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# STUDY Mate

Department of Education

GRADES 8–11 ISSUE 15 OCTOBER 2007

## Learning activities for Grades 8–11

Education Minister Naledi Pandor

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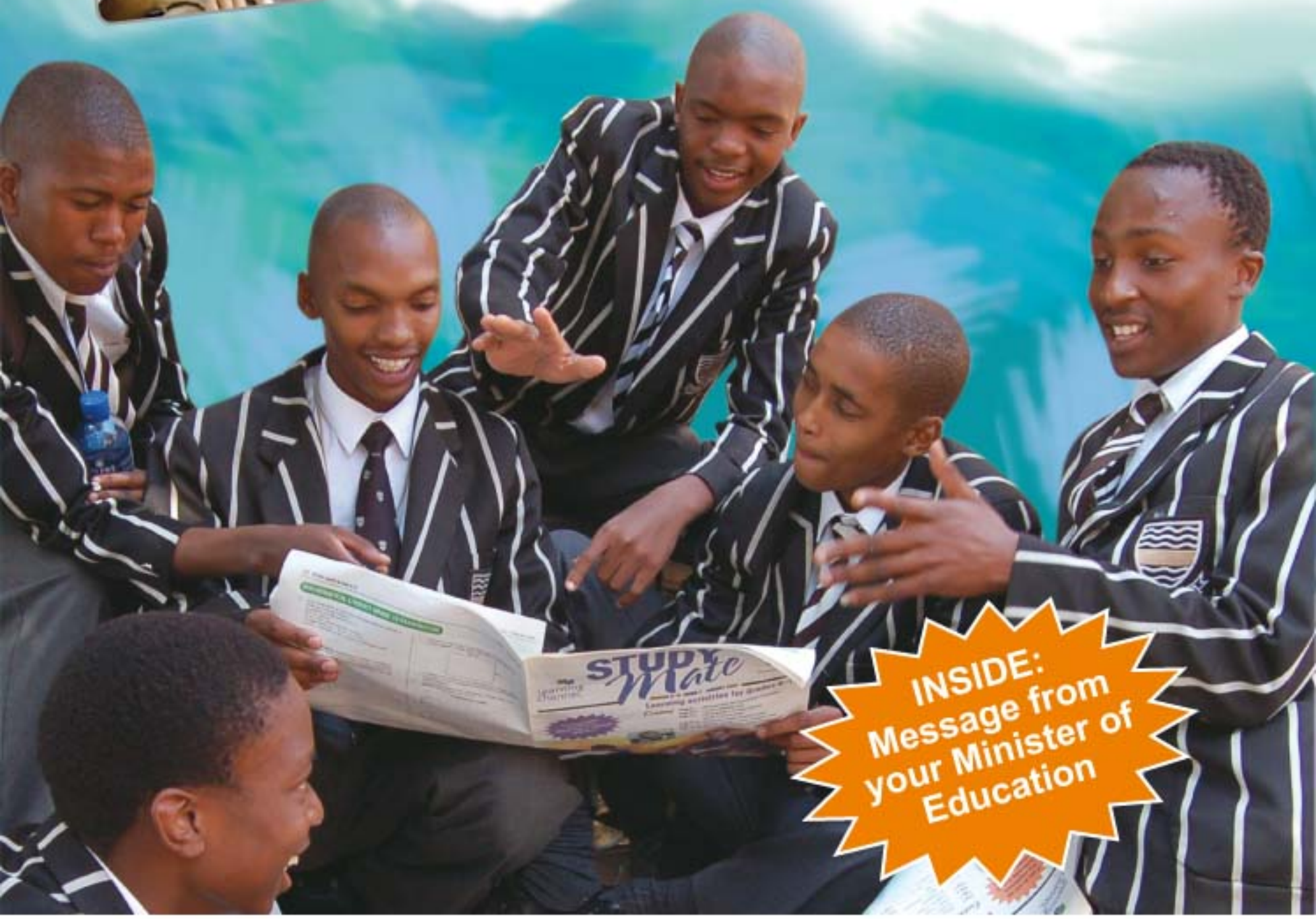


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# MESSAGE OF GOOD WISHES TO THE CLASS OF 2007

The end of yet another academic year is fast drawing to a close for all learners. In particular, 599 048 learners who have completed 12 years of nurturing and guidance by their teachers and parents, will sit for their final examination across 8 000 centres. These learners are our vital investment in the future of this country. As a nation, we collectively wish each and every Grade 12 learner well as they embark on the writing of this crucial examination.

I am pleased to see that each year growing numbers of young South Africans write the Senior Certificate examination and that more and more learners succeed. In 2005, 533 405 learners enrolled to write the Senior Certificate; in 2006, the enrolment was 554 079; and in 2007, it is 599 048. These figures illustrate significant increases over the past three years.

Despite the challenges that confronted us in 2007, I am appreciative of the additional effort and sacrifices that were made by learners, parents, administrators and teachers.

The 2007 examination is the last fully fledged examination that will be based on the current curriculum. I am confident that the Class of 2007 will view this as their special opportunity to raise our performance as a country to the highest level. There will continue to be an examination in May/June from 2008 for those learners who may still need to complete their outstanding subjects. The Department of Education has also established a special support programme to ensure that all learners in the system will complete the Senior Certificate before March 2011.

Remember, you have reached the last lap of the race and many opportunities await all those who have committed time and energy to their studies. The Ministry of Education wishes every candidate great success in the 2007 Senior Certificate examination. I urge you to be calm during this period and to seek assistance from school, family and friends if you feel any anxiety.

**Mrs Naledi Pandor, MP**
**Minister of Education**

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## Expand your vocabulary: words for family members

On your own, write down the answers in English to these questions about family members:

1. One of my uncles has six children and the other uncle has four children. How many cousins do I have?
2. I am a woman. My sister's son is called Mpumi. What am I to Mpumi?
3. My father's name was Mr Simelane. I am married but I have not taken my husband's surname. What is my surname?
4. When my mother died, my father married again. What is his new wife to me?
5. Peter is married to my sister. What is Peter to me?
6. My brother has two daughters and one son and my sister has three sons and one daughter. How many nieces and nephews do I have?

## Just for fun: some and any

Look at this picture and answer the questions on the next page.

1. As a class, look at the picture and play "I spy". The first person must say, "I spy with my little eye something beginning with the letter "c". (You can choose any letter.) The others must ask questions about things in the picture until they guess what the first person was spying. They must ask questions like this: "Is it anything on the table?/Is it something under the chair?/Is it anything on the floor?" and then guess what the thing is. It must begin with the right letter.
2. Work with a partner. Look at the picture again and write sentences about all the things that are happening or have happened in the picture. Use as many adjectives and adverbs as you can. Then read all the sentences out in class and decide which describe the picture most clearly.

## Build language skills: conditional forms

With a partner, rewrite these sentences to show that each event is unlikely. The first one has been done for you as an example:

1. If he wins the lottery, he'll buy sports kit for the soccer team.
   If he *won* the lottery, he *would* buy sports kit for the soccer team.
2. If you come shopping with me, I'll buy you an ice cream.
3. My mother said she will take me to Durban if I pass the examination.
4. If my family comes for the holidays, there will be fifteen of us in the house.
5. If we go to stay in the village, we will be bored.

## Reading and viewing: scanning for information

On your own, scan the table on page 85 to answer the questions. The table tells us how many people live in each municipality in the Eastern Cape.

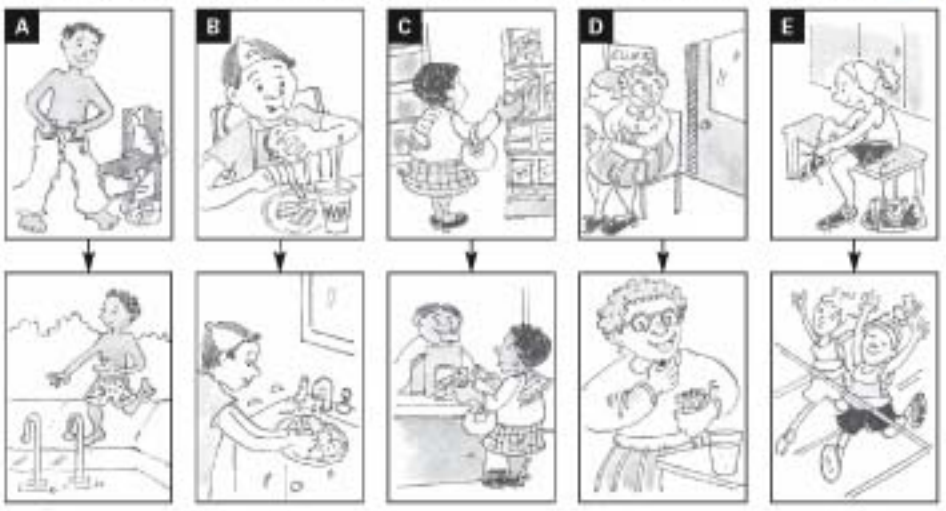


| Local Municipality | Total population | Male population | Female population | Age group 0–14 | Age group 15–64 | Age group 65 + |
|---|---|---|---|---|---|---|
| Umzimkulu | 165 353 | 72 699 | 92 654 | 78 265 | 77 803 | 9 285 |
| Camdebo | 45 418 | 21 870 | 23 548 | 16 026 | 25 839 | 3 553 |
| Makana | 76 685 | 36 279 | 40 406 | 21 534 | 50 394 | 4 757 |
| Mbhashe | 254 317 | 112 852 | 141 465 | 118 290 | 116 816 | 19 211 |
| Buffalo City | 659 531 | 311 307 | 348 224 | 196 300 | 423 701 | 39 530 |
| Lukanji | 177 838 | 82 870 | 95 058 | 61 973 | 103 345 | 12 520 |
| Mbizana | 231 746 | 102 190 | 129 556 | 110 390 | 107 335 | 14 021 |
| Port St John's | 145 738 | 65 205 | 80 533 | 72 813 | 64 337 | 8 588 |
| King Sabata Dalindyebo | 380 673 | 173 547 | 207 126 | 162 620 | 195 970 | 22 083 |

1. Which municipality has the most males?
2. Which municipality has the greatest total population?
3. Which municipality has the fewest females?
4. Which municipality has the most old (65 +) people living in it?
5. Which TWO municipalities have the most very young (0–14) people?
6. Which municipality has the fewest people in the 15–64 age group?
7. Which is the least populated municipality?
8. Write one sentence saying which municipality you would prefer to live in and why. You must make your choice based on the figures in the table and not on any other information that you might have!

