STUDY *mate*

learning channel

Department of Education

GRADES 8–11 ISSUE 2 JULY 2007

Learning activities for Grades 8–11

Content

Education Minister Naledi Pandor

If you do not use this supplement, please pass it onto someone who may need it.

PH Setting Tel: (011) 616-0744

Mathematical Literacy

MATHS LITERACY PAPER GRADES 8 – 10

QUESTION 1

TABLE 1 below shows a summary of the water accounts for Mr DG Moletsane for a period of eight months. The first 5,6 kilolitres (kℓ) used for each month, is free. (Remember that 1 000 litres = 1 kℓ.)

TABLE 1: Mr DG Moletsane's water account for a period of eight months

Month	Total kilolitres used	Kilolitres free	Kilolitres to be paid for	Cost of each kilolitre (RANDS)	Amount due (RANDS)
August	22,0	5,6	16,4	4,57	75,95
September	28,0	5,6	22,4	4,57	102,37
October	23,5	5,6	17,9	4,57	81,80
November	20,6	5,6	15	4,57	68,5
December	27,9	5,6	22.3	4,57	101,91
January	25,10	5,6	(QUESTION 1.4.1)	4,57	89,12
February	24,6	5,6	19	4,57	(QUESTION 1.4.2)
March	(QUESTION 1.4.4)	5,6	(QUESTION 1.4.3)	4,57	98,70

1.1 How many litres of water were consumed in September? (1)

1.2 What is the highest amount that Mr Moletsane had paid for water used? (1)

1.3 In which month did Mr Moletsane pay the least for water used? (1)

1.4 Now complete the outstanding values for the table above. Write down the question numbers (1.4.1 to 1.4.4) and show ALL calculations next to it. (7)

1.5 The water usage for August was 22 kℓ and for September it was 28 kℓ.

Calculate the percentage increase for the total number of kilolitres (kℓ) of water used for August and September. (3)

1.6 Calculate the total amount paid by Mr Moletsane for water from August to January.

The interest rate for value added tax (VAT) is currently 14%. (2)

Calculate the VAT payable on the amount calculated in QUESTION 1.6. (3)

1.7 Assume that Mr Moletsane did not pay his account for September.(Municipal accounts are to be paid on the last day of every month.)

If Mr Moletsane only pays this amount at the end of five months, calculate the interest that is payable on this amount (excluding VAT) IF:

1.7.1 The municipal charges 12% per annum interest compounded monthly (4)

1.7.2 The municipal charges 12% per annum simple interest (3)

1.7.3 Explain which of compound interest or simple interest you expect to be higher and give a reason for your answer. (2)

[27]

Answers

QUESTION	SOLUTION(S)	COMMENTS
1.1	28 kl ✓	✓Answer
1.2	R102,37 ✓	✓Answer
1.3	November ✓	✓Answer
1.4.1	19,5 kl ✓	✓Answer
1.4.2	$19 \times$ R4,57 ✓ =R86,83 ✓	✓Method(product) ✓Answer
1.4.3	R98,70 ÷R4,57 ✓ = 21,60 ✓	✓ Method(quotient) ✓Answer
1.4.4	21,60 + 5,6 ✓ = 27,2 kl ✓	✓ Method(sum) ✓Answer
1.5	Increase = 28kl – 22kl = 6 kl ✓ Percentage increase = 6/ 22 × 100 ✓ = 27,27 % ✓	✓ Calculating increase ✓Method(fraction) ✓ Correct answer
1.6	R74, 95 + R102,37 + R81,80 + R 68,55 + R101,91 + R89,12 = R518,70 ✓✓	✓✓ 2 marks for the correct answer or zero marks
1.7	✓ ✓ VAT= 14/100 ×R518 ,70 = R72,62 ✓	✓ VAT % ✓ substituting R518,70 ✓ Correct answer
1.7.1	$A = P(1 + r/100)^n$ ✓ $= R102,37(1 + 1/100)^5$ ✓ = R 107,59 ✓ C.I = R107,59 – R 102,37 = R5,22 ✓	✓ Formula ✓ Substitution ✓ Correct answer ✓ Calculating the interest
1.7.2	S.I = P × r/100 × n ✓ = R102,37 × 1/100 × 5 ✓ = R5,12 ✓	✓Formula ✓ Substitution ✓ Correct answer
1.7.3	Compound Interest is higher✓ Interest is paid on interest and not only on capital amount as is the case with simple interest ✓	✓ Correct answer ✓ Explanation

English Lesson Notes

Studying Poems

LESSON 5

Intention, Message and Comparisons

When you study poetry at school, you are often asked to identify the poet's intention and his or her message to the reader. In addition, you must identify and explain the effect of figures of speech (imagery) that are used to convey meaning. In this lesson we define these aspects of poetry and we consider examples taken from modern and traditional poetry as well as modern song lyrics.

Lesson notes

Poet's intention: the presumed reasons why a poet has written a poem.
Message: what the poet is trying to tell us in the poem. The message is the deeper meaning which we remember after we have finished reading the poem.
Figurative Language: Words and language are used to extend their meaning beyond the everyday, and create more than surface meaning. They often add meaning by comparing or contrasting two different elements.

Here are two very different examples of poetry.

Lyrics from "Cleaning out my Closet" by Eminem
I'm sorry mama
I never meant to hurt you
I never meant to make you cry
But tonight, I'm cleaning out my closet…

Message:
In this song, Eminem writes about his childhood experiences. He wants to tell us his belief that his mother is not a good parent to him. In this extract, his message is that he does not want to hurt his mother with what he is about to reveal, but he does want the truth to come out.

Intention:
Eminem's intention may have been to hurt his mother, purge his conscience, or appeal to the youth. He could also be writing to point out how parents sometimes fail in their duty to their children. It is difficult to guess exactly what a poet's intention for creating a text was.

Figurative language used:
This line "cleaning out my closet" could have both a figurative and literal interpretation. Literally it means to clear the junk out of your cupboards but figuratively it means to expose something, or to move away from the (possibly unpleasant or upsetting) experiences of the past.

Extract from "How do I love thee" by Elizabeth Barrett Browning
How do I love thee? Let me count the ways.
I love thee to the depth and breadth and height
My soul can reach …

Message:
This message is written to the poet's lover. She wants him to know that she loves him as much as it is possible to love.

Intention:
She wants to express the extent and power of her love for the recipient.

Figurative language used:
The poet compares the extent of her love to the infinite reach of her soul. This comparison emphasises the extent of her love, as it is infinite just like the "depth and breadth and height my soul can reach".

TASK

- Examine the following stanza.

Extract from the poem "The Birth of Shaka" by Oswald Mtshali
His baby cry
Was of a cub
Tearing the neck
Of the lioness
Because he was fatherless

- What are the poet's intention and message in this poem?
- What comparative figures of speech have been used? Explain what is being compared and how the words add meaning to the poem.

