x^2}$

$= \frac{x^4}{x^2} - \frac{6x^2}{x^2} - \frac{1}{x^2}$

$= x^2 - 6 - \frac{1}{x^2}$

Test through substitution:

$x = 2$

$\frac{x^4 - 6x^2 - 1}{x^2}$

$= \frac{2^4 - 6(2)^2 - 1}{x^2}$

$= \frac{16 - 6\,242 - 1}{4}$

$= \frac{-9}{4}$

$= -2\frac{1}{4}$

$x^2 - 6 - \frac{1}{x^2}$

$= (2)^2 - 6 - \frac{1}{(2)^2}$

$= 4 - 6 - \frac{1}{4}$

$= -2 - \frac{1}{4}$

$= -2\frac{1}{4}$

a. $\frac{x^4 - 2x^2 - 3}{x^2} =$

b. $\frac{x^6 - 2x^3 - 1}{x^3} =$

c. $\frac{x^8 - 2x^4 - 2}{x^2} =$

Problem solving

Divide a multi-term algebraic expression by a monomial. Solve it.

51 Simplify algebraic expressions

Look at the following. What do you notice?

$2\,(x + 5)$

2	x	5

$2x + 10$

$2\,(x^2 + 3x + 4)$

2	x^2	$3x$	4

$2x^2 + 6x + 8$

Why are these called algebraic expressions?

1. Revision: calculate the following:

Example:

$2\,(3 + 4)$
$= 2 \times 3 + 2 \times 4$ or
$= (2 \times 3) + (2 \times 4)$
$= 6 + 8$
$= 14$

You can write it in brackets, if it is easier for you.

2	3	4

$6 + 8$

a. $2\,(3 + 6) =$

b. $4\,(8 + 1) =$

c. $6\,(9 + 4) =$

d. $8\,(2 + 3) =$

e. $3\,(5 + 6) =$

f. $10\,(7 + 8) =$

2. Calculate:

Example:

$2\,(x + 5)$
$= (2 \times x) + (2 \times 5)$
$= 2x + 10$

$2\,(x + 5)$
$= 2x + 10$

2	x	5

$2x + 10$
$= 2x\ 10$

a. $2\,(x + 4) =$

b. $4\,(x + 7) =$

c. 5 (x + 2) =

d. 6 (3 + x) =

e. 3 (6 + x) =

f. 7 (x – 9) =

3. Calculate:

Example: 2 (x^2 x x + 3)
= (2 x x^2) + (2 x x) + (2 x 3)
= 2 x^2 + 2 x + 6

2 (x^2 + x + 3)
= $2x^2$ + $2x$ + 6

2	x^2	x	3

$2x^2$ + 2x + 6

a. 2 (x^2 + x + 4) =

b. 4 (3 + x + x^2) =

c. 6 (7 + x + x^2) =

d. 7 (2 + x + x^2) =

e. 3 (x^2 + x + 3) =

f. 3 (5 + x + x^2) =

Problem solving

Multiply any number with a three-term algebraic expression. Simplify it.

52 Calculate the square numbers, cube numbers and square roots of single algebraic terms

Revise: Laws of exponents.

$x^m \times x^n = x^{m+n}$



It is very important to study the Laws of exponents. Write down three you already know

1. Revision: calculate:

Example: $x^m \times x^n$
$= x^{m+n}$

a. $x^a \times x^b =$

b. $a^c \times a^d =$

c. $c^e \times c^f =$

d. $m^a \times m^b =$

e. $y^c \times y^a =$

f. $t^x \times t^y =$

2. Revision: calculate:

Example: $x^2 \times x^3$
$= x^{2+3}$
$= x^5$

a. $x^4 \times x^3 =$

b. $a^5 \times a^2 =$

c. $b^6 \times b^4 =$

d. $c^3 \times c^2 =$

e. $m^4 \times m^5 =$

f. $x^3 \times x^3 =$

3. Use the example to complete the following:

Example: $4x^6$
$= 2x^3 \times 2x^3$

a. $16x^4$ = _____ x _____

b. $18x^{10}$ = _____ x _____

c. $64x^4$ = _____ x _____

d. $15x^8$

e. $60x^6$

f. $144x^{12}$

4. Calculate:

Example: $\sqrt{36x^{36}}$
$= \sqrt{6x^{18} \times 6x^{18}}$
$= 6x^{18}$

a. $25x^4$

b. $49x^9$

c. $100x^6$

d. $4x^{12}$

e. $16x^{18}$

f. $121x^{22}$

Problem solving

Write five different equation where the answers are all equal to: x = -9

53 Multiple operations: rational numbers

Do this activity with a friend.

What do you notice?

$\frac{1}{3}a^2 + \frac{1}{4}a^2 =$ $\quad$ $\frac{1}{3}a^2 - \frac{1}{4}a^2 =$

$\frac{1}{3}a^2 \times \frac{1}{4}a^2 =$ $\quad$ $\frac{1}{3}a^2 \div \frac{1}{4}a^2 =$

1. Calculate the following:

Example: $\left(\frac{1}{2}a^2 + \frac{1}{5}a^2\right) + \left(\frac{1}{2}a^2 \times \frac{1}{2}a^2\right) =$

What are the like terms?

$= \frac{5a^2 + 5a^2}{10} + \frac{1}{4}a^4$

$= \frac{7a^2}{10} + \frac{a^4}{4}$

a. $\left(\frac{1}{8}a^2 + \frac{1}{8}a^2\right) + \left(\frac{2}{8}a^2 \times \frac{1}{8}a^2\right) =$

b. $\left(\frac{1}{5}x^2 + \frac{1}{2}x^2\right) + \left(\frac{1}{5}a^2 + \frac{1}{10}a^2\right) =$

c. $\left(\frac{1}{2}y^2 + \frac{11}{3y}\right) + \left(\frac{1}{2}y^2 \times \frac{1}{3}y^2\right) =$

Make notes on what you learned.

2. Calculate the following:

Example: $\left(\frac{1}{2}a^2 + \frac{1}{4}a^2\right) + (3a^2 + 4a^2) + (3a^2 - 4a^2)$

$= \left(\frac{2}{4}a^2 + \frac{1}{4}a^2\right) + 7a^2 + (-a^2)$

$= \frac{3}{4}a^2 + \frac{6}{1}a^2$

$= \frac{3}{4}a^2 + \frac{24}{4}a^2$

$= \frac{27}{4}a^2$

$= 6\frac{3}{4}a^2$

a. $(7a^2 + 2a^2) + \left(\frac{1}{2}a^2 + \frac{1}{4}a^2\right) + (6a - 4a^2) =$

b. $\left(\frac{1}{2}y^2 + \frac{1}{5}y^2\right) + (-9y^2 - 2y^2) - (8y^2 \div 4y^2) =$

c. $\left(\frac{1}{2}x^2 + \frac{1}{2}x^2\right) + (7x^2 \times 2x^2)(-8x^2 - 3x^2) =$

Make notes on what you learned.

Problem solving

Write a polynomial using rational numbers, like and unlike terms. Solve it.

54 Multiple operations

Do this activity with a friend.



$\frac{1}{5}x^2 + \frac{1}{6}x^2 =$ ____ $\frac{1}{5}x^2 - \frac{1}{6}x^2 =$ ____

$\frac{1}{5}x^2 \times \frac{1}{6}x^2 =$ ____ $\frac{1}{5}x^2 \div \frac{1}{6}x^2 =$ ____

1. Calculate:

Example: $2(5 + x - x^2) - x(3x + 1)$

$= 10 + 2x - 2x^2 - 3x^2 - x$

$= -5x^2 + 1x + 10$

$= -5x^2 + x + 10$

This will help you to multiply the constant will all the terms.

$2(5 + x - x^2) - x(3x + 1)$

a. $2(x^2 + x + 4) - x(2x + 1) =$

b. $5(x + x^2 + 2) + x(4x + 3) =$

c. $3(x^2 + x + 6) - x(5x + 2) =$

Make notes on what you learned.

2. Calculate:

Example: $\left(\frac{1}{3}a^2 \times \frac{1}{4}a^2\right) + (3a^2 + 4a^2) + a(2a + 4)$

$= \frac{1}{2}a^4 + 7a^2 + 2a^2 + 4a$

$= \frac{1}{2}a^4 + 9a^2 + 4a$

a. $2(x^2 + x + 8) + x(5x + 2) + (9x^2 - 5x) =$

b. $\left(\frac{1}{4}x^2 + \frac{1}{5}x^2\right) - (-9x^2 - x^2) - 2(x + 2x + 8) =$

c. $(3x^2 + 6x^2) + \left(\frac{1}{6}x^2 - \frac{1}{3}x^2\right) + (2x^2 \div 3x^2) =$

d. $5(4x + 3x^2 + 6) - (8x^2 \times 4x^2) + \left(\frac{1}{4}x^2 \times \frac{1}{5}x^2\right) =$

e. $6(6 + 3x + 2x^2) + \left(\frac{1}{9}x^2 \div \frac{1}{5}x^2\right) - x(-5x + 2x) =$

Problem solving

Write a polynomial using rational numbers and like and unlike terms. Solve it.

55 Division operations

Compare the three blocks.

What are the same?

$\frac{x^2(x^2+1)}{x^2}$

$\frac{x^4+x^2}{x^2}$

$\frac{x^4}{x^2}+\frac{x^2}{x^2}$

Are any different?

1. Revision: calculate:

Example:

$$= \frac{x^4}{x^2} - \frac{6x^2}{x^2} - \frac{1}{x^2}$$

$$= x^2 - 6 - \frac{1}{x^2}$$

a. $\frac{x^5+3x^2+2}{x^2}$

b. $\frac{x^4+2x^2+3}{x^3}$

c. $\frac{x^3+4x^2+6}{x^2}$

2. Calculate:

Example: $\left(\frac{x^4 + 6x^2 - 1}{x^2}\right) + (3x^2 + 4x^2) + \left(\frac{1}{3}x^2 + \frac{1}{3}x^2\right) + 2(5 + x - x) + -x(3x + 1)$

$= x^2 - 6 - \frac{1}{x^2} + 7x^2 + \frac{2x^2}{3} + 10 - 3x^2) - x$

$= x^2 + 7x^2 - 3x^2 + \frac{2x^2}{3} + 10 - 6 - \frac{1}{x^2}$

$= 5x^2 + \frac{2x^2}{3} - x + 4 - \frac{1}{x^2}$

$= \frac{15}{3}x^2 + \frac{2}{3}x^2 - x + 4 - \frac{1}{x^2}$

$= \frac{17}{3}x^2 - x + 4 - \frac{1}{x^2}$

$= 5\frac{2}{3}x^2 - x + 4 - \frac{1}{x^2}$

a. $3(7 + x - x^2) + 2(3x + 1)\left(\frac{1}{2x^2} + \frac{1}{4x^2}\right) + (2x^2 - 2x^2) =$

b. $\left(\frac{x^5 + 2x^2 + 4}{x^3}\right) + 2(4x^2 + 2x^2) + \left(\frac{x^4 - 6x^4 - 2}{x^2}\right) - \left(\frac{1}{3x^2} \Big/ \frac{1}{4x^2}\right) =$

c. $\left(\frac{x^6 + 4x^2 + 2}{x^2}\right) - \left(\frac{1}{3x^2} \Big/ \frac{1}{4x^2}\right) - 2(4x^2 + 2x^2) - \left(\frac{x^5 + x^4}{x^3}\right)$

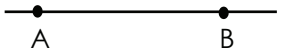
Problem solving

Write a polynomial using rational and whole numbers and like and unlike terms. Solve it.

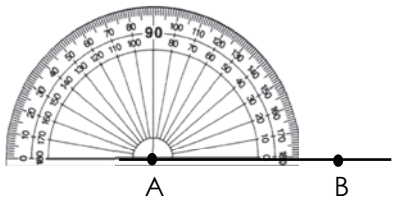
Constructing geometric figures

Revise the following.