## Build language skills: the past perfect tense

Write a sentence about each pair of pictures on the next page. Use the past simple and past perfect tenses. The first one has been done for you:




After he had put on his bathing costume, he went for a swim.

## Reading, viewing and writing: organise information

1. Copy the columns below into your books and use the information from the box to fill in the columns.

Get enough sleep  Eat junk food  Play sports
Eat lots of fruit and vegetables  Drink lots of fizzy cooldrinks
Keep yourself clean  Use lots of sugar in your tea
Use drugs  Exercise every day  Smoke cigarettes
Take time out to relax  Visit a clinic or a doctor if you feel ill

| Column A | Column B |
|---|---|
| A healthy lifestyle | An unhealthy lifestyle |

2. Now write a paragraph about how to keep healthy. Use this title: "How to lead a healthy lifestyle." Your first sentence will be: If you really care about your health there are certain things you should and should not do. Continue your paragraph using the information you wrote in columns A and B.



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## Reading: a personal story

1. On your own, read this short story about Bongi's experience. Make sure you understand the story clearly so that you can answer the questions.

### Bongi's story

It had happened so quickly that Bongi had been caught off guard. He had been so nice to her recently, she should have known he was up to something. That beautiful blue dress he had bought her, those chocolates … he had never given her anything big before. Why hadn't she realised that he wanted something from her in return? How could she have been so stupid?

Bongi shivered as she remembered what had happened the day before. Everyone else in the family had gone out, except him. She had been reading her book quietly in the kitchen when he had put his arms around her from behind. Not realising what was coming next, she smiled up at him. He had had a funny look on his face. Then he had tried to kiss her. Her book had crashed to the floor, bending some pages. She remembered how she had jumped up, surprised, saying, "What are you doing?"

He hadn't even replied, but had started to pull at her clothes.

"NO!" she had screamed, remembering her grandmother's words of advice: "Your body is not like a car, my child, that can be fixed. Look after it. Don't let others hurt you."

These words had given her courage, she thought now. Thank goodness she had been able to run out of the house in time. But now she was scared to be in the same place as he was, and too scared to tell her mother what had happened.

2. Answer these questions on your own:
   a) Who is the person referred to as "he" in the story?
   b) Where does the story take place? In other words, what is the setting of the story?



   c) Did Bongi know this person quite well? How do you know this?
   d) What did this man want from her? Did he get what he wanted?
   e) What advice had Bongi's grandmother given her? Was it good advice?
   f) How did Bongi feel afterwards?
   g) Why do you think Bongi was scared to tell her mother about what had happened?
   h) What do you think Bongi should have done?
   i) What does it mean "to be caught off guard"? Think what the words "caught" and "guard" mean. Then think about the context (what happened in the story).
   j) Look at the pronouns in this sentence. Then rewrite the sentence using appropriate nouns instead of the pronouns.

   "He had been so nice to her recently, she should have known he was up to something."

## Speaking: stating your opinion

1. Work with a group and discuss what you would say and do in each of these situations.
   a) What would you say and do if you saw two of your good friends fighting?
   b) What would you say and do if you saw a good movie?
   c) What would you say and do if you won a lot of money on the lotto?
   d) What would you say and do if your friend told you he or she was HIV positive?
   e) What would you say and do if a stranger offered you a lift in his or her smart car?
   f) What would you say or do if you were chosen to represent your school in your favourite sport?
2. Then work on your own and write a paragraph about what you would do in one of the situations. Start like this and think carefully about the verb tenses you need to use:



## Build language skills: countable and uncountable nouns

1. Work with a partner. Put **much** or **many** into the spaces and then read and role-play this conversation:

PIET: I can't fit into my jeans any more. I think I've put on too ____ weight.
PHINDILE: The problem with you is that you eat too ____ food.
PIET: No, I don't. I just eat too ____ sweets and drink too ____ cooldrinks.
PHINDILE: You're right. If you eat too ____ sweets, you begin to put on too ____ weight.
PIET: What shall I do? ____ people eat sweets all day and they don't get fat! Why me?
PHINDILE: People are different. Too ____ sweets make you fat and there is not ____ you can do about it!

2. The crossed out parts of these sentences are wrong because the writers have not thought whether the nouns are countable or uncountable. Rewrite these sentences correctly. Use your dictionary if you need help.
   a) I asked for ~~a milk~~.
   b) Phindi went to the shop to buy ~~meats~~ and vegetables.
   c) There is ~~few~~ water in the bucket.
   d) What will ~~a weather~~ be today? Will we have rain or sunshine?
   e) There was ~~a great happiness~~ when the team won the match.

## Build language skills: verb tenses

Complete these sentences. Use the correct form of the verb given in brackets and then add appropriate words or phrases that make sense. The first one has been done for you.

1. If I had some free time I (watch) …
   If I had some free time I would watch television.
2. I (have) a problem. Please can you …
3. When the president comes to visit our school, we (sing) …
4. If I was good at sport, I (play) …
5. I (live) in Cape Town. Where do …
6. She said that she (to see) … last week.
7. I (have) two sisters and …
8. When the football players come on to the field, we (cheer) … and …
9. If I (to see) the notice, I would …
10. If I had access to the Internet, I (look for) …



## Expand your vocabulary: using adjectives to describe

Choose the words under each picture that describe the people in each picture

a) enthusiastic, nasty, supportive
b) shocked, confused, angry
c) hard-working, bored, interested
d) excited, bored, happy, scared
e) freezing, lonely, excited
f) overjoyed, fighting, imaginative



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## Build language skills: future with "when"

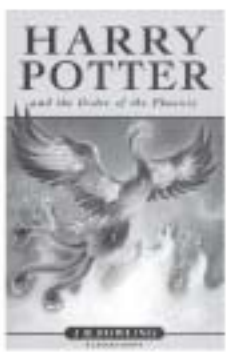
Answer these questions. Study the example first so that you know what to do.

What will you do when you get home today?
→ When I get home I will watch television and then do my homework.

a) What will your mother do when she gets home today?
b) What will you do when the soccer match is finished?
c) What will your friends do when they are on holiday?
d) What will you do on Saturday morning?
e) What will the tourists do when they visit your town?
f) What will you do when you have finished your exams?

## Reading and viewing and writing: a book review

1. Read this book review with your group.




**Harry Potter and the Order of the Phoenix**
by J.K. Rowling
(Published by Bloomsbury 2003)

"He was a skinny, black-haired, bespectacled boy who had the pinched, slightly unhealthy look of someone who has grown a lot in a short space of time. His jeans were torn and dirty, his T-shirt baggy and faded, and the soles of his trainers were peeling away from the uppers. Harry Potter's appearance did not endear him to the neighbours…."

Harry Potter looks like an ordinary teenager. But of course he isn't – as all Harry Potter fans will know! In this book, Harry is in his fifth year at the Hogwarts School of Witchcraft and Wizardry. But during the year he learns more about what happened to his parents and why his friends have not been telling him things.

This is the fifth book in the world-famous series and it's just as exciting and gripping as the previous books. It's quite a long book – nearly 800 pages. But don't be afraid to try and read it because it's so long. It's worth the effort!



2. Discuss these questions with your group and then write your own answers.
   a) Did the person who wrote this review enjoy the book? How do you know?
   b) Do you think this is a book you would enjoy? Why or why not?
   c) How old do you think Harry Potter is (more or less)? Explain your answer.
   d) Work out what these words mean, from the context of the book review. Read the sentences again carefully.
      i) trainers
      ii) endear
   e) Draw a picture of Harry Potter. Use the information in the description.
3. Now work on your own and write your own book review of a book you have enjoyed reading.

## Reading and viewing: telephone directory

A telephone directory or telephone book gives a lot of information.

Find the following as quickly as possible in your local telephone directory:

1. The fax and telephone number of your school.
2. The area code for all Johannesburg numbers.
3. The fax number of your local hospital.
4. The number of your local library.
5. The number of your favourite shop.
6. The home telephone number of one of your friends.
7. The number of one of your relatives.
8. The address of your local supermarket.
9. The number you must dial if you have a question about your Telkom account.
10. The number of a restaurant you would like to go to.
11. The number you must dial if you want to find out the time.