English Lesson Notes

Studying Poems

LESSON 6

Style, Tone and Atmosphere

Understanding the concepts of style, tone and atmosphere will help you when studying poetry and other forms of literature. In this lesson we consider various features of a poem by Mogane Wally Serote to see how style and tone and atmosphere are conveyed.

Lesson notes

Style refers to the manner or way a writer expresses meaning in language – how a writer says what he/she says.

The tone of a writer is his/her emotional attitude, contained within the words he/she writes.

Tone can be determined by:

- considering the poet's message
- imagining how the line would be read aloud
- determining the poet's attitude towards his subject matter.

Atmosphere or mood create the reader's expectation of 'what is going to happen'.
If you are trying to determine the mood or atmosphere of a poem think about the feeling that you as the reader get about what is going to happen next in the poem. You should describe the mood or atmosphere of a poem in terms of emotions.

An example:

"A Poem" by Mongane Wally Serote
Everyone of us
Throbs footsteps inside the chest of the earth
For we belong there.
The earth is always tight-lipped
But only talks to itself
Perturbed by its throbs.
Each of us will answer
When the worms dig in and out of us for the truth,
Below the earth.

Structure:

- This poem is an example of free verse poetry. There are no rhyming words and the lines are of different lengths, which creates a free rhythm.
- The structure of the poem is simple. There are three stanzas consisting of three lines each.
- Enjambment has been used to ensure that the three lines flows into one sentence per stanza.

Content:

- Serote's message is that we cannot hide the actions of our lives and that eventually we will have to answer for what we do.
- The first stanza introduces the idea that we all belong in the earth. The second stanza clarifies this statement and the final stanza leaves the reader to consider his present and future position in the light of the message of the poem.

Style:

- The poet has used everyday language. Words such as "everyone" and expressions such as "tight-lipped" are used in conversations by us all.
- The sentences are not overly complicated and they make up one qualified statement each. For example, the idea that is conveyed in the first stanza is that we all have a part in the earth.

Tone:

- The tone of this poem is one of WARNING – Serote is advising the reader to take care with the way we live our lives, so that the truth of our lives is acceptable, when it is exposed publicly and "each of us will answer".
- The tone is uncomfortable to the reader. For example, the line "worms dig in and out of us for the truth" describes the fate of people.

Atmosphere:

- The atmosphere is foreboding. You are encouraged to think about your actions and are warned about the price of wrongdoing.

TASK

- Identify and describe the atmosphere of these two lines of poetry.
  The trees are in their autumn beauty,
  The woodland paths are dry,
- Which words does the poet use to convey the atmosphere?

English Lesson Notes LESSON 7

Studying Poems

Analysing Poems

In this lesson we analyse a South African poem focusing on techniques that we have learnt. Pay attention to how the analysis has been worded – this is how you should word your answers in poetry tests and exams.

Lesson notes

Extract from "Paradise" by Achmat Dangor

Oh paradise, cool paradise
of Africa,
what memories you recreate.

Oh why, why do you
tighten the chains?

Style:

- His style is informal, and the language he uses is uncomplicated and direct. He asks a rhetorical question ("why do you tighten the chains") and uses apostrophe to address Africa as if it were a person – adding to the informality of the poem.

Figurative language:

- Dangor is speaking directly to Africa – this figure of speech is called apostrophe. He asks Africa "Why do you tighten the chains?". This is an example of a rhetorical question – the poet is asking this question for effect, he doesn't expect an answer. By using these devices, Dangor's close relationship with Africa is highlighted.
- Dangor uses a metaphor in the line "Tighten the chains". The poet compares the feeling of chains being tightened, to difficult circumstances in his life. In this poem, "chains" symbolise oppression.

Structure:

- There are two stanzas, one with three lines, and the other with two. This is significant because in the first stanza the poet is praising Africa, whilst in the second he is asking a difficult question. The structure of the poem helps to highlight the poet's conflicting feelings about Africa.
- Dangor has emphasised his love for Africa by repeating "paradise" and he strengthened the hurt and despairing tone, by repeating the questioning word: "why".

Tone:

- The tone of Dangor's poem is despairing and questioning (emphasised by the rhetorical questions) – he is trying to understand why Africa and his society treat him so harshly – "tighten the chains".

Context:

- This poem was written during the Apartheid Era and its intention is to criticise the policies of racial segregation of the government of the time.
- We can work this out from the poet mentioning that Africa is a paradise, but that oppression or "chains" that are being "tighten(ed)" mar it.

Intention and Message

- We can imagine that the poet's intention is to criticise Africa (or some African people) and encourage change.
- The poet's message is to encourage the reader to realise the injustice of the society. His message is one of protest against injustice.

TASK

- Examine this poem that was also written by a South African poet.

  "Learning" by Modikwe Dikobe

  Learning has no limitations
  Last year I made mistakes
  The previous year I blundered
  This year I shall do better.

  In the Garden of Eden
  I learnt to make fire
  Clothe myself
  And have children.

  The world is boundless
  Each one of us
  Can contribute
  Provided
  We pluck off
  Complexes, fear and mistrust.

- Analyse it in a similar way to the poem by Achmat Dangor. Remember to say what devices the poet has used to communicate his message and create the desired effect. Be guided by the sub-headings used to analyse Dangor's poem.

English Lesson Notes LESSON 8

Studying Poems

Lesson notes

Here are some questions that are often asked about answering questions on poetry and writing poems of your own.

Can I give my own opinions about a poem?

Learners think that teachers won't allow them to interpret the meaning of poems. The belief is that teachers will not accept anything other than their own ideas about the meaning of poems. This is not the case – providing of course that your interpretation is reasonable and well phrased!

What techniques should I use to get the best possible marks?

- Use poetry terminology wherever possible to refer to different poetic devices and techniques.

For example, refer to metaphors, similes, personification etc.

- Provide reasoning and proof for claims

For example, quote lines or words from the poems that provide evidence for what you are saying.

- Refer to the actual meaning of words and the meaning in context

Consider the meanings of the words used and how they relate to the context of the poem as a whole. This will help you to distinguish between literal and figurative language.

- Refer to poetic techniques in answers

Be on the lookout for how meaning is conveyed by poetic techniques such as rhythm, rhyme scheme and figurative language and refer to these in your answer.

Lesson 3: Intention, Message and Comparisons

The poet's intention and message:

The poet's message is to tell us what Shaka was like as a child and his intention may be to show us how, like a lion cub, Shaka succeeded despite being illegitimate.

Comparative figures of speech:

A metaphor is used to compare Shaka's "baby cry" to the sound a lion cub makes whilst tearing his at mother's throat. It's as though the baby and the cub become the same thing - the cry of the baby is exactly the same as the sound of the lion cub. Because of this metaphor, the ferocious qualities of the lion cub are transferred onto the baby. The strength and ferocity of the lion reflect or mirror the description of the baby and his strong, ferocious cry, blaming his mother for his lack of a father.

or atmosphere because a scene of "autumn beauty" is described. A sense of anticipation is also created as we wonder what is about to happen in this setting of dry "woodland paths".