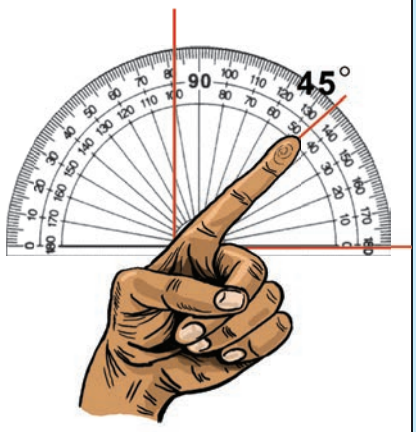
Step 1:
Draw a line. Label a segment AB.



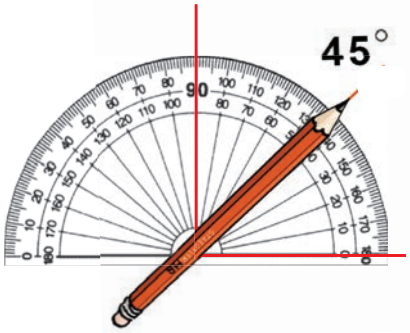
Step 2:
Place the protractor so that the origin (small hole) is over the point A. Rotate the protractor so that the base line is exactly along the line AB.



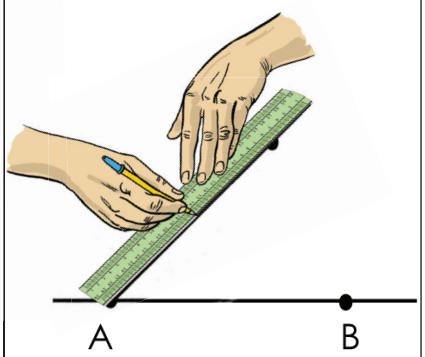
Step 3:
Using (in this case) the inner scale, find the angle desired - here 45°.



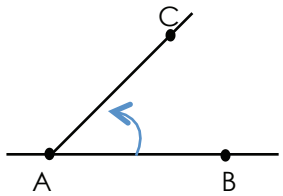
Step 4:
Make a mark at this angle, and remove the protractor .



Step 5:
With a ruler, draw a line from A to the mark you just made. Label this point C.

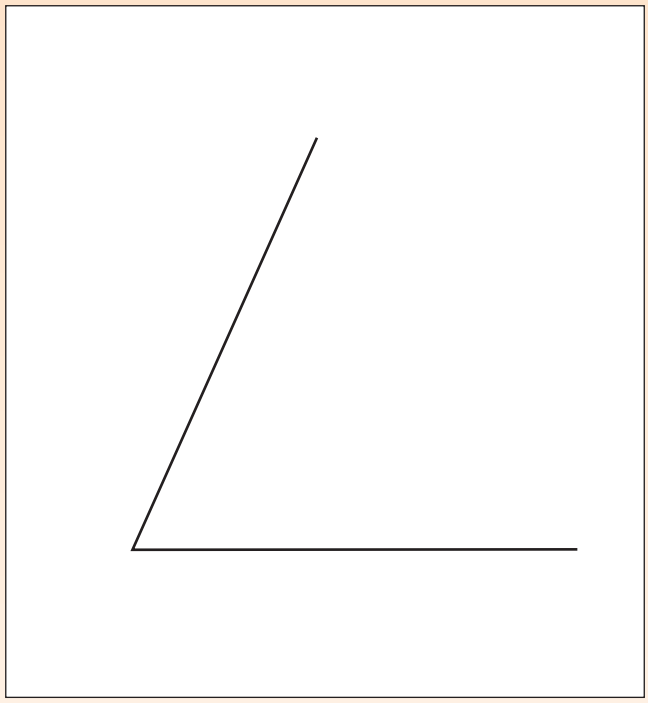


Step 6:
The line drawn (a ray) makes an angle with a measure of 45° between the two rays AC and AB.

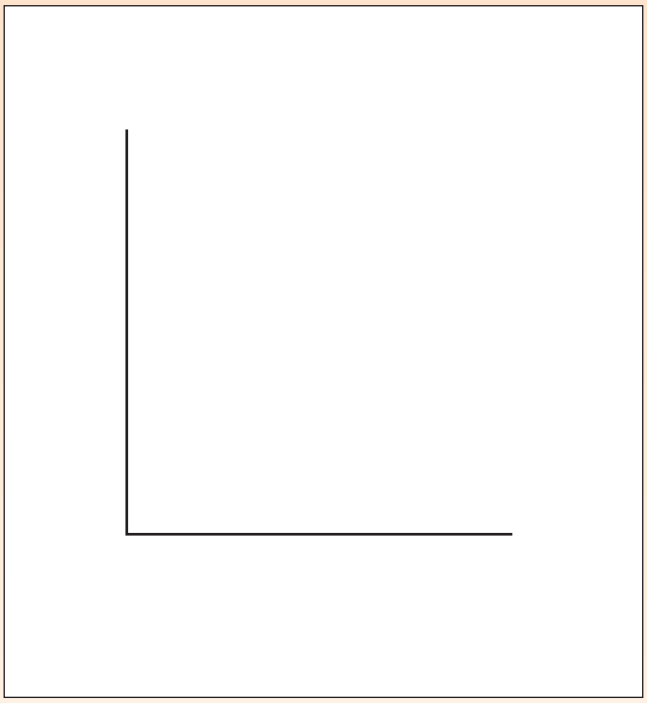


1. Label and measure the following angles. You might need to extend the lines.

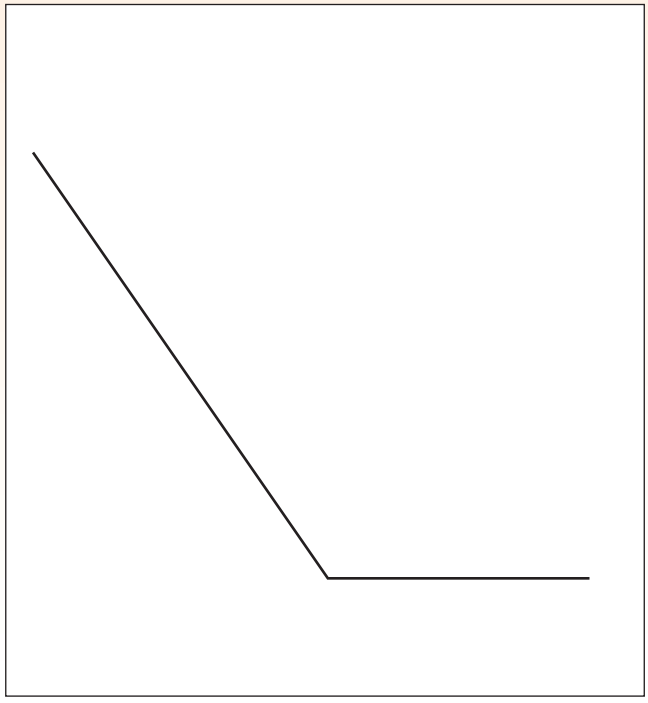
a. Acute angle: ABC



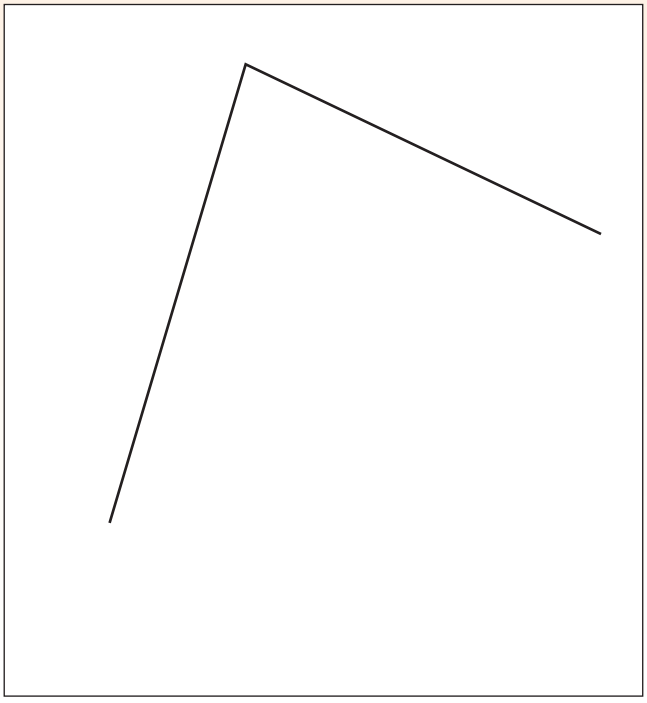
b. Right angle: DEF



c. Obtuse angle: ABC



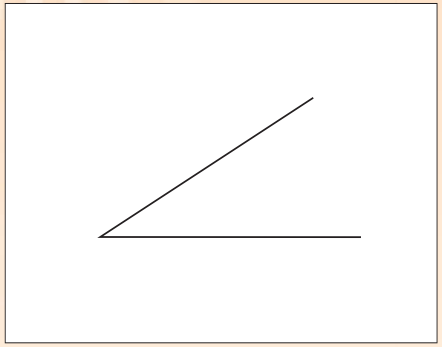
d. Reflex angle: XYS



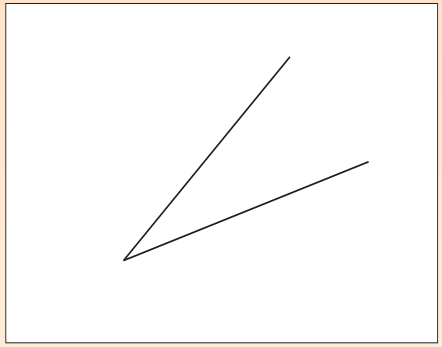
continued ☛

56b Constructing geometric figures
continued

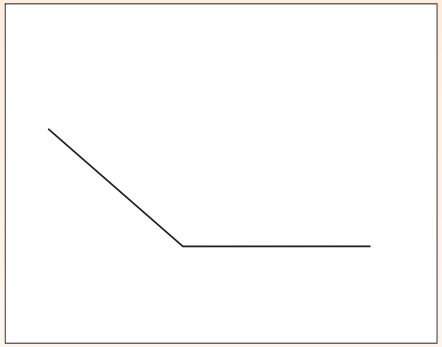
e. Acute angle: GHI



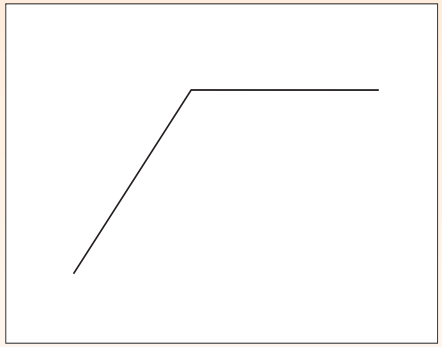
f. Reflex angle: KLM



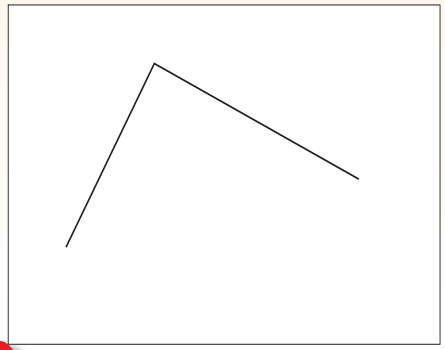
g. Obtuse angle: MNO



h. Obtuse angle: PQR



i. Right angle: GHI



j. List all the different kinds of angles.
Use the first one to guide you.
An Acute angle is smaller than 90°.

_____

_____

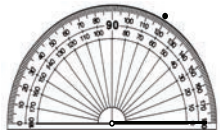
_____

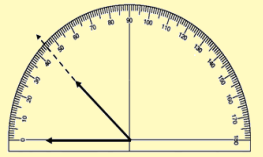
A straight line _____

2. Draw the following using a protractor. Label your geometric figures.

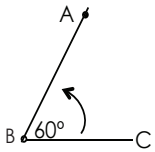
Example: a 60° angle ABC.

Step 1



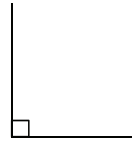


Step 2



In the questions that follow the angle may be smaller than the protractor. Use your ruler to extend the ray to make it easier to read the measurement. The second ray on this angle points to 60, so this is a 60° angle.

a. Right angle



An angle with a 90° angle.

b. Acute angle

c. Reflex angle

d. Scalene triangle

e. Right angled triangle

f. Isosceles triangle

Problem solving

How would you construct an angle with a protractor that is bigger than 180°?