**Check your partner**
Check your partner's work and help him or her to find the correct answers if necessary.



## Writing and speaking: describing a process

1. With a partner, look at the pictures carefully and read the speech bubbles. The pictures explain what you have to do to apply for an identity document.

2. Explain to your partner what you need to do to apply for an ID book.
3. On your own, write a letter or an email to a friend. Describe what you had to do to apply for your ID book.

**Check yourself**
Use this checklist to assess your work.



| Answer these questions: | Yes | No | Action |
|---|---|---|---|
| 1. Do you understand exactly what you have to do to apply for an ID book? | | | |
| 2. Can you explain what you have to do to apply for an ID book? | | | |

## Writing: punctuation

Work on your own. Rewrite this passage in your exercise book. Insert all the missing capital letters, full stops, commas and quotation marks. The text is about a herbalist, whose name is Protus Cele.

the two wooden benches in the wehlela zemithi shop in j section of umlazi are crammed with patients when the herbalist protus cele arrives it's always so full he says as he takes us to his office outside someone is pounding strips of bark into medicine

## Reading: completing a passage

Work with a partner. Read this story and find words to put in the spaces.

This passage comes from a book called *Chasing the Wind*. It was written by Dianne Stewart.

It is the near the end of the school term. Jodie and her friends are in class.

Piet van Schalkwyk aimed a paper plane at the blackboard, just missing Jodie's ear.

"Y-E-S! Only four school ____ left and I'm out of this prison!" he ____.

The boys were suddenly ____. Sheets of paper were ripped out of ____ and the classroom became a ____.

A distracted Meneer ____ stepped though the door, ____ all over the grounded paper planes and anxiously ____ the class.

"Get this place ____ up at once." He loosened the top button of his ____ that had become too tight. Then his ____ voice changed ____ an apologetic pleading tone.

"Class, I ____ exam marking ____ has to be done by ____. Would you mind reading ____ this period? Unless you'd rather ____ on next year's ____?"

"____!" screamed the class "____".



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## Work with integers

You can read to be cool and up-to-date. Anna decides to give Yusuf a gift voucher so that he can buy a book, but she has only R40 and the voucher costs R50. She borrows R10. You can say 40 − 50 = −10. So Anna has −R10, which means she owes R10.

**Work in pairs.**

1 Look at the examples of subtraction below:

**a** To find the difference between (+7) and (+3) start at +3. What must you add to +3 to reach +7? Answer: 4 jumps to the right. So: (+7) − (+3) = +4

**b** To find the difference between (−5) and (−2) start at −2.
To reach −5, take 3 jumps to the left. So: (−5) − (−2) = −3

2 Draw a number line like the one in the example above. Show the jumps you use to work out the following differences on the number line.

**a** (+6) − (+4)
**b** (−6) − (−4)
**c** (+3) − (−2)
**d** (−3) − (+1)
**e** (+2) − (+7)
**f** 0 − (−7)

3 Calculate the answers to the following addition sums:

**a** (+7) + (−3)
**b** (+3) + (−7)
**c** (−5) + (+2)
**d** (+1) + (+1)

4 Compare the answers of number **3a** and **c** to the answers of number **1**.

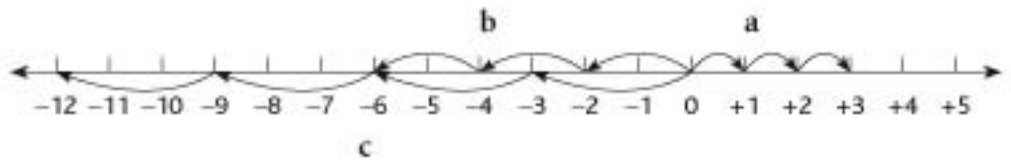
- To subtract a second integer from a first integer, change the sign of the second integer and then add it.
  For example: (+6) − (−4) = (+6) + (+4) = +10
  (additive inverses)
- It is not necessary to write a "+"-sign to show a number is positive: 7 is the same as +7



5 Use the rule in the "hint box" on page 16 to calculate these differences:

**a** 20−(−10) **b** (−13) − (−5) **c** 19 − (+11)
**d** 11 − 19 **e** (−123) − (−23) **f** (−78) − (−78)

6 Look at the examples of multiplication as repeated addition below:




**a** 3 × 1 = 1 + 1 + 1 = 3
**b** 3 × (−2) = (−2) + (−2) + (−2) = −6
**c** (−3) × 4 = 4 × (−3) = (−3) + (−3) + (−3) + (−3) = −12
**d** 5 × 0 = 0 + 0 + 0 + 0 + 0 = 0
**e** 0 × (−5) means 0 jumps of (−5) = 0

7 **a** Copy and complete the table on the right.
**b** What pattern do the answers in column 1 form?
**c** What pattern do the answers in column 2 form?
**d** Complete the rest of column 2 according to this pattern.
**e** Do you agree that a negative integer times a negative integer gives a positive product?

| Column 1 | Column 2 |
|---|---|
| (+3) × (+4) = ..... | (+3) × (−4) = ..... |
| (+2) × (+4) = ..... | (+2) × (−4) = ..... |
| (+1) × (+4) = ..... | (+1) × (−4) = ..... |
| 0 × (+4) = ..... | 0 × (−4) = ..... |
| (−1) × (+4) = ..... | |
| (−2) × (+4) = ..... | |
| (−3) × (+4) = ..... | |

(−1) × (−4) = .....
(−2) × (−4) = .....
(−3) × (−4) = .....

- The general rule for multiplying any positive and negative numbers is:
  ⊞ × ⊞ = ⊞ ⊞ × ⊟ = ⊟ ⊟ × ⊞ = ⊟ ⊟ × ⊟ = ⊞
- You can also write (−2) × (−4) as (−2)(−4). Two bracketed numbers without any sign between the brackets means multiplication.

8 Calculate the following:

**a** (−12) × (+5) **b** (+7)(−8) **c** (−10) × (0,75) **d** (−15)(−7)
**e** (−6)(−5)(−2) **f** $12 \times (-\frac{3}{4})$ **g** −1 000 × (1 − 1) **h** $(-1)^2$

**Inbox**

positive integer(s)
negative integer(s)
repeated addition

**Save**

- Zero is also an integer and any number multiplied by 0 is equal to 0.
- You cannot show the product of two negative integers on a number line as repeated addition.



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## Work with integers and exponents

South Africa has a mix of people with different cultures, languages and beliefs. If we are positive and multiply our efforts to overcome our differences and negative attitudes, we will grow exponentially.

- The general rule for dividing any positive and negative numbers is:
  positive number ÷ positive number = positive number, so ⊞ ÷ ⊞ = ⊞
  positive number ÷ negative number = negative number, so ⊞ ÷ ⊟ = ⊟
  negative number ÷ positive number = negative number, so ⊟ ÷ ⊞ = ⊟
  negative number ÷ negative number = positive number, so ⊟ ÷ ⊟ = ⊞
  zero ÷ any non-zero number = zero, for example: $0 \div 5 = 0$
- A divisor cannot be 0, so $5 \div 0$ is meaningless.
- You can write any division as a fraction, for example:
  $(-6) \div (-3) = +2$ is the same as $\frac{-6}{-3} = 2$

**Work on your own.**

1 Use the rules above and calculate the following:

**a** $(-49) \div 7$ **b** $54 \div (-6)$ **c** $(-96) \div (-12)$

**d** $(-10 \times 0{,}75) \div 1{,}5$ **e** $\frac{36}{-9}$ **f** $\frac{-132}{-11}$

**g** $(-7) \times \frac{(-15)}{(-35)}$ **h** $108 + \frac{(-27)}{(-2)(9)}$ **i** $(-10) \div (-5)(+5)$

- $3 \times 3$ is $3^2$ and called "3 squared" or "3 to the power of 2"
- $3 \times 3 \times 3$ is $3^3$ and called "3 cubed" or "3 to the power of 3"
- $3 \times 3 \times 3 \times 3$ is $3^4$ and called "3 to the power of 4"
- $3^1 = 3$ and $3^0 = 1$
- In $3^4$, the 3 is called the base and the 4 the exponent, and $3^4$ is called a power.
- The base of a power can also be a negative number, for example:
  $(-3)^2 = (-3) \times (-3)$

2 Write the following as powers:

**a** $4 \times 4$ **b** $2 \times 2 \times 2$

**c** $1 \times 1 \times 1 \times 1 \times 1$ **d** $(-5) \times (-5) \times (-5) \times (-5)$

**e** $(0{,}5) \times (0{,}5) \times (0{,}5)$ **f** $10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$

**g** $(-\frac{1}{2}) \times (-\frac{1}{2}) \times (-\frac{1}{2})$

3 Rewrite the following powers in factor form and calculate their values, for example, $4^3 = 4 \times 4 \times 4 = 64$.

**a** $8^2$ **b** $2^6$ **c** $5^5$ **d** $3^4$

**e** $(-8)^2$ **f** $(-2)^5$ **g** $(-1)^7$ **h** $(\frac{1}{2})^3$



- Perfect squares are the product of two identical factors, for example:
  $1^2 = 1$; $2^2 = 4$; $3^2 = 9$; $4^2 = 16$; ...
- $3 \times 3 = 3^2 = 9$, so "3 is the square root of 9" or $3 = \sqrt{9}$
- Only positive numbers have square roots, for example, $\sqrt{4} = 2$ because $2 \times 2 = 4$, but $\sqrt{-4}$ is meaningless as: $(-2) \times (-2) \neq -4$

4 Work out the square root of each of the following perfect squares by first writing it in factor form, for example, $\sqrt{4} = \sqrt{2 \times 2}$; therefore $\sqrt{4} = 2$.