Lesson 7: Analysing Poems

Here is an analysis of the poem "Learning" by Modikwe Dikobe. Your analysis may differ from this one. Note the style of the analysis and the type of information that is included.

Modikwe's opening claim is optimistic and positive – he claims there are "no limitations". The next few lines explain how he has made mistakes, even big ones, but by the last line of the first stanza, the positive emotions emerge again when he writes, "This year I shall do better". The second stanza deals with the poet's idea of how human history has evolved, and then he makes a very optimistic statement to open the third stanza. At the end of the poem, he expresses his hope that we can all change if we will: "Pluck off complexes, fear and mistrust".

Modikwe uses a number of effective words and phrases. "Blundered" is a word to emphasise how stupid a mistake was. So Modikwe, in one word manages to point out that the errors he, and the whole of humanity, make, are really silly and unacceptable. The words "pluck off" seem to imply the violent, decisive action we should all take to get rid of our complexes, fears and mistrust.

The symbol of the Garden of Eden comes out of the Christian, Islamic and Jewish religions, and represents idyllic happiness in the very beginnings of humans and human societies. By using this symbol, Modikwe can explain that his poem is about himself, but also about all of humanity.

Modikwe conveys a hopeful mood that if we can all pluck off complexes, fear and mistrust, the world could become a far better place. The mood he creates is one of optimism and hope for the future – "boundless". Modikwe gives us this positive message: He is saying that it is possible that each one of us can contribute, to making the world a better place. His intention is to encourage us to keep learning and understanding our world.

This poem follows a free-verse structure. No words rhyme but the poem is divided into three stanzas. The first stanza refers to the poet's mistakes and how human he is. The second stanza refers to his history, and how he (or mankind) lived life in simplicity and contentment. The third suggests that we can all revert to that state of happiness, and how to achieve it.

Physical Sciences Lesson Notes LESSON 5

Motion in One Dimension

Acceleration – Decreasing Velocity

The lesson begins by recapping what acceleration is, and by providing the answers to the previous lesson's task. When something slows down, its velocity changes. The object is accelerating in the opposite direction when it slows down. This lesson focuses on calculating the acceleration of objects as they slow down.

Lesson Notes

Problem: A motorbike, travelling forwards at an initial velocity of 20 m.s^{-1}, comes to rest in 4 s. What is its acceleration?

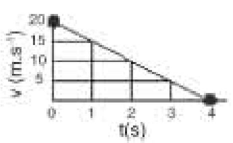
$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time}}$$
$$= \frac{\text{(final velocity - initial velocity)}}{\text{time}}$$
$$= \frac{(0 - 20)\ \text{m.s}^{-1}}{4\ \text{s}}$$
$$= -5\ \text{m.s}^{-2}$$

What does this negative value of acceleration mean?

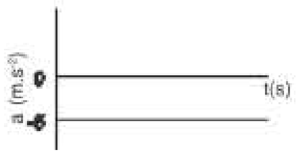
The motorbike travels forwards, slowing down to a stop. The forwards direction is taken as positive. Our calculation gives the acceleration a negative value so it must be acting in the opposite direction i.e. backwards.

So the answer to this problem is:
acceleration = 5 m.s^{-2} backwards.
A graph of velocity-time when the motorbike slows down will still show a straight line graph.

Velocity - time graph of motorbike



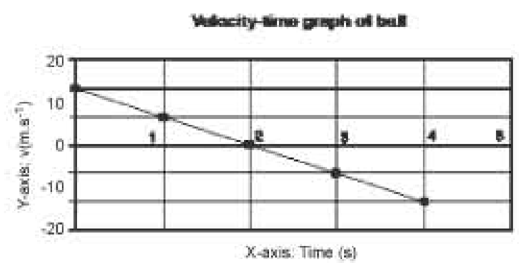
This graph will have a negative slope – the velocity is decreasing, so the graph slopes down from the left hand side to the right hand side. The negative slope of the graph shows that the acceleration is in the opposite direction to that of the initial velocity.



TASK

Draw a velocity-time graph for the motion of a ball, thrown up into the air at 20 m.s^{-1} which returns to the thrower's hand at a speed of 20 m.s^{-1} after 4 s.

Answer



Physical Sciences Lesson Notes LESSON 6

Motion in One Dimension

Arrive Alive!

All motor vehicles should comply with basic safety regulations such as the specifications for their brakes, steering systems and tyres. This lesson takes physics into the work place and finds out how a traffic officer investigates what happened during a motor vehicle accident.

Lesson Notes

The death toll on our roads increases dramatically during peak holiday seasons. What are some of the causes of these road accidents?

Faulty brakes, faulty steering systems and smooth tyres may cause cars to skid out of control. The skid marks made by a car on the road can help us calculate the speed of the car before the brakes were applied. We can also see if a car pulled to one side during braking by carefully examining the skid marks.

Most of our road accidents are caused by human error, rather than through people driving unroadworthy cars. In the accident in the video lesson, the driver braked hard to avoid hitting a pedestrian who crossed the highway in front of him. The skid marks tell us for how long the driver applied his brakes but they don't tell us about the driver's reaction time. Reaction time is the time it takes the driver to see the hazard in the road and to respond by putting his foot on the brake pedal.

In the laboratory a small group of learners set up an experiment to measure the reaction time of a driver. There was a wide range of reaction times within the group and this variation is possibly also present among drivers on South African roads. The longer the reaction time, the longer it takes for the driver to respond to a hazard ahead – and the closer the car comes to the hazard.

The initial velocity of the car can be calculated by using the equations of uniformly accelerated motion:

$$v = u + at$$
$$s = ut + \tfrac{1}{2}at^2$$
$$v^2 = u^2 + 2as$$

v	-	final velocity	(m.s^{-1})
u	-	initial velocity	(m.s^{-1})
s	-	displacement	(m)
t	-	time	(s)
a	-	acceleration	(m.s^{-2})

TASK

Some people think that the speed limit should be increased while others think that it should be decreased. Write a report in which you motivate for one of these options.

Answer

Each learner's answer will differ and some possible arguments are given below:

Increasing the speed limit:

- Modern cars are built with many advanced safety features and have been designed to go faster than 120 km/h.
- Modern highways are constructed to transport cars at high speed.
- Travelling at higher speed will reduce driver fatigue, a major cause of accidents.
- In Germany there is no speed limit on the Autobahn.
- Increased speed limits will increase the skill of drivers.

Decreasing the speed limit:

- o At decreased speeds, a car will be able to stop sooner during the driver's reaction time – more chance of avoiding hazards in front of the car.
- o Fuel consumption will be improved and cars will cost less to run. This will have a positive spin-off for taxi drivers and motorists who have to go on long trips.

Physical Sciences Grade 10 Lesson Notes LESSON 7

Gravity and Mechanical Energy

Why on Earth do Things Fall?