Remember that angles are parts of a circle. This will help you to understand the design of the protractor .

57 Construction with a protractor

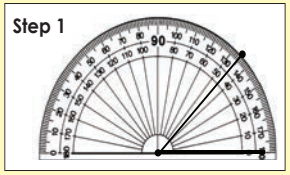
Remember that if an angle is smaller than the protractor, use the ruler to extend the ray to make it easier to read the measurement.

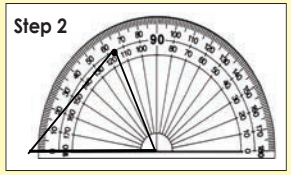
Find out who use protractors in their jobs.

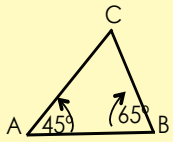
Geometry requires the use of polygons such as triangles and quadrilaterals. You should know how to construct these shapes.While some of these shapes can be created with a compass and ruler, it is often faster to create them with a protractor.

1. Use the example to guide you. Construct a triangle with two given angles. Name the type of triangle.

Example: a triangle of which the angles include 45° and 65°.







a. 90° and 45°

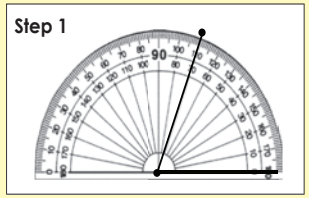
b. 65° and 75°

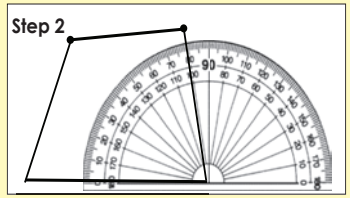
c. 80° and 45°

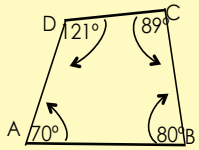
d. Write down step by step what you did.

2. Use the example to guide you. Construct a quadrilateral with the two angles given. Label it.

Example: a quadrilateral of which the angles include a 70° angle and a 80° angle.







a. 68° and 118°

b. 135° and 70°

c. 70° and 110°

d. Write down step by step what you did.

Problem solving

Using a protractor, construct:
(a) any polygon other than a triangle, and
(b) a quadrilateral.

58 Parallel and perpendicular lines

Look at this structure – it is the Nelson Mandela bridge in Johannesburg. Identify the parallel, perpendicular and line segments.



1. Who will use a compass in their work? For what?

2. Revision: Match column B with column A.

Column A	Column
Line segment	
Parallel lines	
Perpendicular lines	

3. Draw the following line segments with a ruler.

5,23 cm

7,55 cm

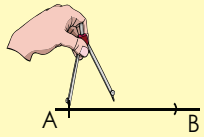
65,5 mm

23,5 mm

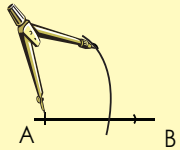
8,95 cm

4. Revision: Construct perpendicular lines from both sides of a line using a compass. Use the guidelines to help you. Join C and D with a straight line

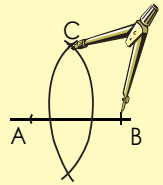
Step 1
Draw a line, mark a point (A and B) on it. Put the compass point on A and open it so that the pencil touches B. (So you have "measured" the length of AB with the pair of compasses.)



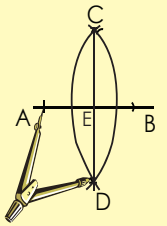
Step 2
Leaving the compass point on A, draw an arc with the compass roughly where you want the perpendicular line to be.



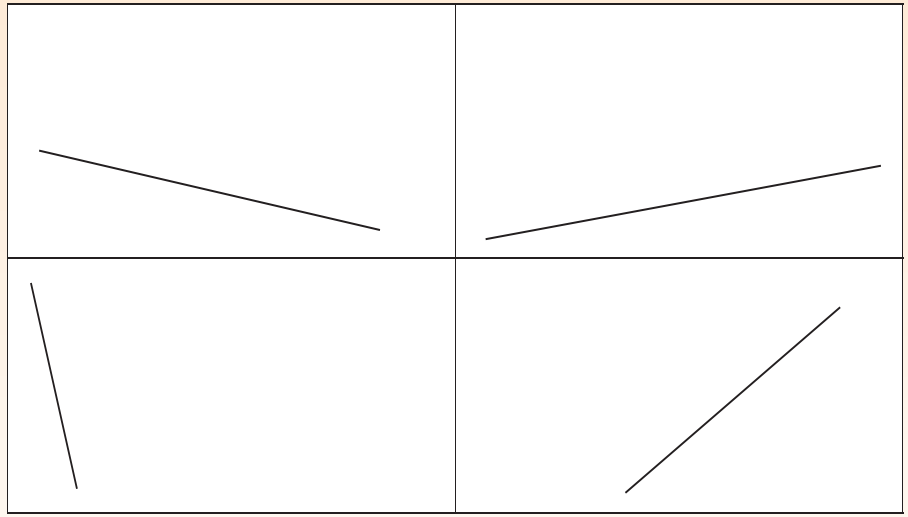
Step 3
Now move the compass point to point B and draw another arc which crosses the first. Label it C.



Step 4
Follow the same steps to get D. Join points C and D crossing line AB at E.



5. Draw lines perpendicular to these using a protractor.



Problem solving

Are these lines parallel or not? Say why or why not.







59 Construct angles and a triangle

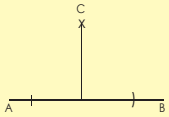
Identify the triangles and estimate the size of the angles.



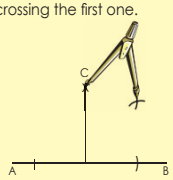


1. Construct a 45° angle. Use the guidelines to help you.

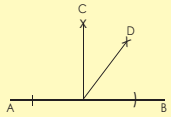
Step 1
Follow the steps for drawing a perpendicular line.



Step 2
Leaving the compass point on C, draw an arc with the compass roughly halfway between C and B. Then place the compass point on B and draw an arc crossing the first one.



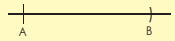
Step 3
Mark it as D and draw the line which creates two 45° angles.



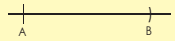
2. Give five real-life examples of where we might find 45° angles.

3. Construct an equilateral triangle. Follow the steps and construct your triangle on the right.

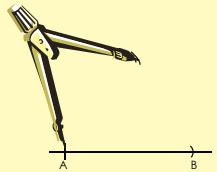
Step 1
Draw a line AB.



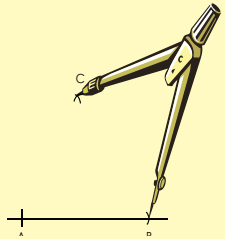
Step 2
Put the compass point on A and open it so that the pencil touches B. (So you have "measured" the length of AB with the pair of compasses.)



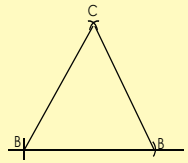
Step 3
Leaving the compass point on A, draw an arc with the compass roughly where you think the other vertex (corner) of the triangle is going to be. (The distance from A to this point is going to be the same as the length of AB.)



Step 4
D not adjust your compass. Now move the compass point to B and draw another arc which crosses the first. Label it C.



Step 5
Step 5: Since the lengths of AC and BC are both equal to the length of AB, we have three points all the same distance from each other. If we join them up, we therefore have an equilateral triangle, with each angle equal to 60°.



continued

59b Construct angles and a triangle

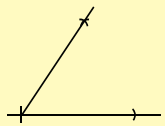
continued

4. Construct a triangle of your own choice that is different from the previous one.

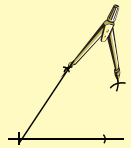
5. Construct a 30° angle. Use the guidelines below.

Follow the steps to construct a 60° angle (as in Question 2) and then follow steps 1 to 3 below.

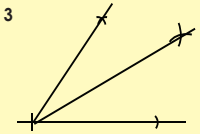
Step 1



Step 2



Step 3



6. How will you construct a 15° angle? Construct it showing it step by step.

7. Construct a triangle with one 30° degree angle.

Problem solving

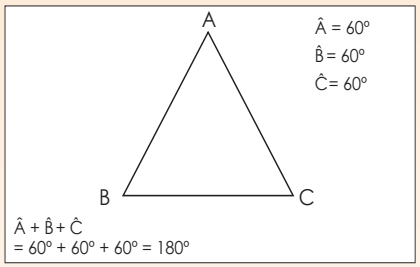
Construct any figure with at least one 30° and one 45° angle.

60 The sum of the interior angles of any triangle equals 180°

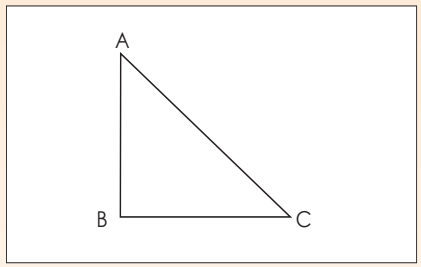
How can you prove that the sum of the interior angles of a triangle is equal to 180° using paper and some glue? Paste your proof here.

1. Measure the interior angles of the triangles and add them together. What do you notice?

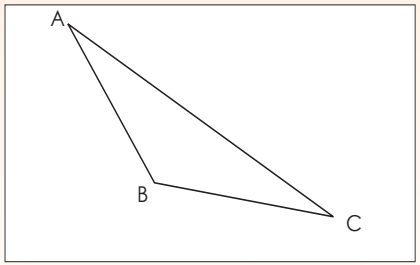
a.



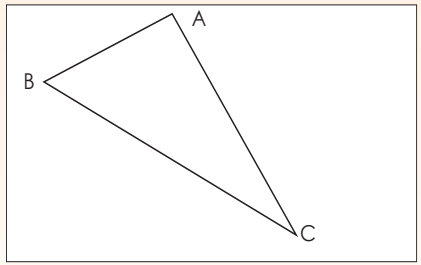
b.



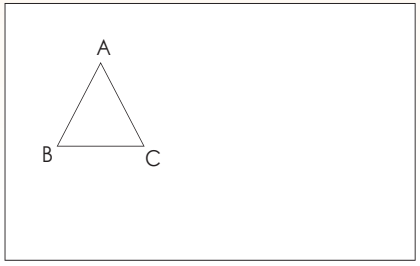
c.



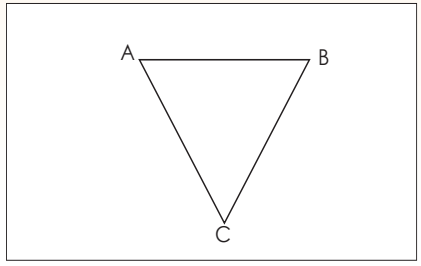
d.



e.

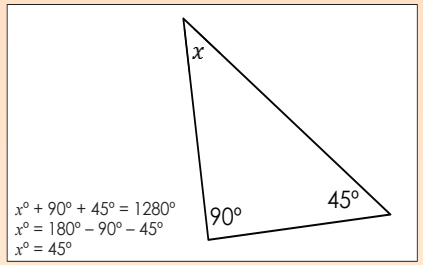


f.

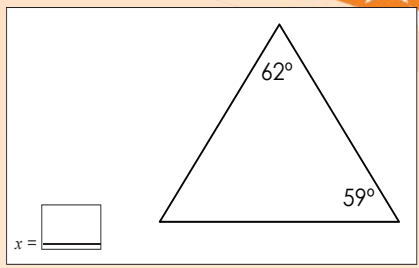


2. Find angle x.

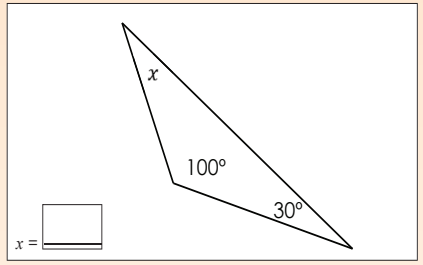
a.