**a** 16 **b** 25 **c** 64 **d** 100

**e** 10 000 **f** $\frac{1}{4}$ **g** $\frac{4}{9}$ **h** 1,44.

- Perfect cubes are the product of three identical factors, for example,
  $1^3 = 1$; $2^3 = 8$; $3^3 = 27$; $4^3 = 64$; ...
- $64 = 4^3$, so "4 is the cube root of 64" or $\sqrt[3]{64} = \sqrt[3]{4^3} = 4$
- Negative numbers also have cube roots: $\sqrt[3]{-8} = \sqrt[3]{(-2)^3} = -2$

5 Calculate the cube root of the following by first writing it as a power:

**a** 1 **b** 27 **c** 125 **d** 1 000

**e** 1 000 000 **f** −27 **g** −1 **h** $-\frac{1}{8}$

6 Use a calculator to work out the square roots of the numbers below. (Hint: Round off your answers to two decimal places.)

**a** 3 **b** 10 **c** 15 **d** 169

**e** 1 000 **f** 2,25 **g** 0,01 **h** −1

7 Simplify the following:

**a** $5^2 + 7^2 - 6^2$ **b** $3^2 \times 9^2 - 12^2$ **c** $5^3 \div 5^2 + 4^3$

### Extension question

8 Simplify the following:

**a** $(-4)^2 + (-2)^3 - (-3)^3$ **b** $(-\frac{1}{2})^2 \times \sqrt{64} \div (-\frac{1}{2})^3$ **c** $\sqrt[3]{-64} + \sqrt{16}$

**Inbox**

integer(s)
base
exponent(ial)
power
perfect square
perfect cube
square root
cube root
factor(s)

**Save**

- Square numbers have two identical factors, for example: $16 = 4 \times 4 = 4^2$ where 4 is the square root of 16, or $\sqrt{16} = 4$
- Cube numbers have three identical factors, for example: $27 = 3 \times 3 \times 3 = 3^3$

## Work with flow diagrams

- Flow diagrams show how input numbers are changed into output numbers.
- We use mathematical rules to tell us what to do to input numbers to get output numbers.

**Work in groups.**

1 Look at the flow diagrams below and play the game.

First game:

| Input | Rule | Output |
|---|---|---|
| $x$ | + 15 steps | $x$ + 15 steps |

Step 1: Take paper and a pen and go outside.
Step 2: Mark a starting point $x$ on the ground with a stone, sticks or paper.
Step 3: Walk 15 steps forward (this is the rule). You are now at $x + 15$ steps.
Step 4: What is the value of $x$ if the output value is 15?

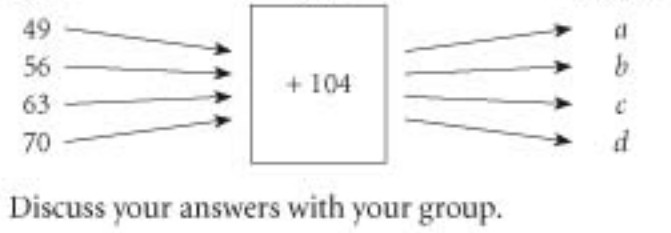
Second game:

| Input | Rule | Rule | Output |
|---|---|---|---|
| 0 (start) | + 25 steps | − 7 steps | $y$ |

Step 5: Work out the value of $y$.
Step 6: Make up some more games to work out the values of output variables. You can also work with negative numbers, for example:

| Input | Rule | Output |
|---|---|---|
| 0 | − 10 steps | $r$ |

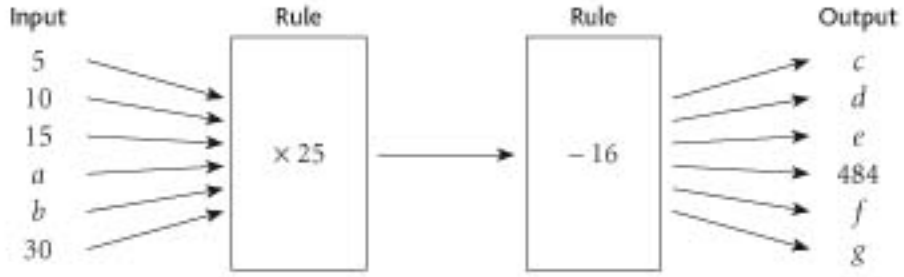
2 **a** Work out the values of the output variables in the flow diagram below:




**b** Discuss your answers with your group.



3 **a** Work out the values of the variables in the flow diagram below:




**b** Discuss your answers with your group.

4 **a** Play the game below in groups of four.
Step 1: Learner 1 says any number (input).
Step 2: Learner 2 gives a rule, for example, + 20, − 31, × 15 (do not use division).
Step 3: Learner 3 gives another rule.
Step 4: Learner 4 says what the output is.
Step 5: Learner 4 starts the next round by giving a new input number.

**b** Discuss why you should not give a division rule in the game.

### Extension question

5 When you put money in the bank (input) and interest is added (or subtracted), you get a different amount out (output). Where else in real life is input changed to an output by a rule?

Did you know that we produce half of the electricity in Africa, but 40% of South Africans do not have electricity?

**Inbox**

digits
flow diagram
input
rule
output

**Save**

- A flow diagram is the same as an equation, but written in a different way, for example:
  Equation: $y = x + 30$
  Flow diagram:

| $x$ | + 30 | $y$ |
|---|---|---|

- To link flow diagrams to equations which have to be solved, you do the following:
  For example: What is the rule to get from 24 to 30?

| 24 | $+x$ | 30 |
|---|---|---|

  Equation: $24 + x = 30$



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## Work with input and output values in tables

- Input and output values can be shown on flow diagrams or in tables. For example:

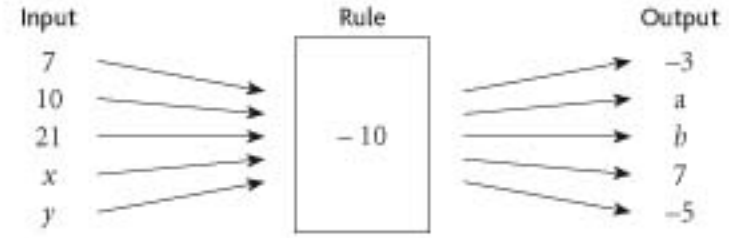
Flow diagram:

Table:

| Input | 1 | 2 | 3 |
|---|---|---|---|
| Rule | + 7 | + 7 | + 7 |
| Output | 8 | 9 | 10 |

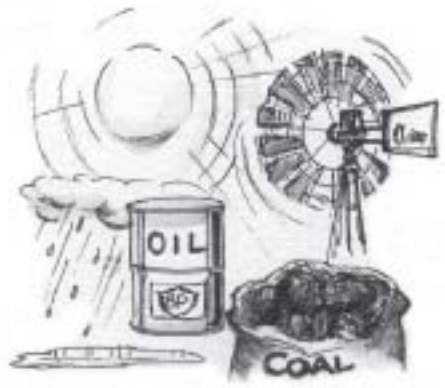
**Work on your own.**

**1 a** Work out the values of the variables in the flow diagram below:




**b** Draw and complete a table showing the same information.

Natural resources are raw materials found in water, air or the ground. Some resources, like sun or wind power, are renewable. Others, like wood, coal and oil, are slowly being used up – they are non-renewable resources.



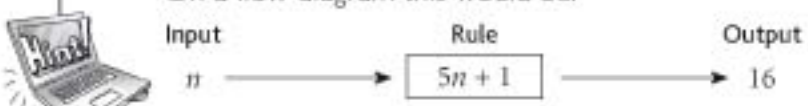



**2** South Africa is one of the five top coal producing countries in the world. Coal deposits can be very deep, but average less than 3 m. Copy and complete the table below:

| Depth of coal deposit in metres | 2 m | 5 m | $s$ | 25 m |
|---|---|---|---|---|
| Conversion | × 100 | × 100 | × 100 | × 100 |
| Depth of coal deposit in centimetres | $p$ | $q$ | 600 m | $r$ |

**3** Draw a flow diagram to show the information in number **2**.

- You can use the letter $n$ to substitute (stand in the place of) a number.
- In the equation $5n + 1 = 16$, the value of $n$ is 3. On a flow diagram this would be:




**4** Copy and complete the table below by calculating the output values:

| $n$ | 1 | 2 | 3 | 4 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|
| $3n + 4$ | 7 | 10 | 13 | 16 | | | | | |