Do heavier objects fall faster than lighter ones? Going back into history we find that many famous scientists and philosophers have carefully considered why things fall, and what affects them as they fall. To check out their theories we design an experiment to drop a number of balls from a height, and we analyse experimental data of the rate at which the balls falls.

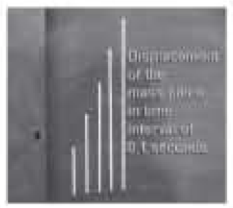
Lesson Notes

What variables should we take into account when finding the rate at which balls of different mass fall from a height? The type of variables we can get are independent variables, dependent variables and variables that need to be controlled.

Remember that we must make this a fair test.

Description of variable	Type of variable

A ticker tape is attached to a ball to analyse its motion as it falls.



The tape shows the displacement of the ball after equal time intervals, and when we paste segments of the tape next to each other we find that there is a constant increase in displacement in each time interval. This means that there is a constant increase in the velocity of the ball, and therefore it accelerates uniformly.

Any two particles in the universe exert gravitational forces of attraction on each other. Gravitational forces act through a distance. The gravitational acceleration on earth is 9,81 $m.s^{-2}$ (approximately 10 $m.s^{-2}$) and on the moon it is 1,6 $m.s^{-2}$.

TASK

Motion Photo

A photograph was taken to show the position of an object falling on a planet out in space. The photograph showed the positions of the object at 0,1 s intervals, and all these positions were superimposed on one another to make a 'multi-exposure' photograph. Use the table of values below to find the magnitude of the acceleration due to gravity (g) on this planet. You may use calculations or use a graph to communicate your results to others.

Time (s)	Position (m)
0,0	0,00
0,1	0,05
0,2	0,20
0,3	0,44
0,4	0,78

Physical Sciences Grade 10 Lesson Notes LESSON 8

Gravity and Mechanical Energy

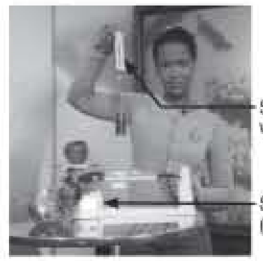
Mass and Weight

This lesson focuses on the difference between the mass and weight of objects, and we find out how these quantities are measured. We also find out what happens to mass and weight when an object is taken to a planet with a different gravitational field to that of the earth.

Lesson Notes

Everything around us has mass and it also has weight.

Weight is the force due to gravity exerted on an object. It is a vector quantity, because it has both magnitude and direction. Weight is measured in newtons (N) using a spring balance.



Mass is the quantity of matter in a body. It is a scalar quantity that is measured in kilograms (kg). Mass can be compared using a balance.

But what is the relationship between weight and mass? Weight is dependent on the mass of an object. We say that the larger the mass of an object, the greater the weight of the object. Weight is directly proportional to the mass of an object.

Weight is also dependent on the acceleration due to gravity and it is directly proportional to the acceleration due to gravity. On earth the acceleration due to gravity is 10 $m.s^{-2}$ downwards but on the moon the acceleration due to gravity is only 1,6 $m.s^{-2}$ downwards. The weight of an object on the moon will be one sixth of its weight on earth.

We can summarise these relationships using this equation:

Weight = mass x acceleration due to gravity

Weight = m x g

Remember, your mass doesn't change when you change position, like traveling to another planet, but your weight does.

Most scales on earth operate using springs to measure weight. The force exerted is converted to a mass reading we see on the scale because gravity on earth is taken to be consatant.

TASK

An astronaut uses a special moon scale to find the weight of some rocks. He finds they have a weight of 480 N downwards when they are weighed on the moon. Find the mass of these rocks and their weight on earth.

g_{moon} = 1,6 $m.s^{-2}$ g_{earth} = 10 $m.s^{-2}$

Answer

Weight on moon = mg_{moon}

480 N = m (1,6 $m.s^{-2}$)

m = $\frac{480}{1,6}$

= 300 kg

Weight on earth = mg_{earth}

= (300 kg)(10$m.s^{-2}$)

= 3000 N

Mathematics Lesson Notes

Algebraic Fractions — Lesson 5

Simplification of fractions by using factorisation

In this lesson we revise how to factorise trinomials in algebraic fractions enabling us to simplify the fractions.

Lesson notes

- In this lesson we learn how to factorise a trinomial without using a diagram.
- Let's work through an example.
  Factorise $x^2 + 9x + 14$.
  Which two numbers, when multiplied together, give +14? Those same numbers must have a sum of +9.
  This is how we write the answer:
  - Multiply two pairs of brackets: ( )( )
  - In the given expression there is an x squared, so write an x in each pair of brackets: $(x\ \ )(x\ \ )$.
  - Now write in the factors of 14, which are +2 and +7:
    $(x + 2)(x + 7)$.
- Here is another example. Factorise:
  $x^2 - 9x + 14$.
  This is similar to the previous example, except that there is a **negative** $9x$. So we need to think, which two numbers multiplied together give positive 14? The same numbers must have a sum of negative 9.
  Did you think of –2 and –7?
  Check: $-2 \times -7 = +14$ and $-2 + (-7) = -9$.
  Now $x^2 - 9x + 14 = (x - 7)(x - 2)$.
- Now let's apply this to simplifying algebraic fractions. Simplify:

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

  Factorise both the numerator and denominator if necessary.
  The numerator is a trinomial, which is factorised as $(x + 2)(x + 1)$.

$(x + 1)$ is a common factor in the numerator and denominator, so divide by it. The answer is $(x + 2)$.

$$\frac{x^2 + 3x + 2}{x + 1}$$
$$= \frac{(x+2)(x+1)}{(x+1)}$$
$$= \frac{(x+2)\cancel{(x+1)}}{\cancel{(x+1)}}$$
$$= x + 2$$

Task

Simplify:

$$\frac{x^2(x-3) + 4(x-3)}{x^2 - x - 6}$$

Answer

$$\frac{x^2(x-3)+4(3-x)}{x^2-x-6}$$
$$= \frac{x^2(x-3)-4(x-3)}{(x-3)(x+2)}$$
$$= \frac{(x-3)(x^2-4)}{(x-3)(x+2)}$$
$$= \frac{(x^2-4)}{(x+2)}$$
$$= \frac{(x+2)(x-2)}{(x+2)}$$
$$= x - 2$$

Telkom Foundation

Mathematics Lesson Notes

Algebraic Fractions — Lesson 6

Simplification of fractions involving multiplication and changing of signs

In this lesson we learn how to rewrite a difference between numbers in an equivalent form. Then we use this method to simplify fractions easily.

Lesson notes

- Is $(a - b)$ the same as $(b - a)$? Let's use some numbers to help answer the question.

  Is (7 – 2) the same as (2 – 7)?
  7 – 2 = 5 and 2 – 7 = – 5. So they are not the same.