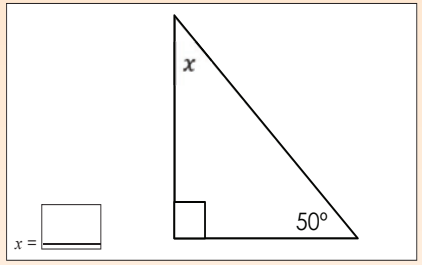
b.



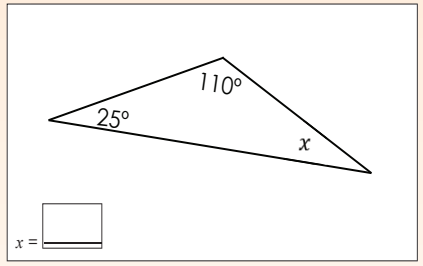
c.



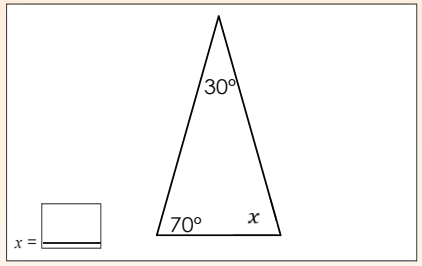
d.



e.



f.



3. If the one angle is ____°, what can the other two be? Give 2 pairs of options.

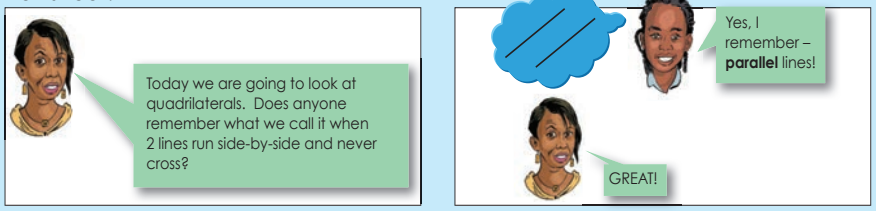
a. 41	____	____	____	____
b. 63	____	____	____	____
c. 90	____	____	____	____
d. 72	____	____	____	____
e. 100	____	____	____	____

Problem solving

If one angle of the triangle equals 32°, give five pairs of possible answers for what the other angles could be.

61 Constructing quadrilaterals

What is a quadrilateral? You can read the rest of the comic strip at the end of this worksheet.



1. Construct and label a quadrilateral with a 90° angle ABC.

What type of quadrilateral(s) could this be?

Step 1: Draw a circle with a pair of compasses..	**Step 2:** Draw a chord on the circle. Label it AB.	**Step 3:** Leave the compass point on B and keep the pair of compasses open at the same distance as for AB. Now draw an arc roughly where you think a line perpendicular to point B will be.
Step 4: Leave the compass point on A (and again keep the pair of compasses open at the same distance as for AB). Draw an arc roughly where you think a line perpendicular to point A will be.	**Step 5:** Label the points.	**Step 6:** Join up the points.

Measure the angles of the quadrilateral ABCD.

2. Use a ruler and a pair of compasses to construct a rectangle with a length of six centimetres and a width of four centimetres.

Step 1: Use a ruler to draw a line and label point A on the line. With your pair of compasses set at 6 cm, mark point B.	**Step 2:** Draw arcs 1 cm on either side of A. Do the same at point B.	**Step 3:** Use the arcs to construct lines that are perpendicular to AB, one through A and one through B. Set your pair of compasses at 4 cm. Place the compass point at A and mark off D on the perpendicular line. Using the same compass setting, place the compass point at B and mark off point C on the perpendicular line.	**Step 4:** Label D and C, and join them.

Measure the angles of ABCD.

3. Construct the following using a compass:

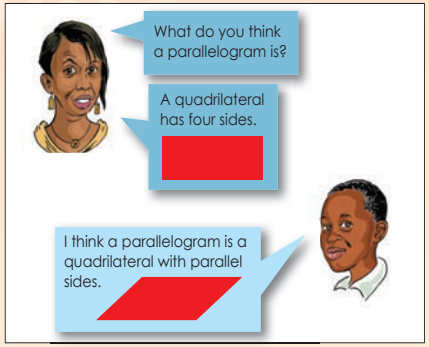
a. A square with sides equal to 4 cm.

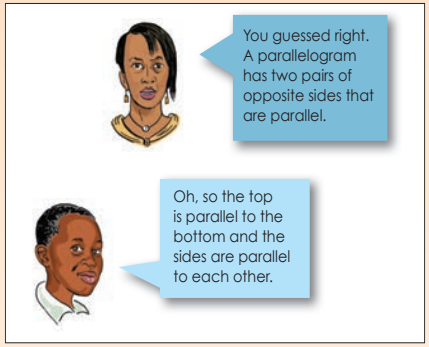
b. A rectangle with sides equal to 3,5 cm and 4,2 cm.

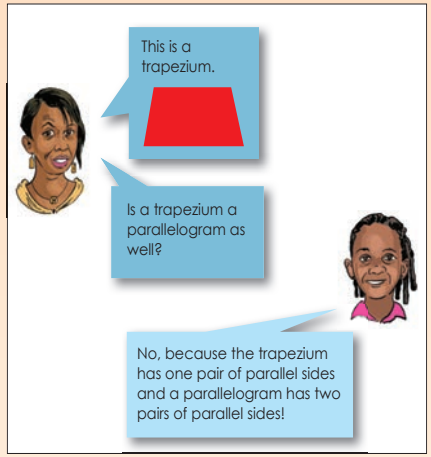
Problem solving

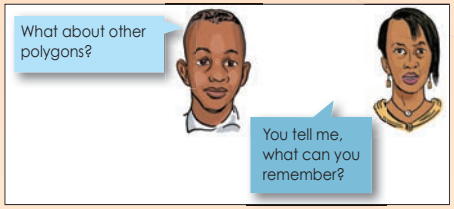
Can you construct a quadrilateral with only one 90° angle? Show it.

continued

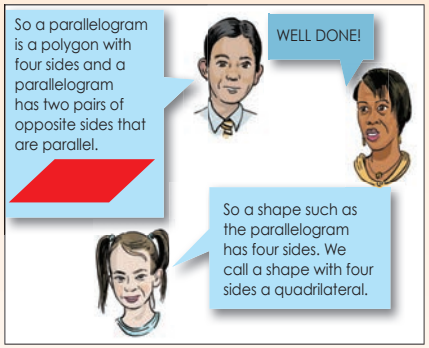

What do you think a parallelogram is?
A quadrilateral has four sides.
I think a parallelogram is a quadrilateral with parallel sides.

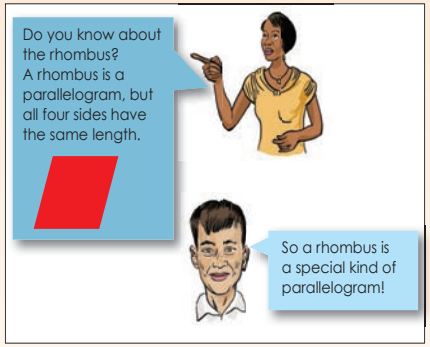

You guessed right. A parallelogram has two pairs of opposite sides that are parallel.
Oh, so the top is parallel to the bottom and the sides are parallel to each other.

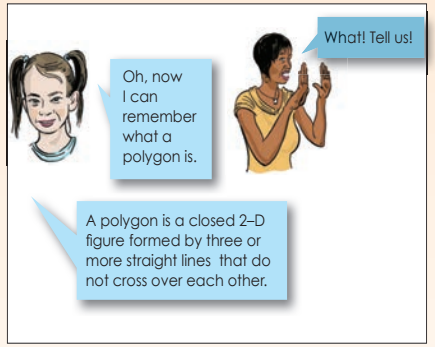

This is a trapezium.
Is a trapezium a parallelogram as well?
No, because the trapezium has one pair of parallel sides and a parallelogram has two pairs of parallel sides!

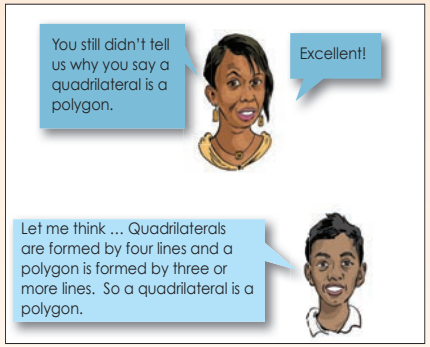

What about other polygons?
You tell me, what can you remember?

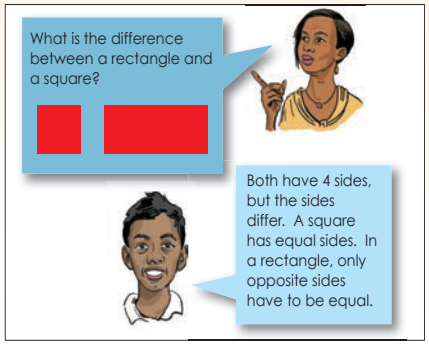

I know a quadrilateral is a polygon.
Why do you say so?

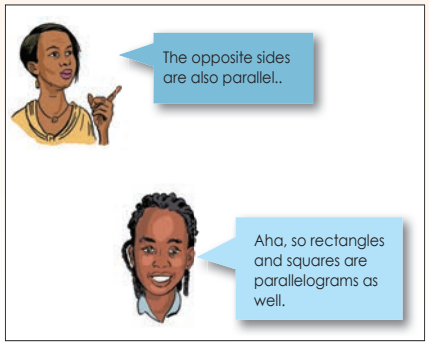

So a parallelogram is a polygon with four sides and a parallelogram has two pairs of opposite sides that are parallel.
WELL DONE!
So a shape such as the parallelogram has four sides. We call a shape with four sides a quadrilateral.

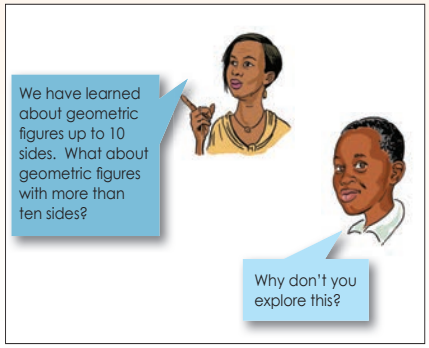

Do you know about the rhombus? A rhombus is a parallelogram, but all four sides have the same length.
So a rhombus is a special kind of parallelogram!


What! Tell us!
Oh, now I can remember what a polygon is.
A polygon is a closed 2–D figure formed by three or more straight lines that do not cross over each other.


You still didn't tell us why you say a quadrilateral is a polygon.
Excellent!
Let me think ... Quadrilaterals are formed by four lines and a polygon is formed by three or more lines. So a quadrilateral is a polygon.


What is the difference between a rectangle and a square?
Both have 4 sides, but the sides differ. A square has equal sides. In a rectangle, only opposite sides have to be equal.


The opposite sides are also parallel..
Aha, so rectangles and squares are parallelograms as well.


We have learned about geometric figures up to 10 sides. What about geometric figures with more than ten sides?
Why don't you explore this?

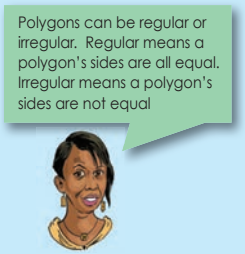
62 Constructing polygons

What is a polygon?



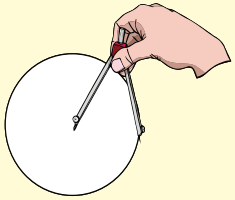
A polygon is a closed two–dimensional figure formed by three or more line segments that do not cross over each other.



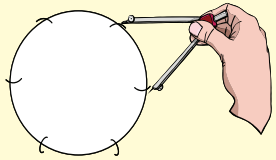


1. Use a ruler and pair of compasses to construct a hexagon.

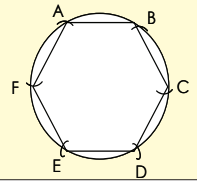
Step 1: Draw a circle. Measure the radius with a pair of compasses.



Step 2: Make markings the same distance apart on the circumference, using the compasses.