**5** Copy and complete the table below by calculating the value of $n$:

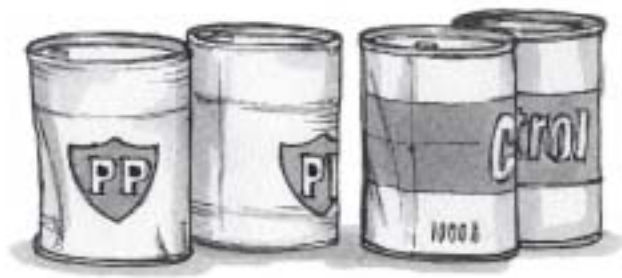
| $n$ | 1 | 2 | 3 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| $3n + 1$ | 4 | 7 | 10 | 13 | 16 | 31 | 46 | 61 | 76 |

### Extension question

**6** Work with $7n + 6$.

**a** Draw a table to show the output values for $n = 1$; 2; 3; 4; 5; 10; 15 and 20.

**b** What input numbers ($n$) will give the output numbers 48 and 62?




**Inbox**

term
substitute

**Save**

- You can write multiplication in different ways: $3a$ means $3 \times a$ means $3.a$ means $3(a)$

## Work with word problems and equations

**Work in pairs.**

**Notes**

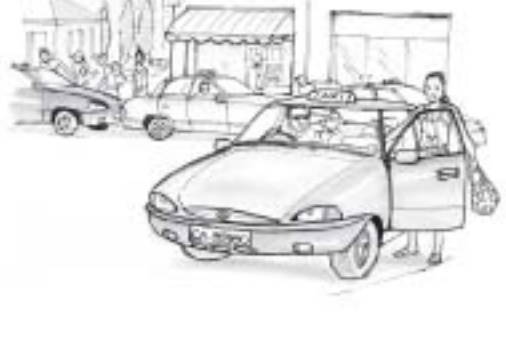
- A "word problem" contains numbers, but the problem is explained in words.
- A word problem that has numbers can often be *translated* into a mathematical *equation*. When you solve the equation, you are able to solve the problem.
- One way to solve an equation is to inspect the equation and then guess a possible answer. If your answer does not solve the problem, you try a better guess-value until you get the correct answer to the problem. So by **trial-and-improvement** or by inspection you eventually solve the problem.
- The following word problem can be solved by inspection:
  *A number increased by 11 gives 20. Work out the number.*
  To start your translation, you replace the unknown number with $x$.
  Translate the word problem into a word equation:
  $x$ increased by 11 gives 20 (word equation)
  Then translate it into a mathematical equation: $x + 11 = 20$ (mathematical equation)
  By inspection, you notice that $x$ must be 9, because: $\mathbf{9} + 11 = 20$

**1** Solve the equations below by inspection:

**a** $x - 6 = 3$ **b** $2x + 6 = 18$ **c** $3x - 2 = 7$
**d** $17 - 2x = 11$ **e** $\frac{3x}{2} = 6$ **f** $\frac{x}{2} + \frac{3}{2} = 4$

**2** Translate the following word problems into mathematical equations. Use $t$ for the unknown number values. Do not solve the equations, just practice translating each word problem into an equation.

**a** If you subtract 8 from a number you get 14.
**b** A certain number is doubled and added to 23. The answer is 31.
**c** A number increased by 12 gives 5.
**d** If you subtract 7 from 6 times a number you get 35.
**e** A restaurant owner orders beer and wine glasses. The number of beer glasses is double the number of wine glasses. In total, she orders 90 glasses. (Hint: Use $t$ for the number of wine glasses.)
**f** The cost for a taxi ride is a fixed amount of R10 plus R1,50 per km. Nadia pays R16 for her taxi ride. What distance does Nadia travel by taxi? (Hint: Use $t$ for the number of kilometres that Nadia travels.)





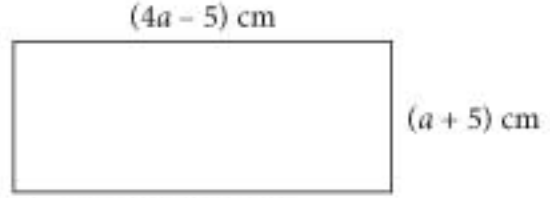
**3** Look at the equations you wrote down in number **2**. Solve for $t$ in each equation by inspection.

**4** Steve has two bags of marbles. Each bag has the same number of marbles in it. During a game, Steve loses 4 marbles and now he only has 14 marbles left. How many marbles were there in each bag before the game?

**a** Translate the word problem above into an equation.
**b** Solve the equation by inspection.

### Extension question

**5** The perimeter of the rectangle below is 40 cm.




**a** Write an equation for the situation.
**b** Simplify the equation and work out the value of $a$ by inspection (or trial-and-improvement).
**c** What is the length of the rectangle?

**Reminders**

- To solve a word problem using Maths, you need to translate the word problem into a mathematical equation.
- Use a letter symbol like $x$ or $t$ for the unknown value. Another word for a letter symbol is a "variable".
- One way to solve an equation is to inspect the equation and then to guess a possible answer. If the answer does not solve the problem, try a better guess-value until you have the correct answer. So by inspection and trial-and-improvement, you eventually solve the problem.

**Words** trial-and-improvement



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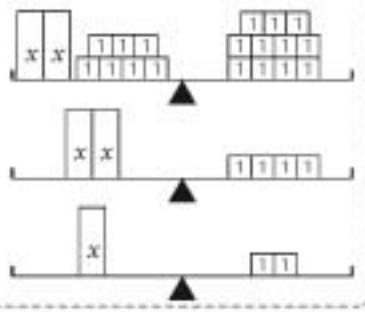
## Solve equations

**Work in pairs.**

**Notes**

- In Activity 1, you learnt how to solve equations by inspection and/or trial-and-improvement, but it is not always easy to find a solution by this method.
- Another method for solving equations is to isolate the letter symbol (variable). This method is also known as the "balancing method".
- A maths equation is like a balanced scale:
  (the weight on the left-hand side) = (the weight on the right-hand side)
- The diagrams on the right represents the equation: $2x + 7 = 11$
- On the left-hand side of the scale there are two unknown weights, with 7 weights of 1 kg each. On the right-hand side there are 11 weights of 1 kg each. The scale is in balance.
- If you take 7 weights of 1 kg each away from each side, the scale remains in balance. You get $2x = 4$.
- If you halve the weights on both sides, the scale stays in balance. You get $x = 2$. This value is called the **solution or root of the equation**.




**1** Work through the following examples to solve each equation by using the balancing method (Hint: To isolate the variable, whatever you do on the LHS of the equation, you must also do on the RHS.)

**a** $3x + 8 = 17$
$3x + 8 - 8 = 17 - 8$
$\therefore 3x = 9$
$\therefore \frac{3x}{3} = \frac{9}{3}$
$\therefore x = 3$

**b** $3x - 8 = 7$
$3x - 8 + 8 = 7 + 8$
$3x = 15$
$\frac{3x}{3} = \frac{15}{3}$
$\therefore x = 5$

**c** $9 - 2s = 19$
$9 - 9 - 2s = 19 - 9$
$\therefore -2s = 10$
$\therefore \frac{-2s}{-2} = \frac{10}{-2}$
$\therefore s = -5$

**Notes**

- To check your answer, use brackets to substitute the value of the variable.
- You can check the above solution for number **1c**. Here are two methods:

Method 1: $9 - 2(-5) = 19$?
$9 + 10 = 19$?
$19 = 19$ (true)

Method 2: LHS $= 9 - 2(-5)$ RHS $= 19$
$= 9 + 10$
$= 19$
RHS $=$ LHS

**2** Use the balancing method to solve the equations below. Check your solutions.

| | | |
|---|---|---|
| **a** $8y + 3 = 27$ | **b** $2p - 9 = 15$ | **c** $11 - x = 21$ |
| **d** $4x - 1 = -9$ | **e** $3x + 7 = x + 8$ | **f** $5a - 3 = 2a + 12$ |
| **g** $12x + 4 = 28$ | **h** $7x - 2 = 22 - x$ | **i** $5x - 8 = 4 + 2x$ |



**Notes**

- When you use the balancing method to solve an equation there are two rules:
  Rule 1: If you want to remove a term, you either add the term to *both sides* (if the term is negative) or you subtract the term from both sides (if the term is positive).
  Rule 2: If you want to remove a factor, you divide the *whole* of *both sides* by the factor.
  For example: $5x = 20$
  $\therefore \frac{5x}{5} = \frac{20}{5}$
  $\therefore x = 4$

**3** Use the balancing method to solve the equations below.

| | | |
|---|---|---|
| **a** $4 + 2x = 20$ | **b** $3x + 2 = 4x + 4$ | **c** $x - 1 = -4x - 16$ |
| **d** $4x + 2 = 2x + 4$ | **e** $4x - 2 = 2x - 4$ | **f** $4x + 6 = 2x + 10$ |
| **g** $9x + 8 = 7x$ | **h** $8x - 3 = 7 + 6x$ | **i** $3x - 2 = 6 - x$ |
| **j** $5x + 6 = 21$ | **k** $12y - 3 = 20$ | **l** $15 - a = 6$ |
| **m** $0 = -4u - 5$ | **n** $11 - 2x = 3$ | **o** $5x + 7 = 11 - 3x$ |

**Reminders**

- When you solve an equation, you work out all the numbers that, when substituted into the equation, make the equation true (LHS = RHS).
- A number that makes the equation true is called the **solution** or **root** of the equation.
- Whatever you do to an equation, you do twice: once to the whole LHS and once to the whole RHS.
- Use brackets to substitute the value of the variable when you check your solution.