  Notice that the difference between the two expressions is in the order of the terms and the signs.

  Let's see how we can rewrite the expression so it looks the same.

  We use a very simple idea: **5 = – (– 5)**
  Let's do the same with 7 – 2:
  7 – 2 = – (–7 + 2) = –(2 – 7)

  So, we can swap the order of the numbers in (7 – 2) and change the sign in front of the brackets and the two numbers are equivalent: (7 – 2) = –(2 – 7).

  This means that by changing the order of the terms and changing the sign in front of the brackets, we have made the numbers in brackets look similar without changing their value!

- Let's apply this to algebra. So we can write $(a - b)$ as $-(b - a)$

- Now work through this example to see how this helps us to factorise.
  Factorise: $2p(a - b) - q(b - a)$

  The terms in the two pairs of brackets are similar but not the same.
  We use this result to make a common factor in this expression.

  Write $(b - a)$ as $-(a - b)$.
  Be careful of the minus signs. You now have $-q$ multiplied by $-(a - b)$.

  So $2p(a - b) - q(b - a) = 2p(a - b) + q(a - b)$

  Now we can identify the common factor.
  A whole term in brackets is common:

  $2p(a - b) + q(a - b)$.

  The factorised answer is $(a - b)(2p + q)$.

- Remember that you can multiply out the answer to make sure that it is the same as the given expression.

Task

Simplify: $\dfrac{a^2 - 4a + 4}{3a + 3} \times \dfrac{1 - a^2}{4 - 2a}$

Answer

$$\frac{a^2-4a+4}{3a+3} \times \frac{1-a^2}{4-2a}$$
$$= \frac{(a-2)(a-2)}{3(a+1)} \times \frac{(1-a)(1+a)}{2(2-a)}$$
$$= \frac{(a-2)(a-2)}{3} \times \frac{(1-a)}{-2(a-2)}$$
$$= \frac{(a-2)}{3} \times \frac{(1-a)}{-2}$$
$$= -\frac{(a-2)(1-a)}{6}$$

Mathematics Lesson Notes Lesson 7

Algebraic Fractions

Finding the Lowest Common Multiple

In this lesson we revise finding the lowest common multiple (LCM) of numbers. We apply this knowledge and find the LCM of algebraic expressions.

Lesson notes

- Let's look at an example involving numbers first.
  If we need to add $\frac{3}{5}$ and $\frac{2}{3}$, we need to change the fractions so that they have the same denominator. We need to find the Lowest Common Multiple (LCM) of 5 and 3.
  Here are some of the multiples of 5:
  5, 10, **15**, 20, 25, **30**, …
  Here are some of the multiples of 3:
  3, 6, 9, 12, **15**, 18, 21, 24, 27, **30**,
  Then we look at which multiples are **common** to 5 and 3. They are 15, 30, 45, 60, etc.
  To find the LCM, look for the **lowest**, or smallest, common multiple, which is 15.
  15 is the smallest number that both 5 and 3 can divide into without a remainder.

- It is easier to find the LCM if we break a number into factors. For example, let's find the LCM of 5, 6 and 9.
  First factorise the numbers, using prime factors.

  $$\boxed{\begin{array}{l} 6 = 2 \times 3 \\ 5 = 5 \\ 9 = 3 \times 3 \end{array}}$$

  For the LCM, multiply the factors from each number together.
  To make sure that you find the lowest multiple, do not repeat a factor that you have already written down. But we need to repeat the 3, because 9 has **two** 3's as its factors.
  We must choose the highest power of each factor that occurs in a number. So the LCM has to include 3×3.

  So, the LCM is $2 \times 3 \times 5 \times 3 = 90$.
  Therefore 90 is the LCM of 5, 6 and 9.

- Now let's apply this to algebraic fractions. Find the LCM of $12a^2b^2$ and $18a^4bc^2$.

  Factorise the numbers using prime factors:
  $12a^2b^2 = 2 \times 2 \times 3 \times a^2 \times b^2$
  $18a^4bc^2 = 2 \times 3 \times 3 \times a^4 \times b \times c^2$

  For the LCM, use the highest power of each factor:
  LCM: $2 \times 2 \times 3 \times 3 \times a^4b^2c^2$

  So $36\,a^4b^2c^2$ is the smallest number that both $12a^2b^2$ and $18a^4bc^2$ can divide into.

Task

Find the LCM of $15x^2y$ and $12xy^2$.

Answer

$15x^2y = 3 \times 5 \times x^2y$
$12xy^2 = 2 \times 2 \times 3xy^2$
LCM $= 2 \times 2 \times 3 \times 5 \times x^2\,y^2 = 60x^2y^2$

Telkom Foundation

Mathematics Lesson Notes Lesson 8

Algebraic Fractions

Operations with Algebraic Functions

In this lesson we learn about operations with algebraic fractions including addition, subtraction, multiplication and division.

Lesson notes

What does it mean to **simplify** algebraic fractions? Let's use some examples to find out.

- Simplify: $\frac{p}{qr} + \frac{r}{pq} - \frac{q}{pr}$
  First we analyse the expression. There are '+' and '–' signs between the terms, so we are dealing with addition and subtraction of algebraic fractions.
  Find the lowest common denominator (you may have to factorise first). In this case the LCD is pqr.
  Write each fraction in an equivalent form with the new denominator: Multiply the numerator by the same number by which you multiplied the denominator:

  $$\frac{p \times p}{qr \times p} + \frac{r \times r}{pq \times r} - \frac{q \times q}{pr \times q}$$

  Add and subtract the numerators: $\frac{p^2 + r^2 - q^2}{pqr}$

- Let's do another example.

  Simplify: $\frac{p}{qr} \times \frac{r}{pq} \div \frac{q}{pr}$

  Analyse the expression. There is a × and a ÷ sign between the terms, so we are dealing with multiplication and division of algebraic fractions.
  To divide, we need to multiply by the inverse:

  $$\frac{p}{qr} \times \frac{r}{pq} \times \frac{pr}{q}$$

  Do the multiplication and simplify by cancelling the common factors. You should get the answer: $\frac{pr}{q^3}$

- Simplify: $\frac{(k-p)}{2} \times \frac{2k}{(p-k)}$
  Analyse the question. This is a simple multiplication of fractions.
  To find a common factor, **change** the **sign** of the second denominator:

  $$\frac{(k-p)}{2} \times -\frac{2k}{(k-p)}$$

  Cancel the common factors to get an answer of $-k$.

Task

Write your own notes about fractions.
Note the terms you have learned and the procedures to follow for different examples.

(No solution required here)

learning channel

ENGLISH - FAL

Lesson 2

Reading skills

Summary writing skills

Introduction

Summary writing is a very useful skill because:

- It is CRITICAL for ALL your studies;
- You use this skill EVERY DAY;
- You will use this skill FOR THE REST OF YOUR LIFE; and
- You need it for your exams!