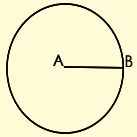


Step 3: Label and join the points.

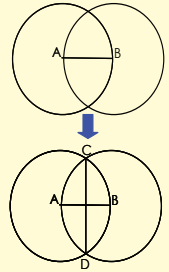


2. Use a ruler and compasses to construct a pentagon on a separate sheet of paper.

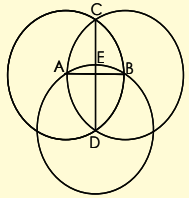
Step 1: Draw a circle around A with radius AB. Draw a line to join A to B.



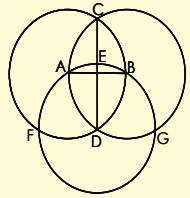
Step 2: Draw a circle around B with radius AB. Call their intersection points C and D.



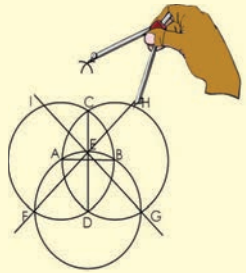
Step 3: Draw a circle around D with radius DA. Circle D intersects line CD at E, circle A at F and circle B at G.



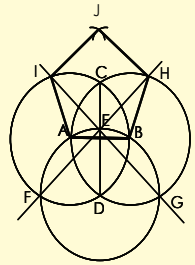
Step 4: Draw a straight line from F through E to intersect circle B at H and a line from G through E to intersect circle A at I.



Step 5: Draw an arc at I with radius IA. Draw an arc at H with radius HB. Arcs I and H intersect at J.



Step 6: All the points A, B, I, H and J are vertices



Problem solving

Construct a polygon different from the ones in this lesson.

63 More about polygons

The formula for calculating the interior angles of a polygon is:

(number of sides – 2) × 180°

Show that this formula is correct.

1. Complete the table.

Polygon	Number of sides	Angle size	Total sum of angles

2. What is this? What polygon/s can you identify?

a. 

b. 

3. What geometric figure do you see?

a. 

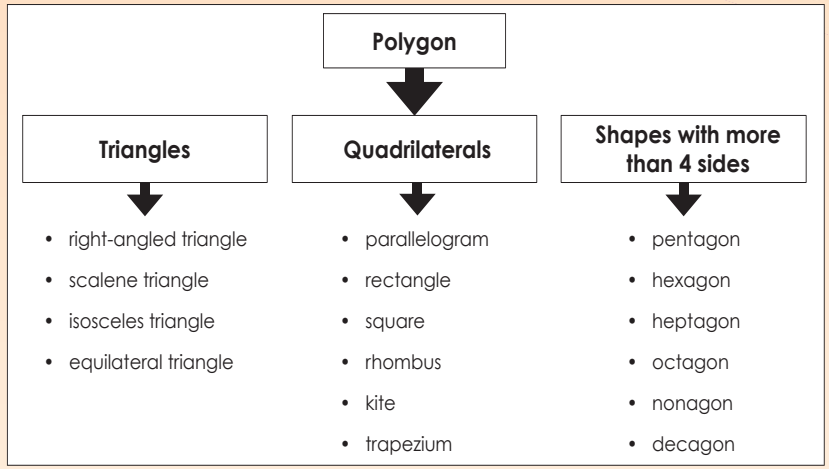
b. 

4. What do you think this is?

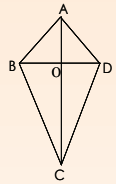


Which shape would you find on this object?

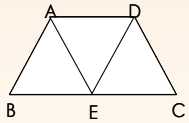
5. Use this flow diagram to prepare for a 5 minute presentation.



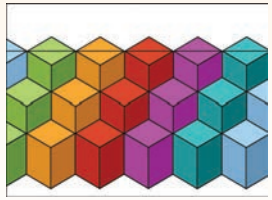
6. Divide a kite into four triangles and describe the triangles.



7. Divide a trapezium into triangles and describe the triangles.



8. Identify and then name the following polygons. Describe each quadrilateral.

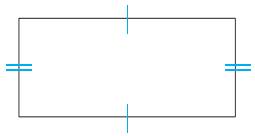


Problem solving

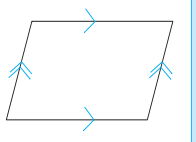
What polygon patterns will you find on a giraffe? Describe them using sides and angles.
Which quadrilaterals have at least one pair of parallel lines?

Triangles and quadrilaterals

Revision: How do you label a geometric figure showing the sides are equal?

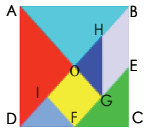


How do you label a geometric showing parallel sides?



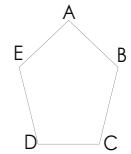
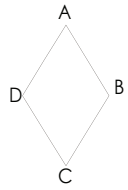
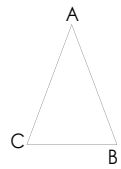
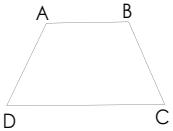
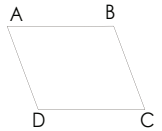
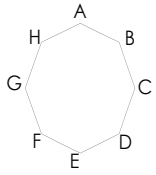
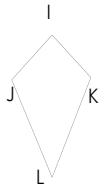
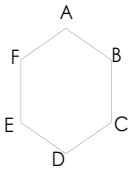
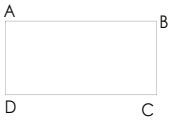
What is a regular and an irregular polygon?

1. Complete the following

a. Identify *IOGF* What fraction of the square ABCD is this shape?  	b. Identify ΔABO and ΔADO and make a square. What fraction of the square ABCD is this square?	c. Identify ΔHGO and ΔDIF and make a square. What fraction of the square ABCD is this square?
d. What shape can you make from ΔHGO, ΔDIF, and ΔECF? What fraction of the square ABCD is this shape?	e. What shape can you make from ΔHGO, ΔDIF and HBEG? What fraction of square ABCD is this shape?	f. What shape can you make from ΔHGO, ΔDIF, ΔABO, HBEG and IOGF?

2. Look at the shapes.

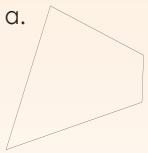
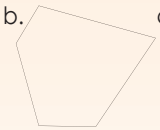
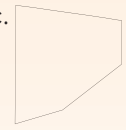
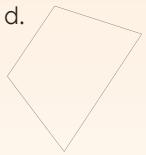
a. What are the differences and similarities between the quadrilaterals and other polygons?

Quadrilateral  Square	 	 	 	
 	 	 	Polygon  Hexagon	

b. Name each polygon.

c. Label the equal and parallel sides on each polygon.

3. State whether or not the following shapes are polygons. Give reasons for your answers.

a. 
b. 
c. 
d. 
e. 
f. 

Problem solving

Name the first ten polygons. Give an everyday example of each.

65 Similar Triangles

What is similarity?

Similar triangles have the following properties:

- They have the same shape but not the same size.
- Each corresponding pair of angles is equal.
- The ratio of any pair of corresponding sides is the same.

These triangles are similar.



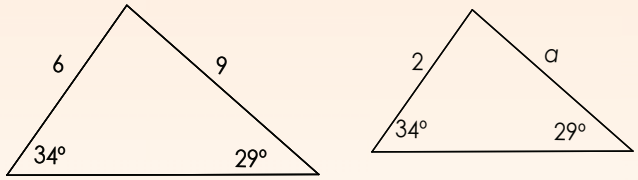
We can tell whether two triangles are similar without testing all the sides and all the angles of the two triangles. There are two rules to check for similar triangles. They are called the AA rule and RAR rule. As long as one of the rules is true, the two triangles are similar.

1. Discuss these rules.

AA rule (Angle Angle)

If two angles of one triangle are equal to two angles of another triangle, then the triangles are similar.

a. Given the following triangles, find the length of a.



Solution:

Step 1: The triangles are similar because of the AA rule.

Step 2: The ratios of the lengths are equal. $\frac{6}{2} = \frac{9}{a}$

Step 3: Make use of cross-multiplication to find the unknown value.

$\frac{6}{2} \times \frac{9}{a}$

$6a = 18$

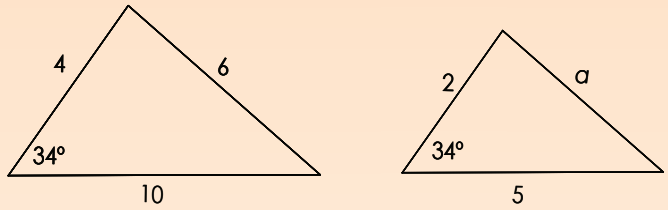
$a = 3$



A ratio shows the relative sizes of two or more values. Example: 2:3

RAR rule (Ratio Angle Ratio)

If the angle of one triangle is the same as the angle of another triangle and the sides containing these angles are in the same **ratio**, then the triangles are similar.



b. Given the following triangles, find the length of *a*.

Solution:

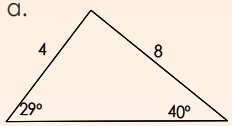
Step 1: The triangles are similar because of the RAR rule

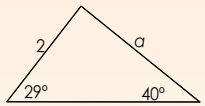
Step 2: The ratios of the lengths are equal.

Step 3: The length of **a** is 3.

2. Find the length of a. State the rule you are using.

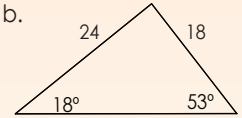
a.

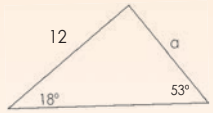




a = _____

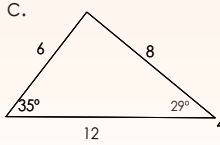
b.

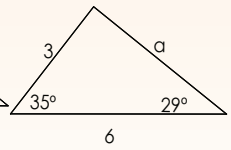




a = _____

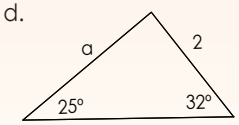
c.

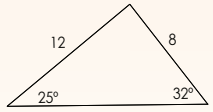




a = _____

d.





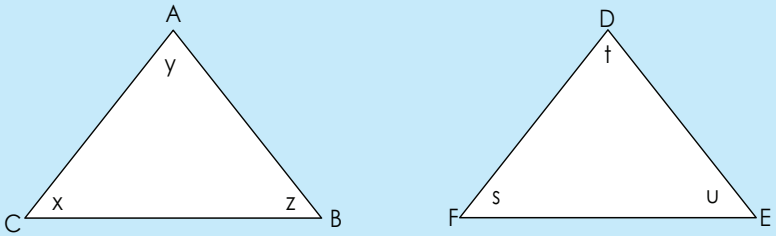
a = _____

Problem solving

Describe how you would find a missing part of a triangle that is similar to another.

Congruent triangles

Congruent triangles are triangles that have the same size and shape. This means that the corresponding sides are equal and the corresponding angles are equal.



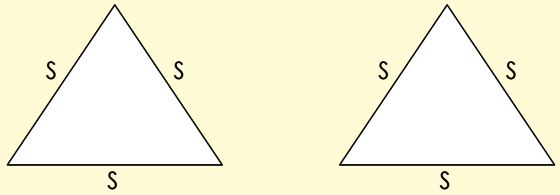
- The corresponding sides are: AC and DF, AB and DE and CB and FE
- The corresponding angles are: y and t, x and s, z and u.

There are four rules to check for congruent triangles. They are called the SSS rule, SAS rule, ASA rule and AAS rule.

1. Discuss the following and draw:

SSS rule (Side Side Side)

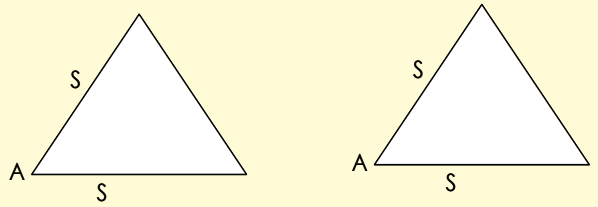
If three sides of one triangle are equal to three sides of another triangle then the triangles are congruent.



a. Draw congruent triangles using the SSS rule. Indicate the length of the sides of the triangles.