**Words** solution of an equation root of an equation

## Work with more complicated linear equations

**Work in pairs.**

**Notes**

- You can look at an equation in this way: (one expression = another expression)
- The unknown number (usually $x$) appears in one or both expressions.
- Equations become more complicated when the expressions contain brackets.
  For example: $2(x+3)+4=3(2x-1)$
- When you solve an equation with brackets, first remove the brackets.
- Work though the following steps to solve an equation with brackets:

Solve: $3(x-2)=15-2(x-2)$

*Solution:*

$3x-6=15-2x+4$ (remove brackets)
$\therefore\ 3x-6=19-2x$ (collect like terms)
$\therefore\ 3x+2x-6=19-2x+2x$ (isolate the letter; balancing method)
$\therefore\ 5x-6=19$ (collect like terms)
$\therefore\ 5x-6+6=19+6$ (isolate the letter; balancing method)
$\therefore\ 5x=25$ (collect like terms)
$\therefore\ \frac{5x}{5}=\frac{25}{5}$ (isolate the letter; balancing method)
$\therefore\ x=5$

Check: $3[(5)-2]=15-2[(5)-2]$?
$3(3)=15-2(3)$?
$9=9$ ✓
$\therefore$ LHS = RHS
$\therefore\ x=5$ is the solution

**OR**

LHS: $3[(5)-2]$
$=3(3)$
$=9$
$\therefore$ LHS = RHS
$\therefore\ x=5$ is the solution

RHS: $15-2[(5)-2]$
$=15-2(3)$
$=9$

1 Simplify the following expressions by first removing the brackets and then collecting the like terms:

a $4(2m-3)+10$ b $5x-2(x-1)$ c $7+2(b-5)$
d $3(4a-3)+7a$ e $8-7x-2(3x-1)$ f $13x+4(x-6)$

2 Solve the following equations. Remember to check your answers using one of the two methods you have learnt.

a $7(x-2)+17=10$
b $3b+4=2(b-3)$
c $2(4x+5)=3x-(x+2)$
d $12+2(y+3)=24$
e $5x-2(3x+1)=9$
f $8x-3(2x+1)=5$

**Notes**

- Equations can also have fractions, for example: $\frac{b}{3}+\frac{3}{2}=18$
- Clear the fractions by multiplying *every term* by the LCM of the denominators.
- Work through the following steps to solve an equation with fractions:

(1) Solve: $\frac{x}{4}=-3$

*Solution:* Clear the fraction by multiplying by 4 (the LCM of the denominator).

$\therefore\ \frac{x}{4}\times\left(\frac{4}{1}\right)=-3\times\left(\frac{4}{1}\right)$
$\therefore\ x=-12$ (fraction is cleared)

(2) Solve: $\frac{2}{5}x+1=\frac{4}{3}$

*Solution:* Clear the fractions by multiplying by 15 (the LCM of 5 and 3).

$\therefore\ \frac{2}{5}x\times\left(\frac{15}{1}\right)+1\times\left(\frac{15}{1}\right)=\frac{4}{3}\times\left(\frac{15}{1}\right)$
$\therefore\ 2x\times 3+15=4\times 5$ (fractions are cleared)
$\therefore\ 6x+15=20$
$\therefore\ 6x+15-15=20-15$ (isolate the letter; balancing method)
$\therefore\ 6x=5$
$\therefore\ \frac{6x}{6}=\frac{5}{6}$ (isolate the letter; balancing method)
$\therefore\ x=\frac{5}{6}$

3 Solve the following equations that have fractions:

a $\frac{b}{3}+2=4$ b $\frac{5a}{3}=a-\frac{2}{3}$ c $\frac{3x}{4}-1=\frac{1}{2}$
d $\frac{3x}{4}-\frac{x}{2}=5$ e $\frac{2a}{3}+\frac{a}{2}=7$ f $\frac{b}{2}=\frac{b}{4}+1$

4 Solve the following equations. (Hint: Some equations have brackets and others have fractions.)

a $\frac{2x}{3}=-5$ b $5x+\frac{2}{3}=1$
c $\frac{w}{2}+1=\frac{5}{3}$ d $3(x+2)=6$
e $\frac{m}{4}-5=6$
f $3(x+2)=2(x-4)$
g $2-b=-2(b+5)$
h $\frac{a}{4}-\frac{a}{8}=\frac{a}{2}-3$
i $4x-2=1-(2x+3)$

**Reminders**

- To solve equations, you need to get the variable (like $x$ or $b$) on one side of the equation.
- First simplify the expressions by removing brackets and clearing fractions.
- Remember: a negative sign in front of a bracket will change all the signs in the bracket.
- To clear fractions, multiply every term by the LCM of the denominators.



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## Work with expressions

**Work in pairs.**

**Notes**

- An algebraic **expression** is any collection of numbers, variables or mathematical symbols. For example, $6t - 7x + 4y$ is an algebraic expression.

- The "$6t$", "$-7x$" and "$4y$" are called the *terms* of the expression.
- The constant numbers "6", " −7" and "4" are called the **coefficients** of the terms.
- When no constant is shown with a variable term, the coefficient is 1, for example, in $x^2 + \frac{y}{3}$ the coefficient of $x^2$ is 1 and the coefficient of $y$ is $\frac{1}{3}$.
- In an expression, terms are separated by "+" and "−" signs, so the expression $6t - 7x + 4y$ has three terms.
- The letters in an algebraic expression represent numbers. The letters are called "variables" because the letters can vary or differ in value.
- In the expression, $6t - 7x + 4y$, the letters "$x$" and "$y$" are variables because they can represent various numbers.

**1** Write down the number of terms in each of the expressions below:

**a** $5x + 3 - 4y$ **b** $-7x$ **c** $x^4 - x$

**d** $\frac{x}{5} - 6x^2$ **e** $\frac{x+y}{3}$ **f** $\frac{3x+4y}{2} - 8x^2$

**2** Write down the coefficient of $x$ in each of the expressions in number **1**.

**Notes**

Powers:

- You have learnt that when a number is written as $2^3$, the "2" is called the base and the "3" is called the index or exponent.

base → $2^3$ ← index or exponent

- $2^3$ means $2 \times 2 \times 2$. The index shows how many factors there are. For example, $5^2$ means $5 \times 5$ (two factors of 5) and $a^4 = a \times a \times a \times a$ (four factors of $a$).
- $2^3$ is called a power of 2, $3^5$ is a power of 3 and $a^2$ is a power of $a$.

**Like** and **unlike terms**:

- Like terms have the same variables and the same corresponding index. For example, $2x^2y^3$ and $-\frac{3}{5}x^2y^3$ are like terms, but $2x^2y^3$ and $-\frac{3}{5}x^3y$ are unlike terms.
- You may only add or subtract like terms, for example: $6x^3 - 2x^3 = 4x^3$
- You may not add or subtract unlike terms, for example: $6x^3 - 2x^2 \neq 4x$



**3** Simplify the following expressions as far as possible by collecting the like terms:

**a** $3x + 21 + 2x$ **b** $2x - 4 + 6x + 10$

**c** $-2xy + 5x - 2y - 3y + 9xy$ **d** $7b - a + 3a - 6b$

**e** $2a^2 + a - 3a^2 + 4ab$ **f** $3ac - 5ab - 6ac - 3ab - 10$

**g** $3p - 5q - 7p + 3p$ **h** $2b^3 - 3b - 7 + 5b + 2$

**i** $-3pq + 3p - 7p - 5q + 5pq$ **j** $6xy^2 - 7x^2y + 9x^2y - 3xy^2$

**k** $2x^2 - 5x - 6 - 4x + 7$ **l** $5y - 2xy + 4x + 7y$

**Notes**

- Expressions represent numbers. For example, the value of the expression $5x - 10$ depends on the value of the letter $x$.
- If $x = 2$; then $5x - 10 = 5(2) - 10$
  $= 10 - 10$
  $= 0$
  If $x = -3$; then $5x - 10 = 5(-3) - 10$
  $= -15 - 10$
  $= -25$
- To calculate the value of the expression, you replace the letter or the variable with the given value. It is always better to put the given value *in brackets*.

**4** Calculate the values of the following expressions by replacing the letters with the values given in brackets:

**a** $-a + 9$ $(a = 4; a = -3)$

**b** $x^2 + 7$ $(x = 2; x = \frac{1}{2})$

**c** $-y^2$ $(y = 3; y = -3)$

**d** $4y^2 + 2y + 5$ $(y = -2; y = 2)$

**e** $3x^2 - 2xy + y^2$ $(x = 2; y = 1)$

**f** $a^2 + 2ab + b^2$ $(a = -1; b = 3)$

**Reminders**

- Expressions can have one or more terms.
- Terms are separated by "+" or "−" signs.
- *Like* terms have the *same* letter symbol(s) with the *same* corresponding indices.
- The coefficients of like terms may differ.
- You may only add or subtract *like* terms.
- The value of an expression depends on the values of the letters. For different letter values, the value of the expression is usually also different.
- To calculate the value of the expression, you replace the letter with the given letter value.
- Use brackets for substitution.