Your syllabus says that you must be able to extract the essential points from a text and summarize it for specific purposes. This skill includes the ability to:

- Follow main arguments;
- Select relevant materials;
- Evaluate bias; and
- Identify assumptions.

Techniques for writing summaries

LC INDIVIDUAL

1. Cut out the redundant words.

   EXERCISE: At what particular point in time did you arrive at the realisation that you were wrong?

   Answer: When did you realise you were wrong?

LC INDIVIDUAL

2. Simplify roundabout wordings

   EXERCISE: In view of the fact that the evidence was indicative of the fact that he was innocent, he was acquitted.

   Answer: As the evidence proved he was innocent, he was acquitted.

LC INDIVIDUAL

3. Translate pompous, inflated words into simpler ones

   EXERCISE: Find out the location of the venue where they carry out their work.

   Answer: Find out where they work.

4. Being able to take a phrase and reduce it to ONE WORD is a VERY IMPORTANT part of writing a summary.

MATHEMATICS

Lesson 2

Algebra

Complete the square to solve problems

Lesson Overview

In this lesson you will:

- Look for patterns in square binomials;
- Learn to complete the square of quadratic binomials;
- Use this concept to find maximum or minimum values;
- Prove that expressions are positive or negative; and
- Use this concept for mathematical modelling.

Squares are useful – why?

- $(x + 2)^2$ is zero when $x = -2$ otherwise the expression is always positive.
- $(x + 2)^2 + 4$ is always positive – in fact the minimum value of the expression is 4 – this happens when $x = -2$.
- $-(x + 2)^2$ is zero when $x = -2$ otherwise it is always negative.
- $-(x + 2)^2 - 3$ is always negative.
- In fact the maximum value of the expression is –3.

Look at the following squares and find a pattern

$(x + 3)^2 = x^2 + 6x + (3)^2$; $(x - 1)^2 = x^2 - 2x + (-1)^2$; $(x + 4)^2 = x^2 + 8x + (4)^2$; $\left(x - \frac{1}{2}\right)^2 = x^2 - x + \left(-\frac{1}{2}\right)^2$

What pattern do you see?

The third term of the trinomial is "half the co-efficient of x squared".

Completing the Square

Examples

1. Write the expression by completing the square of:

   $x^2 + 4x + 2$

   Solution

   $x^2 + 4x + (2)^2 - (2)^2 + 2$(add and subtract $\left(\frac{4}{2}\right)^2$; factorise the square.

   $= (x + 2)^2 - 4 + 2 = (x + 2)^2 - 2$

   The minimum value of the expression is –2.

2. Complete the square of: $2x^2 - 3x + 6$

   Take out a common factor of 2

   $2\left(x^2 - \frac{3}{2}x + 3\right)$

   add $\left(-\frac{3}{4}\right)^2$ and subtract $\left(-\frac{3}{4}\right)^2$ in the brackets.

   $2\left[x^2 - \frac{3}{2}x + \left(-\frac{3}{4}\right)^2 - \frac{9}{16} + 3\right]$

   Factorise the square trinomial

   $2\left[\left(x - \frac{3}{4}\right)^2 - \frac{9}{16} + 3\right]$

Simplify

$2\left(x - \frac{3}{4}\right)^2 - \frac{9}{8} + 3$

$= 2\left(x - \frac{3}{4}\right)^2 + \frac{15}{8}$

Conclusions

$2\left(x - \frac{3}{4}\right)^2 + \frac{15}{8}$ tells us that the expression is always positive.

The expression has a minimum value of $\frac{15}{8}$ when $x = \frac{3}{4}$.

MATHEMATICS

3. Complete the square of :

$-x^2 + 3x + 1$

Solution

Take out a factor of –1.

$-(x^2 - 3x - 1)$

add and subtract $\left(-\frac{3}{2}\right)^2$

$= -\left[x^2 - 3x + \left(-\frac{3}{2}\right)^2 - \frac{9}{4} - 1\right]$

$= -\left[\left(x - \frac{3}{2}\right)^2 - \frac{9}{4} - 1\right]$

$= -\left(x - \frac{3}{2}\right)^2 + \frac{13}{4}$

The expression has a maximum value of $\frac{13}{4}$ when $x = \frac{3}{2}$

4. Complete the square of

$-2x^2 + 4x - 5$

Solution

$-2\left(x^2 - 2x + \frac{5}{2}\right)$

$= -2\left[x^2 - 2x + (-1)^2 - 1 + \frac{5}{2}\right]$

$= -2\left[(x - 1)^2 + \frac{3}{2}\right]$

$= -2(x - 1)^2 - 3$

- The expression has a maximum value of –3 when $x =$ 1.
- The expression is always negative.

Activities

Activity 1

What term must be added to each of the following expressions so that the expression will result in a perfect square.

1. $x^2 + 6x$ 2. $x^2 + 5x$ 3. $x^2 - 4x$ 4. $x^2 - 3x$ 5. $x^2 + \frac{1}{2}x$ 6. $x^2 - \frac{2}{3}x$

Activity 2

1. Complete the square of each of the following expressions and write the expression in the form $a(x \pm p)^2 \pm q$. Say whether the expression has a maximum or minimum value and determine the max or min value.

   a) $x^2 + 2x - 24$ b) $-x^2 - 5x - 1$ c) $-3x^2 + 6x$ d) $-2p^2 + 3p + 6$

   e) $x(x - 2) + 5$ f) $5x^2 + 4x + 3$ g) $-3x^2 - 3x - 4$ h) $2x(x + 2)$

   i) $x^2 + px + 3$ j) $ax^2 + bx + c$

2. Prove that the following quadratic expressions are always positive.

   a) $x^2 - x + 5$ b) $2x^2 - 3x + 8$ c) $10x^2 + 5x + 2$

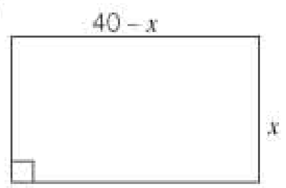
3. Prove that the following quadratic expressions are always negative.

   a) $-x^2 + 3x - 5$ b) $-4x^2 - 2x - 1$

4. Mathematical modelling

Problem solving

a)



   i) Find an expression for the area of the above rectangle.

   ii) Find the maximum area of the rectangle.

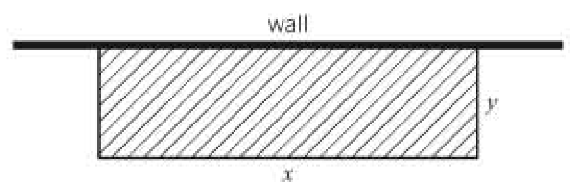
   iii) What are the dimensions of the rectangle so that the area is a maximum.

b) James intends to build a rectangular enclosure for his chickens.
He has 100m of fencing. He intends using a wall for one side of the enclosure.

   i) Make an expression for the area.

   ii) What is the maximum area?

   iii) What are the dimensions of the rectangle?