SAS rule (Side Angle Side)

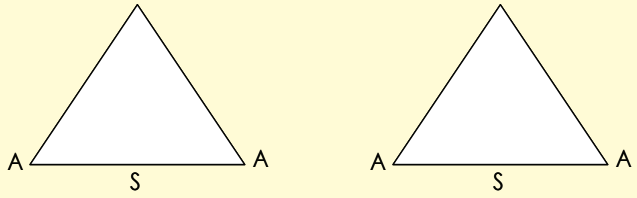
If two sides and the included angle of one triangle are equal to two sides and the included angle of another triangle, then the triangles are congruent.



b. Draw congruent triangles using the SAS rule. Indicate the length of the sides of the triangles.

ASA rule (Angle Side Angle)

If two angles and the included side of one triangle are equal to two angles and the included side of another triangle, then the triangles are congruent.



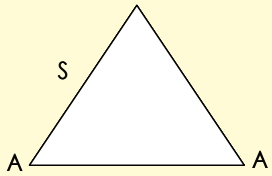
continued

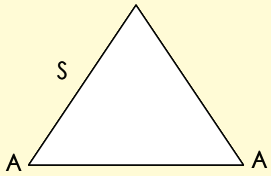
Congruent triangles continued

c. Draw congruent triangles using the ASA rule. Indicate the length of the sides of the triangles.

AAS rule (Angle Angle Side)

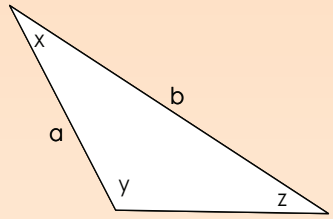
If two angles and a non–included side of one triangle are equal to two angles and a non–included side of another triangle, then the triangles are congruent. Note that we can also say SAA.

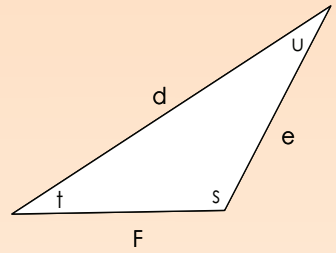




d. Draw congruent triangles using the AAS rule. Indicate the length of the sides of the triangles.

2. Which of the following conditions would be sufficient for the above triangles to be congruent? Give an explanation for each.





a. a=e, x=u, c=f

b. a=e, y=s, z=t

c. x=u, y=t, z=s

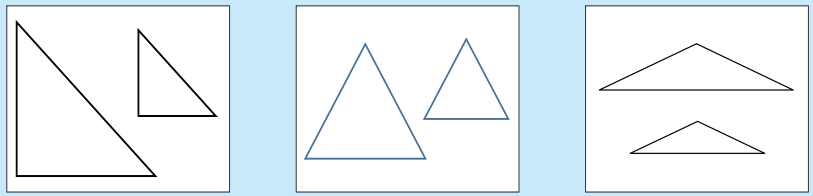
d. a=f, y=t, z=s

Problem solving

Where in everyday life will we find congruent triangles?

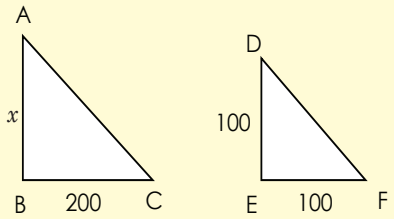
67 Similar triangles problems

What is the ratio between these triangles? You might need a calculator.Make the corresponding sides the same colour.



1. Solve for x.

Example:



$\Delta ABC \sim \Delta DEF$

We know that the ratio of corresponding sides are equal.

~ means similar

$$\frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF}$$

$$\frac{x}{100} = \frac{200}{100}$$

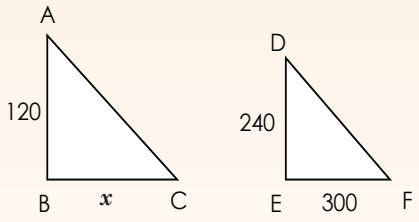
We only need two sides to calculate x.

We do cross multiplication.

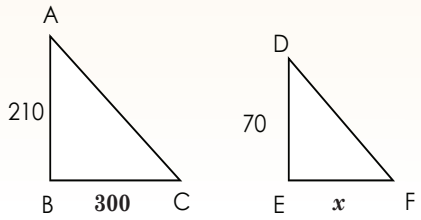
$100x = 20\,000$

$x = 200$

a.

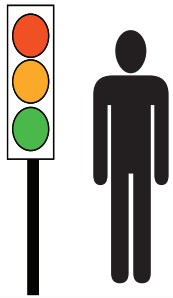


b.

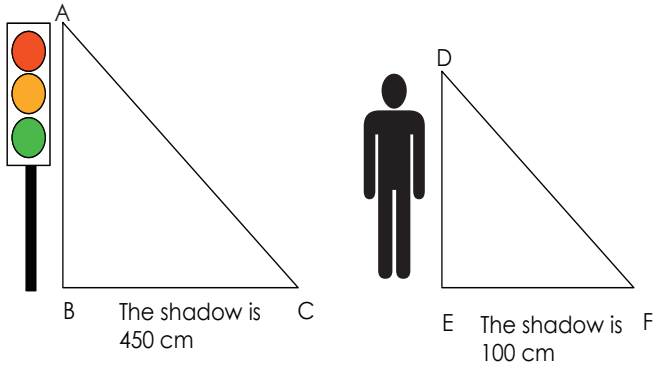


2. A traffic light has a shadow of 450 cm long. Ben is 200 cm tall and his shadow is 100 cm long. What is the height of the traffic light? Your friend gave you his two drawings to help you. He explained it and gave you some incomplete notes. Complete it.

Draw the traffic light and Ben.



Draw the similar triangle next to them.



Label the triangles

$\Delta ABC \sim \Delta DEF$

The symbol ~ means similar

So we can say:

$$\frac{AB}{DE} = \_\_\_\_ = \frac{AC}{DF}$$

$$\frac{x}{200}$$

We do cross multiplication

$$\frac{x}{200} = \_\_\_\_$$

_____

_____

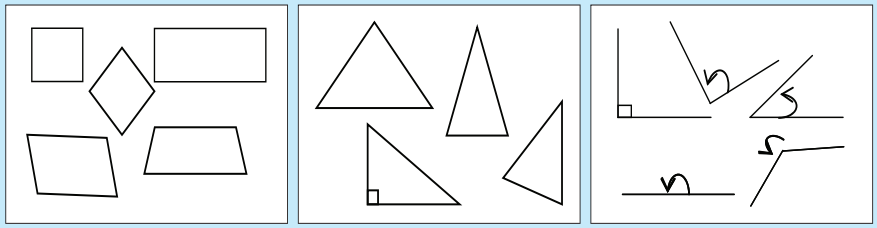
_____

Problem solving

Write your own problem using 'similarity of triangles' to solve it.

68 Quadrilaterals, triangles & angles

Name the quadrilaterals, triangles and angles.



1. Explore these sets of triplets.

a. What do they have in common? What could the brackets represent?
(30°, 120°, 30°); (50°, 80°, 50°); (55°, 70°, 55°); (20°, 140°, 20°); (70°, 40°, 70°)

b. Draw, label and name the geometric figures.

2. Explore these sets of four numbers.

a. What do they have in common? What could the brackets represent?
(90°, 90°, 90°, 90°); (135°, 62°, 47°, 116°); (120°, 60°, 120°, 60°);(71°, 130°, 109°, 50°).

b. Draw, label and name the geometric figures.

3. One of the interior angles of a triangle is 60°. The largest angle in the triangle is twice as large as the smallest. What are the two other angle sizes of this triangle? Make a drawing.

4. Two opposite angles of a quadrilateral are 110° each. What will the other two angles measure?

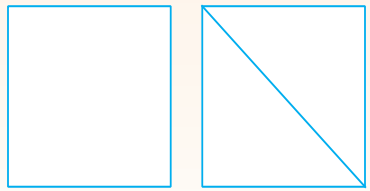
5. A quadrilateral with two pairs of equal sides and four equal angles is divided into two congruent triangles. What are the possible sizes of the angles of the triangles? Explain and make a drawing.

6. Identify all the triangles and quadrilaterals in this net?



What other polygons can you identify?

7. Which will make the strongest shape? Explain.



Where is this strongest shape used often?

These are called truss bridges.

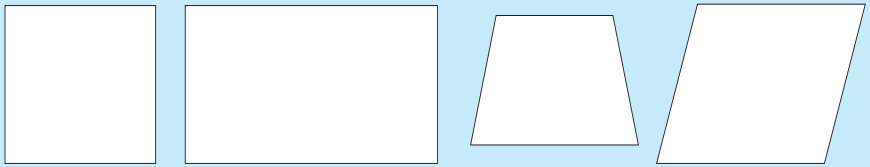


Problem solving

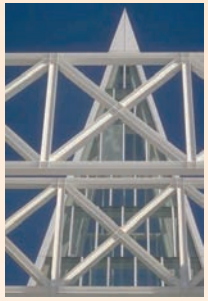
Find a structure in your environment made up with triangles and quadrilaterals. Draw and describe it.

69 Triangles and quadrilaterals

Look at these quadrilaterals and name them. Divide each so that it forms two triangles. Name the triangles.



1. Look at this photograph.



a. What quadrilateral do the beams form? _____

b. What will the sum of the interior angles be? Calculate it without the use of a protractor. _____

c. Identify the triangles. _____

d. What will the sum of the angles be? _____

e. What do you notice about the length of the sides? _____

2. The structure in the photograph is made up of squares divided into triangles. The sides of the squares are equal, and the sides of the triangles are equal. Now answer these questions.

a. What about the diagonals – are they the same length as the sides of the triangle?

_____

b. Are the diagonals the same length as the square sides? Check this.

_____

c. Why do we use triangles in structures? Test this. _____

_____

3. Look at the geometric figures on these knitted hats.



a. Identify the triangles on these hats.

b. Identify the quadrilaterals on these hats.

c. Don't measure the angles with a protractor to answer this question. What are the sizes of the angles? Make drawings to support your answer.

4. Divide:

a. An equilateral triangle into 4 equilateral triangles.

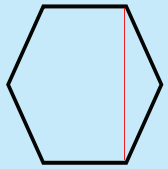
b. A hexagon into triangles.

Problem solving

Share some of these drawing with your family members. Ask them to come up with some ideas.

70 Diagonals

What is a diagonal?





A **diagonal** is a straight line inside a shape drawn between two vertices that are not adjacent to each other.



Oh, so we can say, if you join two vertices of a polygon which are not already joined by one edge, you get a diagonal.

1. Identify the quadrilaterals outlined on a knitted piece of fabric then, in accordance with the definition, identify the diagnals of these quadrilaterals.



2. Look at Worksheet 69 again.

a. Draw all the quadrilaterals and triangles done in Worksheet 69.

b. Draw as many diagonal lines on them as you can.

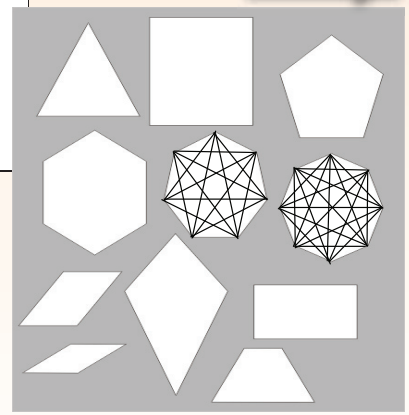
c. What do you notice?

3. Draw a trapezium and draw in two diagonals.
(You could cut the trapezium up into the triangles, to help you to find the answer.)

4. Complete the table.

Shape	Number of sides	Number of diagonals	Difference between diagonals
Triangle	3	0	
Quadrilateral	4		2
Pentagon	5		1
Hexagon			
Heptagon			
Octagon			
Nonagon			
Decagon			

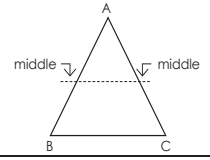
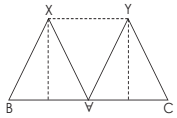
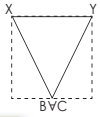
This template will help you.