**Words** expression coefficient like terms unlike terms

## Work with addition and subtraction of polynomials

**Work on your own.**

**Notes**

- A **polynomial** is an algebraic expression where the variables have indices that are positive whole numbers. Variables are *not* used in the denominators of the terms of a polynomial.
- The following expressions are polynomials:
  (1) $6t^3 - 2t + 7$ (2) $2x^3 - 7xy^4$ (3) $-\frac{2}{3}a^2 + 6a^5$
- The following expressions are not polynomials. Make sure you know why.
  (1) $6t^3 - \frac{2}{t^2} + 7t^4$ (2) $2x^{-3} - 5xy^4$ (3) $6t^{\frac{1}{2}} + 3t^{\frac{1}{3}}$
- A **monomial** is a polynomial expression with *one* term.
- A **binomial** is a polynomial expression with *two* terms.
- A **trinomial** is a polynomial expression with *three* terms.

**1** Work through the steps to add the following polynomials:
$3a^2 - 2a - 7$; $3a + 4$; $-2a^2 + 9a$

*Solution:*
$(3a^2 - 2a - 7) + (3a + 4) + (-2a^2 + 9a)$ (remove the brackets)
$= 3a^2 - 2a - 7 + 3a + 4 - 2a^2 + 9a$ (collect like terms)
$= a^2 + 10a - 3$

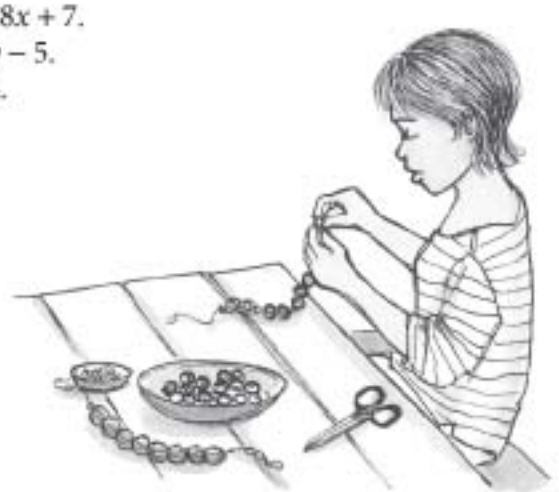
**2** Add the following polynomials:
**a** $t^3 - 4t - 1$; $2t^2 - 3t + 3$; $-3t^2 + 9t - 2$
**b** $2x^3 - 4x$; $-x^3 - 5$; $2x + 7$
**c** $a^2b + ab$; $5ab - 6$; $2ab^2 + 3$
**d** $x^3 - 3x^2 - 3x - 5$; $-2x^3 - 3x^2 + x$; $x^3 - 2x^2 + 3x + 3$

**3** Work through the following steps to subtract $3x^2 + 4x - 5$ from $2x^2 + 5x - 11$.

*Solution:*
$2x^2 + 5x - 11 - (3x^2 + 4x - 5)$
$= 2x^2 + 5x - 11 - 3x^2 - 4x + 5$ (note the change in signs)
$= -x^2 + x - 6$

**4** **a** Subtract $2x^3 - 3x - 6$ from $5x^3 - 8x + 7$.
**b** Subtract $3b^2 - 5b + 4$ from $b^2 - b - 5$.
**c** From $7x - 3$, subtract $x^2 - 7x - 4$.

**5** Simplify each of the following:
**a** $-2xy + 3x - y - (5x - 6y + 7xy)$
**b** $2x^2 - x - 3 + (x^3 - 4x^2 + 5x - 7)$
**c** $3x^4 - 2x - (8x^4 - 3x^2 + 5x)$





**Notes**

- You write polynomials in ascending or descending order. The order refers to the indices of the variable(s).
  For example: $2x^3 + 7x^2 + 3x + 4$ is written in *descending* order of $x$, but
  $6 + a + 2a^4 + 7a^5$ is written in *ascending* order of $a$.
- The expression $5x^3 + 4x + 6x^2 + 3x^4$ is not written in any order.
- Remember that $x^0 = 1$, therefore $6x^0 = 6$.
- The highest index (or exponent) is the degree of the polynomial.
  For example, $6 + a + 2a^5 + 7a^5$ is a polynomial of the fifth degree in $a$.
- If the polynomial has two or more variables, then the largest sum of the indices in any term is the degree of the polynomial.
  For example; $3x^4y^2 - 5x^2y^5$ is a polynomial of the sixth degree. However, it is a fourth degree polynomial in $x$ and a third degree polynomial in $y$.

**6** Rewrite the following polynomials in ascending order of $x$ and state the degree of each polynomial:
**a** $x^6 + 4x + 7 + 3x^2 + 5x^4$ **b** $2x + 6 + x^2$
**c** $x^5 + 7x^3 + 5x^4 + 2x^2$ **d** $15x^4 - 2x + 6x^2 + 14x^7 - 4$

**7** Rewrite the polynomials in number **6** in descending order of $x$.

**8** If $P = (8x^3 - 3x^4 + 5x)$ and $Q = (3x^4 - 2x)$:
**a** write P and Q in ascending order of $x$
**b** calculate P + Q
**c** calculate P − Q
**d** calculate Q − P.
**e** Do number **8c** and **8d** give the same result? Give a reason for your answer.

**9** If $A = (9x^3 - 3x^2 + 5)$; $B = 4x^2 - 2x$ and $C = 6x$, calculate the following:
**a** (A + B) + C **b** A + (B + C) **c** (A − B) − C **d** A − (B − C).

**10** **a** Do number **9a** and **9b** give the same result? Give a reason for your answer
**b** Do number **9c** and **9d** give the same result? Give a reason for your answer.

**Reminders**

- Polynomials are expressions made up of one or more terms.
  The indices of the variables are positive whole numbers.
- Polynomials are usually arranged in *ascending* or *descending* order.
- You add or subtract polynomials by adding or subtracting the *like* terms.
- Because addition is commutative and associative, it does not matter in which order you *add* two or more polynomials and with which ones you start.
- However, you cannot change around the order in which you subtract one polynomial from another.

**Words** polynomial monomial binomial trinomial



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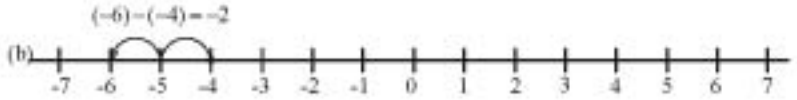
## Grade 8 Work with integers

1.

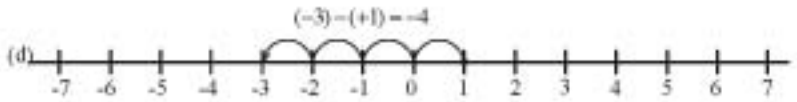
(a) $(+6)-(+4)=+2$

(b) $(-6)-(-4)=-2$



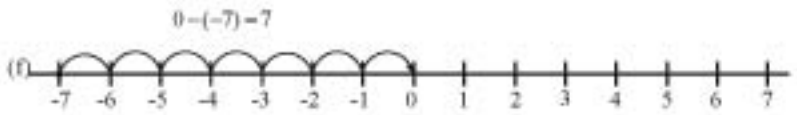

(c) $(+3)-(-2)=+5$

(d) $(-3)-(+1)=-4$




(e) $(+2)-(+7)=-5$

(f) $0-(-7)=7$




3.
(a) 4 (b) −4 (c) −3 (d) 2

5.
(a) 10 (b) −8 (c) 8 (d) −8 (e) −100 (f) 100

7.
(a)

| Column 1 | Column 2 |
|---|---|
| $(+3)\times(+4)=+12$ | $(+3)\times(-4)=-12$ |
| $(+2)\times(+4)=+8$ | $(+2)\times(-4)=-8$ |
| $(+1)\times(+4)=+4$ | $(+1)\times(-4)=-4$ |
| $0\times(+4)=0$ | $0\times(-4)=0$ |
| $(-1)\times(+4)=-4$ | |
| $(-2)\times(+4)=-8$ | |
| $(-3)\times(+4)=-12$ | |

(b) Subtract the previous answer by 4. (Decreasing multiples of 4)

(c) Add 4 to the previous answer. (Increasing multiples of 4)

(e) Yes.