NOTE: If $a > 0$ and q is greater than 0, then the expression will always be positive.

ENGLISH - FAL

INDIVIDUAL

EXERCISE:

1. You must perform exercise on a daily basis.
2. TEMPORARY REDUCTIONS IN PRICE CURRENTLY ON OFFER!

Answers

1. Exercise daily.
2. Sale on now!
5. What other skills do you need? When you summarize, take out:
   - All the UNNECESSARY details;
   - The figures of speech;
   - The short examples; and
   - The repetitions.

INDIVIDUAL

EXERCISE:

Some people are so eager to talk that they will allow no-one else to finish speaking. Just as in a farmyard one chicken will grab a grain of meal from another's beak, so do these people take the words out of a speaker's mouth and begin to talk themselves. They surely give the other person every reason to want to quarrel with them; for nothing annoys us as much as a sudden check to our wishes and pleasures, however trifling, such as when someone blocks your mouth when you open it to yawn or unexpectedly holds your arm when you are about to throw something.

Answer: Some people want to talk so much they interrupt others. This makes other people angry because they are stopped from doing what they want.

NOTE: EVERYTHING that is NOT ABSOLUTELY NECESSARY GOES.

How do you tackle summarising a passage?

Read it through completely once, to get an idea of what it is about. Read it through again, more slowly, concentrating on the important details. Now, you have a number of alternatives:

1. You can underline what you think is important.
2. You can make notes of what is important.
3. You can draw a mind map.

Choose the method that suits you, and plan, draft, and write your summary.

Note:

- If you are given a specific number of words, for example 60, in which to summarise the passage, do not have fewer than 57 words, or more than 63. If you are told to write a summary of 50-60 words, keep strictly to that limit.
- Write the EXACT number of words at the bottom of your summary. DO NOT LIE.
- What if your teacher asks you to do a PRECIS of the passage? Remember: another word for summary is precis. Technically, a precis should be a third of the length of the original, whereas a summary can be any length.

However, there are other issues you have to deal with – not just the shortening.

Before you start the summary, ask:

- What is my PURPOSE?
- Who is my AUDIENCE?

Remember that you will choose language that is suited to your purpose. If you are asked to summarise the preacher's sermon in church for an elderly friend, you would use a formal register. If you summarize a lesson for a friend, you would use a colloquial, probably slangy register. If you are giving your report of an accident to the police, you would choose a formal register. Always choose the right register for your audience.

Read the question carefully to decide how the examiner wants you to manipulate the information.

A FINAL NOTE: No summary is achieved without work. You must make up your mind to draft and re-draft. Practise and practise, and then, when you have to do a summary in a rush - like in an exam - you will have the SKILLS to do it. No sportsman or woman participates in a competition without TRAINING. You need to train your MIND. SKILLS need to be developed, improved, and sharpened. That takes TIME, EFFORT, and PRACTICE.

PHYSICAL SCIENCE

Lesson 2

Mechanics

Newton's Third Law

Introduction

If we start from the general form of Newton's Second Law we can define a new quantity called "impulse". The way we use the word in everyday language suggests "the cause of change". That is the same way it is used in mechanics. But in mechanics it refers specifically to "the cause of a change in momentum."

Recap of momentum

In order to describe the motion of a body when acted on by a force, Isaac Newton defined a quantity that he called "quantitas motus", Latin for "quantity of motion". We call this quantity: momentum and define it as follows: The momentum (**p**) of a body is given by the product of its mass **m** and its velocity **v**. So $\mathbf{p} = \mathbf{m} \times \mathbf{v}$ [the units are $kg.m.s^{-1}$].

Impulse

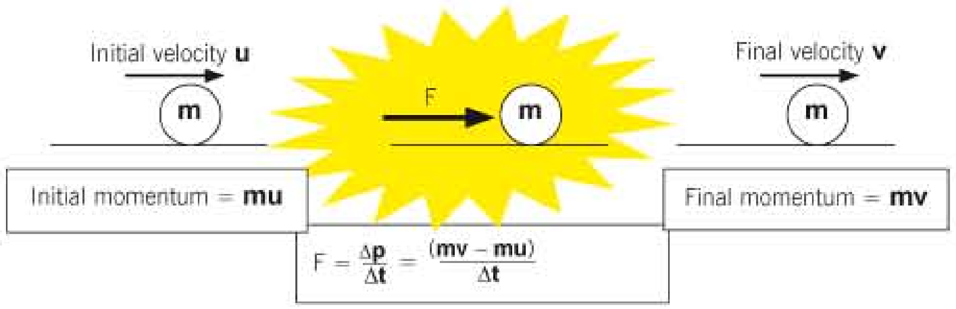
As we have seen, according to Newton's Second Law the rate of change in a body's momentum is proportional to the magnitude of the force that causes the change:

$$F = \frac{\Delta \mathbf{p}}{\Delta \mathbf{t}}$$

Whenever we see the words "rate of change" it means that we divide the change in some quantity by the time taken for that change to happen. If we draw this in a diagram we see how the action of a resultant force cause a body's velocity, and therefore its momentum, to increase.

Since we talk about "rate" of change, the time that the force acts is also important.

Remember that "change" is always calculated by subtracting the initial condition from the final condition.



We define an "impulse" as the product of a force (F) and the duration or the length of time ($\Delta \mathbf{t}$) that it acts. An impulse on a body is the change in its momentum.

$$\boxed{F.\Delta \mathbf{t} = \Delta \mathbf{p} = (\mathbf{mv} - \mathbf{mu}) = \mathbf{m}\Delta \mathbf{v}}$$

Example 1

A force of 200 N acts on a resting body whose mass is 2 kg. If the action of the force on the body lasts for 0,01 s, by how much will its momentum change?

$F.\Delta \mathbf{t} = (\mathbf{mv} - \mathbf{mu})$ [$\mathbf{u} = 0\ m.s^{-1}$ since the body is initially at rest.]

$(200\ N).(0{,}01\ s) = (2\ kg).(\mathbf{v} - 0)$ [the mass of the body remains constant.]

$\therefore \mathbf{v} = 2{,}0\ N.s / 2\ kg$

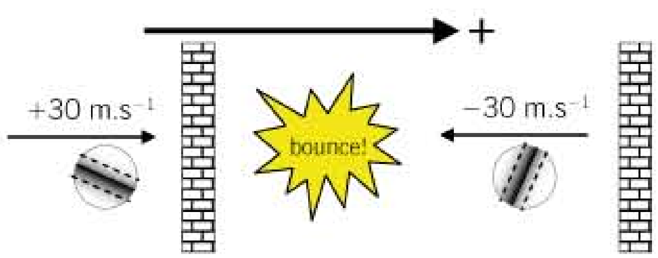
$= \mathbf{1\ m.s^{-1}}$

The body's velocity changes from rest ($\mathbf{u} = 0\ m.s^{-1}$) to $1\ m.s^{-1}$.