Problem solving

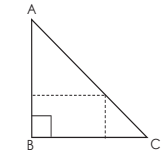
Find five patterns in your immediate environment with diagonals.

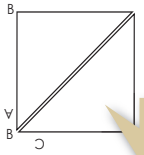
Do the following practical activities in pairs.

Draw any triangle (like △ ABC) on paper and cut it out. Find the middle of AB and of AC, and draw a line joining them up. Label it XY.	
Fold vertex A down over the line XY so that vertex A just touches BC.	
Fold B and C over as shown.	

Angles A, B and C fit together along the bottom edge of the paper (straight line). So the sum of ∠A, ∠B and ∠C are 180°

Fold a right-angled triangle as shown in the diagrams.





What is the sum of the sizes of the acute angles of the right–angled triangle?

1. What do you notice?

Look at the drawings above and answer these questions:

a. What geometric figure is formed after the triangles are folded?

b. What geometric figure is formed by the three angles of the triangle?

c. What kind of triangle is shown in Practical activity A.

d. Do you think that the paper–folding experiment will work equally well for an obtuse triangle?

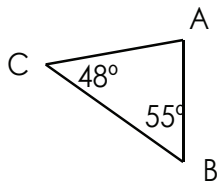
e. Perform the same experiment using an obtuse triangle cut out of paper. Was your prediction correct?

f. Show that the sum of the angles of a quadrilateral is 360°? Use the introduction to guide you.

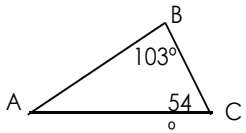
continued

2. Using a compass, go through the steps to construct a line labeled CD perpendicular to both sides of a line labeled AB using a compass.

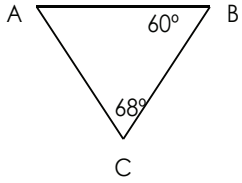
a.



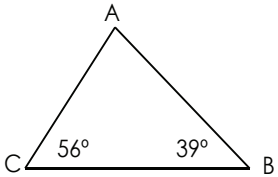
b.



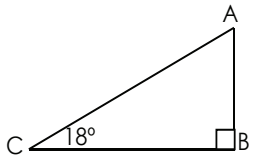
c.



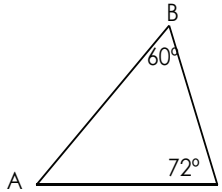
d.



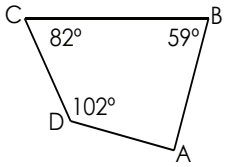
e.



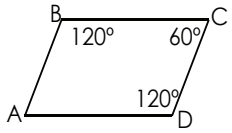
f.



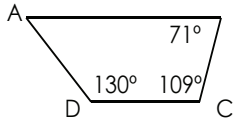
g.



h.



i.



3. Answer these questions.

a. An isosceles triangle has two angles that each measure 40°. What is the size of the third angle?

b. Determine the size of the third angle of a triangle if the sizes of the other two angles are 110° and 38°.

c. Determine the size of the fourth angle of a quadrilateral if the other three angles are 80°, 79° and 120°.

d. One of the acute angles of a right–angled triangle measures 39°. Determine the size of the other acute angle.

e. An obtuse angle of an isosceles triangle measures 110°. Determine the size of one of the acute angles.

Problem solving

If I draw two diagonal lines on a square, what will the sizes of the angles of each of the triangles be?

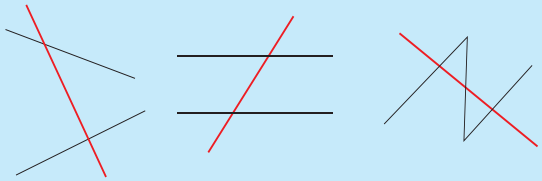
If I draw two diagonal lines on a parallelogram, one of the triangles has angle sizes of 27°, 27° and 126°. What are the sizes of the angles of the other triangles? Make a drawing to show your answer.

72 Parallel and perpendicular lines

Parallel lines are always the same distance apart and will never meet. We called it equidistant. Make a drawing.

Perpendicular lines are lines at right angles (90°) to each other. Make a drawing.

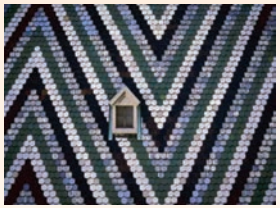
The red lines are transversals. Describe them.



A **transversal** is a straight line intersecting two or more straight lines.

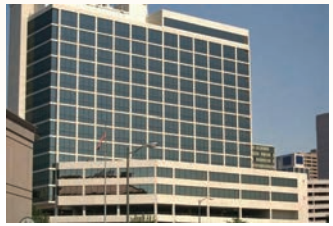
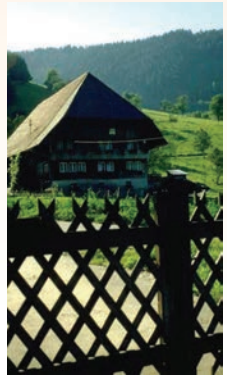
1. Highlight the parallel lines in these pictures.






Looking at what you highlighted, write your own definition for parallel lines.

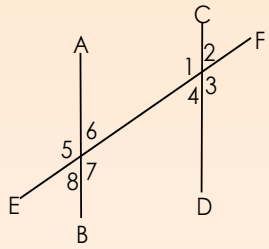
2. Identify the parallel and perpendicular lines in these photographs.
What is each one a photo of?

3. Draw two parallel lines with a line intersecting them. Number the angles.

Measure the angles.

4. Answer the questions on the following diagram.



a. Name a a pair of parallel lines.

b. How do we know they are parallel?

c. Name a transversal.

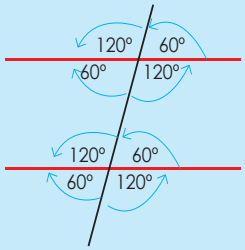
d. Measure the angles where the transversal crosses other lines.

Problem solving

Find a picture of a building and identify all the perpendicular and parallel lines.

73 Pairs of angles

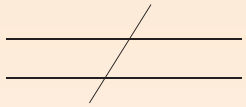
When parallel lines are crossed by another line (a transversal) there is a regular pattern in the angles around the crossing point. Why are many angles the same looking in this diagram?

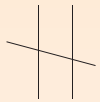


These angles form pairs of angles which have special names.

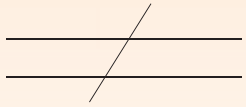
1a. Identify the other vertically opposite angle.

(Show it by using coloured pencils or symbols.)

i. 

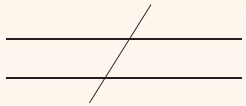
ii. 

b. Other corresponding angles.

i. 

ii. 

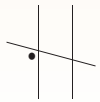
c. Identify the alternate angles.

i. 

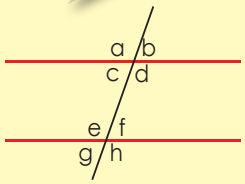
ii. 

d. Identify all angles that will be equal to the one marked.

i. 

ii. 

Use the information below to help you.



Parallel lines

Transversal

Vertical angles:
a = d; b = c; e = h; f = g

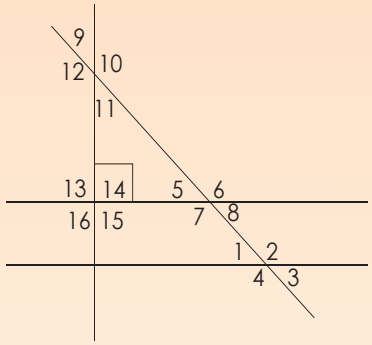
Corresponding angles:
a = e; b = f; c = g; d = h

Alternate interior angles
c = f; d = e

Alternate exterior angles
a = h; b = g

Consecutive interior angles
c + e = 180°d + f = 180°

2. Explain what you see in this diagram using only words, without any calculations. How would you work out each angle, if only angle 1 was given?

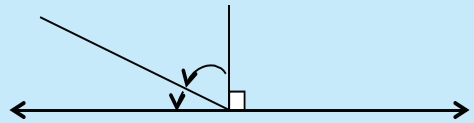


Problem solving

Find a picture and identify alternate and corresponding angles.

Revise the following:

Without measuring the angles, what could the possible angles be? Work in a pair to come up with a possible answer.



1. Solve the following:

a. If A, B an C are three angles on a straight line, with A = 55°, B = 75°, what is the size of C? Construct and name it.

b. If A, B and C are the angles of a triangle, with A = 90° and B = 35°, what size is C? Construct and name it.

c. If A, B, C and D are the angles of a quadrilateral, with A = 150°, B = 30° and C = 150°, what size is D? Construct and name it.

d. If A, B an C are three angles on a straight line, with A = 24°, B = 49°, what is the size of C? Construct and name it.

e. If A, B and C are the angles of a triangle, with A = 40° and B = 64°, what size is C? Construct and name it.

f. If A, B, C and D are the angles of a quadrilateral, with A = 99°, B = 48° and C = 72°, what size is D? Construct and name it.

Problem solving

In which job will a person need to calculate angles. Give an example of such a person and why the person is calculating angles.

75 Geometric figures puzzle fun

Warm up! How fast can you solve the following?

How do you play Sudoku?

	6						1	
			6	5	1			
1		7				6		2
6	2		3		5		9	4
		3				2		
4	8		9		7		3	6
9		6				4		8
			7	9	4			
	5						7	

How many square are on a Sudoku puzzle? Think carefully.

	6		7		8		4	
		8	9		5	3		
		1				8		
3			5	6	9			8
2								9
5			2	4	7			3
		4				7		
		2	8		3	1		
	5		4		6		8	

Identify parallel lines on the Sudoku puzzle.

	6						1	
			6	5	1			
1		7				6		2
6	2		3		5		9	4
		3				2		
4	8		9		7		3	6
9		6				4		8
			7	9	4			
	5						7	

1. Identify the six quadrilaterals, three types of angles and three types of triangles.

T	G	P	B	C	S	B	E	J	M	E	E	M	E	J
R	S	U	B	M	O	H	R	N	S	L	A	A	R	D
A	W	E	S	V	P	T	R	U	E	R	B	V	A	T
P	D	N	T	E	K	R	T	I	G	L	F	M	U	C
E	A	C	U	T	E	B	E	O	G	N	A	P	Q	L
Z	C	D	X	C	O	N	L	C	A	H	J	C	S	Y
I	U	G	U	J	I	E	E	R	T	H	T	N	S	I
U	E	Q	U	I	L	A	T	E	R	A	L	D	S	B
M	I	A	X	L	D	A	E	Y	W	R	N	O	W	D
U	U	M	A	K	W	D	M	G	B	J	S	G	P	R
T	S	R	N	I	I	T	A	Q	W	C	Q	B	L	W
J	A	U	T	T	N	T	D	V	E	I	M	O	U	E
P	W	U	B	E	B	A	V	L	W	G	W	D	W	Z
T	K	J	Q	Q	R	B	E	L	R	I	E	D	Y	V
X	H	Q	L	F	K	S	K	B	S	Y	V	T	W	V

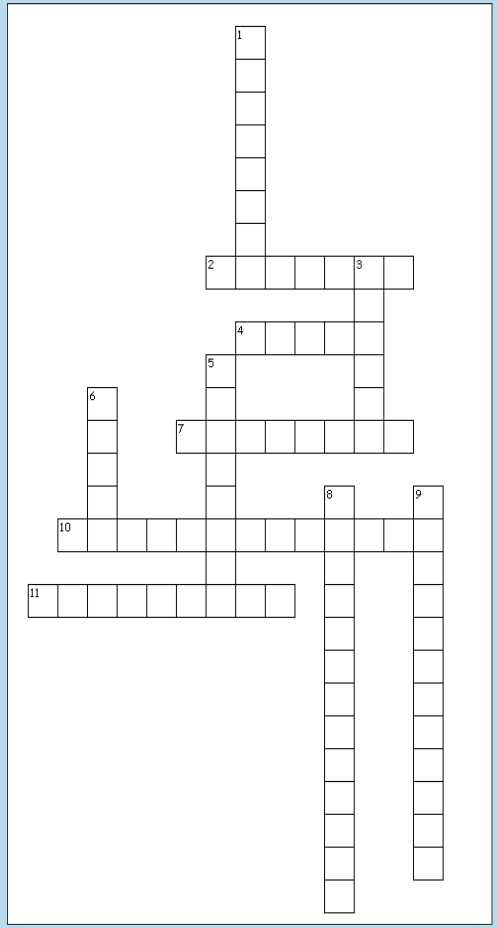
2. Complete the crossword puzzle.