8.
(a) −60 (b) −56 (c) −7,5 (d) 105 (e) 60 (f) −9
(g) 0 (h) 1

## Grade 8 Work with integers and exponents

1.
(a) −7 (b) −9 (c) 8 (d) 5 (e) −4 (f) 12
(g) −3 (h) $109\frac{1}{2}$ (i) 10

2.
(a) $4^2$ (b) $2^3$ (c) $1^7$ (d) $(-5)^4$ (e) $(0,5)^3$ (f) $10^7$
(g) $\left(-\frac{1}{2}\right)^3$

3.
(a) $8\times 8=64$ (b) $2\times2\times2\times2\times2\times2=64$ (c) $5\times5\times5=125$
(d) $3\times3\times3\times3=81$ (e) $(-8)\times(-8)=64$
(f) $(-2)\times(-2)\times(-2)=-8$
(g) $(-1)\times(-1)\times(-1)\times(-1)\times(-1)\times(-1)\times(-1)\times(-1)=-1$
(h) $\left(\frac{1}{2}\right)\times\left(\frac{1}{2}\right)\times\left(\frac{1}{2}\right)=\frac{1}{8}$

4.
(a) $\sqrt{16}=\sqrt{4\times4}=4$ (b) $\sqrt{25}=\sqrt{5\times5}=5$ (c) $\sqrt{64}=\sqrt{8\times8}=8$
(d) $\sqrt{100}=\sqrt{10\times10}=10$ (e) $\sqrt{10000}=\sqrt{100\times100}=100$
(f) $\sqrt{\frac{1}{4}}=\sqrt{\frac{1}{2}\times\frac{1}{2}}=\frac{1}{2}$ (g) $\sqrt{\frac{4}{9}}=\sqrt{\frac{2}{3}\times\frac{2}{3}}=\frac{2}{3}$



(h) $\sqrt{1,44}=\sqrt{\frac{144}{100}}=\sqrt{\frac{12}{10}\times\frac{12}{10}}=\frac{12}{10}$

5.
(a) $\sqrt[3]{1}=\sqrt[3]{1^3}=1$ (b) $\sqrt[3]{27}=\sqrt[3]{3^3}=3$
(c) $\sqrt[3]{125}=\sqrt[3]{5^3}=5$ (d) $\sqrt[3]{1000}=\sqrt[3]{10^3}=10$
(e) $\sqrt[3]{1\,000\,000}=\sqrt[3]{100^3}=100$ (f) $\sqrt[3]{-27}=\sqrt[3]{(-3)^3}=-3$
(g) $\sqrt[3]{-1}=\sqrt[3]{(-1)^3}=-1$ (h) $\sqrt[3]{\frac{1}{8}}=\sqrt[3]{\left(\frac{1}{2}\right)^3}=\frac{1}{2}$

6.
(a) 1,73 (b) 3,16 (c) 3,87 (d) 13
(e) 31,62 (f) 1,5 (g) 0,1
(h) "error" (this is not a real number)

7.
(a) 38 (b) 585 (c) 69

8.
(a) 35 (b) −16 (c) 0

## Grade 8 Work with flow diagrams

2. $a=153$ $b=160$ $c=167$ $d=174$

3.
(a) $a=20$ $b=25$ $c=109$ $d=234$ $e=359$
$f=609$ $g=734$

4.
(b) Complicates calculations (number may not be divisible by the divisor)

## Grade 8 Work with input and output values in tables

1.
(a) $a=0$ $b=11$ $x=17$ $y=5$

(b)

| Input | 7 | 10 | 21 | 17 | 5 |
|---|---|---|---|---|---|
| Rule | −10 | −10 | −10 | −10 | −10 |
| Output | −3 | 0 | 11 | 7 | −5 |



2.

| Depth of coal deposit in metres | 2 m | 5 m | s = 6 m | 25 m |
|---|---|---|---|---|
| Conversion | ×100 | ×100 | ×100 | ×100 |
| Depth of coal deposit in centimetres | $p=200$ cm | $p=200$ cm | 600 cm | $r=2500$ cm |

4.

| n | 1 | 2 | 3 | 4 | 5 | 10 | 20 | 50 | 100 |
|---|---|---|---|---|---|---|---|---|---|
| 3n + 4 | 7 | 10 | 13 | 16 | **19** | **34** | **64** | **154** | **304** |

5.

| n | 1 | 2 | 3 | **4** | **5** | **10** | **15** | **20** | **25** |
|---|---|---|---|---|---|---|---|---|---|
| 3n + 1 | 4 | 7 | 10 | 13 | 16 | 31 | 46 | 61 | 76 |

6.(a)

| n | 1 | 2 | 3 | 4 | 5 | 10 | 15 | 20 |
|---|---|---|---|---|---|---|---|---|
| 7n + 6 | **13** | **20** | **27** | **34** | **41** | **76** | **111** | **146** |

(b) (i) If output = 48 then input(n) = 6
(ii) If output = 62 then input(n) = 8

## Grade 9 Working with word problems and equations

1.
(a) $x=9$ (b) $x=6$ (c) $x=3$ (d) $x=3$
(e) $x=4$ (f) $x=5$

2.
(a) $t-8=14$ (b) $23+2t=31$ (c) $t+12=5$ (d) $6t-7=35$
(e) wine glasses = $t$ ∴ beer glasses = $2t$ and the equation is: $t+2t=90$
(f) $1,50t+10=16$

3.
(a) $t=22$ (b) $t=4$ (c) $t=-17$ (d) $t=7$
(e) $t=30$ (f) $t=4$

4.
(a) Number of marbles in each bag = $x$ ∴ the equation is: $2x-4=14$
(b) $x=9$ (Number of marbles in each bag is 9)

5.
(a) Perimeter of rectangle = $2l+2b$
∴ the equation is: $2(4a-5)+2(a+5)=40$
(b) $8a-10+2a+10=40$



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$\therefore 10a = 40$
$\therefore a = 4$

(c) Length $= 4(4) - 5 = 11$

## Grade 9 Solve equations

2.
(a) $y = 3$ (b) $x = -10$ (c) $p = 12$ (d) $x = -2$
(e) $x = \frac{1}{2}$ (f) $a = 5$ (g) $x = 2$ (h) $x = 3$
(i) $x = 4$

3.
(a) $x = 8$ (b) $x = -2$ (c) $x = -3$ (d) $x = 1$
(e) $x = -1$ (f) $x = 2$ (g) $x = -4$ (h) $x = 5$
(i) $x = 2$ (j) $x = 3$ (k) $y = \frac{23}{12}$ (l) $a = 9$
(m) $a = -\frac{5}{4}$ (n) $x = 4$ (o) $x = \frac{1}{2}$

## Grade 9 Work with more complicated equations

1.
(a) $8m - 2$ (b) $3x + 2$ (c) $2b - 3$ (d) $19a - 9$
(e) $-13x + 10$ (f) $17x - 24$

2.
(a) $x = 1$ (b) $b = -10$ (c) $x = -2$ (d) $y = 3$
(e) $x = -11$ (f) $x = 4$

3.
(a) $b = 6$ (b) $a = -1$ (c) $x = 2$ (d) $x = 20$
(e) $a = 6$ (f) $b = 4$

4.
(a) $x = -\frac{15}{2}$ or $-7\frac{1}{2}$ (b) $x = \frac{1}{15}$ (c) $w = \frac{4}{3}$
(d) $x = 0$ (e) $m = 44$ (f) $x = -14$ (g) $b = -12$
(h) $a = 8$ (i) $x = 0$

## Grade 9 Work with expressions

1. The terms are to be counted in it is original form not after the simplification of the expression.
(a) 3 (b) 1 (c) 2 (d) 2 (e) 1 (f) 2

2. When one determines the coefficient of a variable the expression must be simplified (expanded).



(a) 5 (b) $-7$ (c) $-1$ (d) $\frac{1}{5}$ (e) $\frac{1}{3}$ (f) $\frac{3}{2}$

3.
(a) $5x + 21$ (b) $8x + 6$ (c) $5x + 7xy - 5y$
(d) $b + 2a$ (e) $-a^2 + a + 4ab$ (f) $-3ac - 8ab - 10$
(g) $-p - 5q$ (h) $2b^3 + 2b - 5$ (i) $-4p + 2pq - 5q$
(j) $2x^2y + 3xy^2$ (k) $2x^2 - 9x - 13$ (l) $12y - 2xy + 4x$

4.
(a) (i) 5 (ii) 12 (b) (i) 11 (ii) $7\frac{1}{4}$
(c) (i) $-9$ (ii) $-9$ (d) (i) 17 (ii) 25
(e) 9 (f) 4

## Grade 9 Work with the addition and subtraction of polynomials.

2.
(a) $t^3 - t^2 + 2t$ (b) $x^2 - 2x + 2$ (c) $a^2b + 2ab^2 + 6ab - 3$
(d) $-8x^3 + x - 2$

4.
(a) $3x^3 - 5x + 13$ (b) $-2b^2 + 4b - 9$ (c) $-x^2 + 14x + 1$

5.
(a) $-2x - 9xy + 5y$ (b) $x^3 - 2x^2 + 4x - 10$ (c) $-5x^4 + 3x^2 - 7x$

6.
(a) $7 + 4x + 3x^2 + 5x^4 + x^6$ Degree: 6
(b) $6 + 2x + x^2$ Degree: 2
(c) $2x^2 + 7x^3 + 5x^4 + x^5$ Degree: 5
(d) $-4 - 2x + 6x^2 + 15x^4 + 14x^7$ Degree: 7

7.
(a) $x^6 + 5x^4 + 3x^2 + 4x + 7$ (b) $x^2 + 2x + 6$
(c) $x^3 + 5x^4 + 7x^5 + 2x^2$ (d) $14x^7 + 15x^4 + 6x^2 - 2x - 4$

8.
(a) $P = 5x + 8x^2 - 3x^4$ and $Q = -2x + 3x^4$
(b) $8x^2 + 3x$ (c) $-6x^4 + 8x^2 + 7x$ (d) $6x^4 - 8x^2 - 7x$
(e) No. Order is important when subtracting expressions. (Commutative law doesn't hold for subtraction)

9.
(a) $9x^3 + x^2 + 4x + 5$ (b) $9x^3 + x^2 + 4x + 5$ (c) $9x^3 - 7x^2 - 4x + 5$
(d) $9x^3 + x^2 + 8x + 5$

10. (a) Yes. Order doesn't matter when adding two or three expressions.
(b) No. Order is important when subtracting expressions.