Across

2. A geometric figure with six sides.
4. An angle that is ninety degrees.
7. Lines that are always the same distance apart and will never meet.
10. Lines that are at right angles (90°) to each other.
11. A triangle with two sides equal.

Down

1. A polygon with the least sides.
3. An angle bigger than ninety degrees.
5. A straight line inside a shape that goes from one vertex to another but not the side.
6. An angle smaller than ninety degrees.
8. Geometric figures with four sides.
9. Parallel lines crossed by another line.



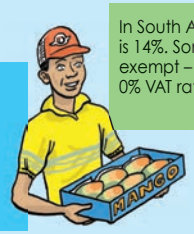
Puzzles

Find some puzzles in a newspaper and solve it with a family member.

76 Finances – profit, loss and discount

Can you still remember the meaning of profit, loss and discount?Do you know the meaning of VAT?

Profit is the surplus remaining after total costs are deducted from total revenue.
Loss is the excess of expenditure over income.
Discount is the amount deducted from the asking price before payment.VAT (Value Added Tax) is the tax payable on all goods and services in South Africa.



In South Africa the current VAT rate is 14%. Some essential foods are exempt – that means they have a 0% VAT rate.

1. Peter buys 10 apples at R2,50 each. He sells each apple for R4,00. How much profit does he make if he sells 50% of his apples at full price and the rest at a 25% discount?

2. Mandla goes to university for one year. It costs R45 000 for his tuition and residence fees. The university offers him 22% discount based on his good school results. How much does he pay for the year?

Interesting facts: Value Added Tax (VAT) was introduced by the European Economic Community (now the European Union) in the 1970s as a consumption tax. It is a tax on the purchase price levied each stage in the chain of production and distribution from raw materials to the final sale. For the final buyer, it is a tax on the full purchase price. For the seller, it is tax only on the "value added" by the seller to the product, material or service (as the seller claims back the VAT they paid for the product). Most of the cost of collecting the tax is borne by business, rather than by the state. Value Added Taxes were introduced in part because they give sellers a direct financial stake in collecting the tax.

3. Ann buys a computer game for R650 excluding VAT. How much VAT will she pay? How much will she pay in total?

4. Lebo buys blank writable CDs in bulk. He repackages them and sells them individually. He pays R40,00 cash (including VAT) for 50 CDs. He receives a 5% cash discount. For how much must he sell each CD to make a 40% profit?

5. Musa buys a new radio for R125,00 excluding VAT. He pays cash and gets a 5% cash discount. How much will he pay in total including VAT?

Problem solving

Palesato receives R100 per week pocket money. She goes to the cinema twice (cost R30,00 per film excluding VAT). She has coffee for R5,00 and buys R25,00 airtime, both with VAT included. How much pocket money can she carry over to the next week?

77 Finances – Budget

Can you still remember what a budget is?
What is the most important rule of a budget ?

Budget is the estimate of revenues and expenditures over a specified period.

Budget isn't a bad word
Budgeting is one of the best keys to good management of your money. Budgeting prevents overspending.



1. You receive R300,00 pocket money every month. You want to go to a movie once a week. The entrance fee is R30,00 and a cold drink is R8,00. The taxi fare is R10,00. Will you be able to go every week? Compile a budget for the month.

2. You had the following expenses last month: Movie R30,00; Taxi R100,00; Ice Cream R9,75; New shirt R45,00; Donation to welfare R50,00; Stationery R65,00; Repairs to your bicycle R175,00. You receive R400 pocket money per month for the chores you do around the house. You have saved R372,00 until now. Complete the budget below to find out if you can save anything or if you will need to use some of your savings?

	Estimated amount	Actual amount	Difference
Income (pocket money)	400,00		
Expenses			
Taxi	75,00		
Movies	60,00		
Sweets	15,00		
Clothes	100,00		
Donations	65,00		
Savings	40,00		
Stationary	50,00		
Estimated total expenses			
Net Income			

3. You plan to start selling flowers to make extra pocket money. A bunch of flowers costs you R65,00 at the market. You need to pay R50 taxi fare for a return trip to the market and your wrapping paper cost you R20,00 for 20 sheets. You only need one sheet per bunch. Use the budget below to calculate what your income for the month must be if you estimate that you can sell 5 bunches per week and you want to make 25% profit. You can only carry 10 bunches at a time in the taxi.

	Estimated amount
Income (sales of flowers)	
Expenses	
Flowers	
Wrapping	
Taxi	
Estimated total expenses	
Net Income (profit)	

4. Previously Sipho spent R160,00 a week of his weekly allowance of R200,00. Now his allowance has been reduced to only R100,00 a week. Work out a new budget so that he can still do the same things.

Previous expenditure:

Movies:	R25 (x2)
Airtime:	R60(x1)
Cold drink:	R8(x4)
Chips:	R3(x6)

Problem solving

Make a list of 5 ways you can extend your budget. Share this list with the rest of the class.

Remember: Extending your budget means you have to increase your surplus.
This does not only mean reducing expenditure, but also increasing income.

78 Finances – loans and interest

Can you still remember what a loan is? What is interest?



A **loan** is sum of money that an individual or a company lends to an individual or company with the objective of gaining profits when the money is paid back.

Interest is the fee charged by a lender to a borrower for the use of borrowed money. The fee is usually expressed as an annual percentage of the amount borrowed, also called interest rate.



Everyone knows the old advice, **"Never a borrower or a lender be,"** but in the modern world loans and credit have just about replaced cash savings as the way that average people finance large purchases. Therefore make sure you know exactly how much interest you pay.



1. Find the simple interest earned on a amount of R1 400 at an annual interest rate of 6.5% over 3 years.

2. On 1 June Sipho opened a savings account at the Postbank that paid 4.5% interest. He deposited R600. Ten days later on 10 June he deposited R1 000. Five days later on 15 June he deposited R500. No other deposits or withdrawals were made. Fifteen days later, at the end of the month, the bank calculated the daily interest.

   a. How much simple interest (calculated to the nearest cent) did he earn?
   b. What was the balance of the account at the end of the first 30 days?

3. Suzy borrowed R2 400 from a bank for a period of two years and six months at a simple annual interest rate of 4.7%. How much must she repay at the end of the time period?

4. Andile has R1 300 to invest and needs R1 800 in 12 years. What annual rate of return will he need to accomplish his goal?

5. Jabu's investment of R2 200 in the stock market earned R528 in two years.
   a. Find the simple interest rate for this investment. If she decide to invest the total amount (original principal amount plus interest) for another two years at the same rate, calculate the following:
   b. What interest will she earn over the second two years.
   c. What is the difference in interest earned over the first two years, compared with interest earned over the second two years?

Problem solving

A total of R24 000 was invested in two accounts. One account earned 8% annual interest and the other earned 9%. The total annual interest earned was R2 020. How much was invested in each account? Write two equations to help you solve the problem.

79 Finances – Hire Purchase

Do you know what hire purchase means?

Hire purchase is a system by which a buyer pays for an asset in regular installments, while enjoying the use of it.

During the repayment period, ownership of the item does not pass to the buyer (it is on 'hire'). Upon the full payment of the loan plus interest, the title passes to the buyer (the 'purchase' is now complete).

Many organisations enter into hire purchase or leasing agreements to pay for and use equipment over a period of time rather than paying the full cost up front.

The repayment period is normally the same as the production life of the machine. For example: a farmer buys a tractor and pays it off over 5 years. After 5 years he typically has to replace the tractor.



Hire purchase must not be confused with **installment sale**.

In the North America and the United Kingdom they call hire purchases, installment sales, but in South Africa an installment sale refers to the finance of an asset that is similar to a loan.In the case of an installment sale the buyer borrows the money from an institution (such as a bank) and uses the equipment as surety. Ownership of the item is transferred to the buyer immediately.In the case of a hire purchase the institution buys the equipment and ownership belongs to the institution. The buyer 'hires' the equipment from the institution at a agreed installment. Only at the end of the hire purchase agreement is ownership transferred to the buyer.

1. How to calculate hire purchase payments

a. Determine the total cost of the item you wish to purchase including the VAT (value added tax) and any other charges or fees that may apply. These may include accounting, insurance, and transport charges, among others.

b. Subtract the amount of your down payment (initial deposit towards the expense) from the total cost. Your payments are based on the total cost minus the down payment.

c. Ask what the interest rate is and how it is calculated. Some interest rates are offered at a flat rate (simple interest), while others are calculated periodically on the balance remaining (compound interest).

d. Calculate hire purchase payments based on the amount you owe, the interest rate and payment schedule. This could amount to an equal payment throughout the course of your payment schedule, or it could mean varying amounts.

2. James buys a gas grill for his restaurant on hire purchase. The grill costs R7 800 and he pays a deposit of R1 000. What will his instalment be if he pays 12 % p.a. simple interest and repays over a period of 18 months?

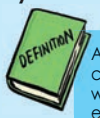
3. Mandla, a farmer, wants to buy a new tractor. The tractor costs R160 000 excluding VAT. He can pay a deposit of R20 000. He decides to buy the tractor on hire purchase over 60 months at a simple interest rate of 10 %.
   a. What will his instalment be?
   b. How much interest will he pay?
   c. How much will he pay in total for the tractor over 60 months?

Problem solving

David buys a new car on hire purchase. The car costs R65 000 (excluding VAT) and he trades in his old car (that was fully paid for) for R7 500. The car registration, documentation and licence fees were R2 500. What will his instalment be if he pays 7 % p.a. in simple interest and repays over a period of 54 months?

80 Finances – exchange rates

Do you know what exchange rate means?



An **exchange rate** is the current market price for which one currency can be exchanged for another.





The **Rand** (sign: R; code: ZAR) is the currency of South Africa.

The **United States Dollar** (sign: $; code: USD; also abbreviated US$) is the official currency of the United States of America.

The **Euro** (sign: €; code: EUR) is the official currency of the Euro zone.

The **Pound sterling** (symbol: £; code: GBP), commonly called the Pound, is the official currency of the United Kingdom.

Quotes using a country's home currency as the price currency (e.g., EUR 0.735342 = USD 1.00 in the euro zone) are known as direct quotation or price quotation (from that country's perspective) and are used by most countries.

Quotes using a country's home currency as the unit currency (e.g., EUR 1.00 = USD 1.35991 in the euro zone) are known as indirect quotation.

Use the exchange rates in the table to help you solve the word problems. Show your work in the space provided.

	ZAR (R)	USD ($)	GBP (£)	CAD ($)	EUR (€)	AUD ($)
ZAR	1,00	6,76	11,06	6,89	9,88	7,17
USD	0,15	1,00	1,60	0,92	1,46	0,87
GBP	0,09	1,09	1,00	0,58	0,91	0,55
CAD	0,15	1,09	1,74	1,00	1,59	0,95
EUR	0,10	0,69	1,10	0,63	1,00	0,60
AUD	0,14	1,15	1,83	1,05	1,67	1,00

1. Mbali earned R100 from waitressing. The new body board she wants to buy costs $12 AUD. After her purchase, how much money will she have left in ZAR?

2. Jack lives in Ottawa, Ontario, Canada. His uncle lives in London, England. For his birthday, Jack received £20 from his uncle. How many Canadian dollars can he buy with his birthday money?

3. Olivia lives in Sydney, Australia. Her grandmother lives in Paris, France. For Christmas, she received €40 from her grandmother. How many Australian dollars can she buy with her Christmas money?

4. Mandla has $11 USD. The computer game he wants to buy costs $10 AUD. Does he have enough money to buy the game? If not, how much more US money does he need?

Problem solving

Jabu has €35. She wants to purchase jeans for $25 CAD and a T– shirt for $15 CAD. After her purchases, how much ZAR will she have left in ZAR?