When a force acts on a body it will seldom be constant. This is because a force, when acting on a body, may deform the body slightly (i.e. squash it or push it out of shape in some way). Therefore we always regard the forces in these examples as being average forces. This means that the value of F remains constant for the entire duration that it acts, i.e. for $\Delta \mathbf{t}$ seconds.

Example 2

A ball with a mass of 500 g strikes a wall at a velocity of $30\ m.s^{-1}$ and rebounds at a velocity of $30\ m.s^{-1}$. If the ball was in contact with the wall for 0,4 s, what was the size of the average force acting by the wall on the ball?



LIFE SCIENCES

Lesson 2

Viral diseases

Summary writing skills

Diseases in Man

- **Influenza:** This is commonly called flu. Symptoms are a fever, headache, sore throat, runny nose and aching muscles. Secondary infections like bronchitis and ear infection are common and caused by bacteria.
- **Measles:** Symptoms are similar to flu with a fever, sore throat, cough and runny nose to begin with. After two days, the body is covered with red spots.

- **Poliomyelitis:** The polio virus causes a fever, headache and stiff muscles to start with. Later, the muscle nerve cells are damaged and destroyed, causing paralysis.
- **Mumps:** Symptoms are a fever and swelling of the glands in the body. In young males, severe swelling of testes may cause sterility as adults.

- **HIV/AIDS:** A retrovirus called the Human Immunodeficiency Virus (HIV) causes this dreaded disease. Once symptoms appear the disease has progressed to Acquired Immune Deficiency Syndrome (AIDS). AIDS is the final stage of HIV infection.

The virus attacks the immune system. Without an immune system, the infected person is unable to resist diseases that attack the body. The HIV person will become ill with flu, TB, diarrhoea, pneumonia or some cancers. When the immune system is broken down completely, any infection will cause death because the person is too weak to withstand the infection.

How is HIV transferred? HIV survives in body fluids like sperm, breast milk, vaginal fluid and blood. Infection results when a person comes into direct contact with these fluids.

HIV is transferred from an infected mother to her unborn child. AZT is a drug that is given to an infected mother, to prevent the virus from being passed to her unborn child. The mother may not breast feed after birth. AZT does not make the baby immune to HIV but prevents the virus from entering the baby's blood supply via the placenta.

HIV is not spread by touching, shaking hands, tears, sneezing, coughing or mosquitoe bites.

For several weeks after infection, the body does not show signs of infection. This is called the "window period" and all tests will show negative. It may take up to 6 months for the HIV test to show positive. There may be no symptoms for up to 10 years. When symptoms appear, the disease has progressed to AIDS.

learning channel
Department of Education

LIFE SCIENCES GRADE 11

Common symptoms of AIDS are:

- Severe loss of weight
- Diarrhoea and fevers
- Skin cancer
- Organs and lymph glands swell
- Secondary infections

There is no known cure for HIV/AIDS.

Viral Animal Disease

Rabies: This virus is transmitted to humans by the bite of an infected dog, rat, cat or other infected mammals. The symptoms of the infected animal is a foaming mouth and wild, aggressive behaviour. If a person is infected, the symptoms are severe headaches, sore body and muscles, convulsions and vomiting. The bite must be cleaned and sterilized. A vaccine injection must be administered by a doctor as soon as possible. Infected animals must be put down.

Viral Plant Disease

Tobacco Mosaic Virus: This virus contains RNA and infects tobacco and tomato plant leaves. Infected leaves have a spotted appearance. Healthy plants are infected when Aphids transfer the sap of an infected plant. Entire infected crops are burned to destroy the virus. Biotechnology and Genetic Engineering have ensured the development of virus-resistant strains of important crops.

Genetic Engineering

This is the transfer of genes from one organism to another, to increase immunity. For immunity against Hepatitis B, the gene for the protein capsid of the virus is inserted into yeast cells. The yeast cells produce the same protein when cultured. The yeast cells are injected into people and stimulate the production of antibodies against the virus.

Biological Importances:

- Viruses are **parasites** because they require a host cell to reproduce
- Viruses are transferred by **direct contact, sneezing, coughing, blood and disease vectors** (mosquitoes, ticks and aphids)
- Viruses are used in Genetic Engineering to transfer **recombinant DNA** into a cell to create a new, useful vaccine or product.

PHYSICAL SCIENCE GRADE 11

$$\mathbf{F}.\Delta t = (mv - mu)$$
$$(\mathbf{F}\text{ N}).(0,4\text{ s}) = (0,5\text{ kg}).[-30\text{ m.s}^{-1} - (+30\text{ m.s}^{-1})]$$
$$\mathbf{F} = (0,5).(-60\text{ m.s}^{-1})/0,4$$
$$= -75\text{ N}$$ **(i.e. opposite to the direction of the incoming ball)**

NOTE: Since the direction of the change of momentum is important we must decide on which direction is to be taken as positive. Her we choose left to right as positive.

Newton's Third Law of Motion

Examine, again, the example of the ball bouncing off the wall. If it is the ball whose momentum is changing, the force causing the change in the ball's momentum must be acting ON THE BALL (otherwise the ball's momentum WOULD NOT CHANGE! Therefore it is the wall's force on the ball that we must calculate.

But something odd is happening! The incoming ball must be exerting a force on the wall. And the wall must be exerting a force on the ball because the ball's momentum is changing. **So it seems that we have a pair of forces acting!**

This brings us to the third of Sir Isaac Newton 's three laws of motion – the final part of the "package deal", the part that completes the picture. Together the three laws give us the tools to understand how and why bodies remain at rest or move.

The First Law describes why a body remains at rest or moving with constant velocity and what needs to be done to change that situation.

The Second Law tells us about the effect that an external, resultant force on a body causes.
What the first two laws DO NOT TELL US is the response of a body to a force when that force acts on it.

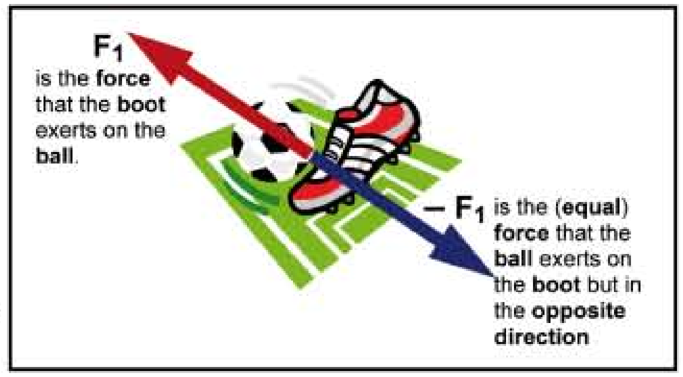
Newton's Third Law of Motion tells us that when one object applies a force on a second object, the second object applies an equal and opposite force on the first object.

Newton's Third Law of Motion:
To every action there is an equal and opposite reaction.

We call an action ($\mathbf{F_1}$) and its reaction ($-\mathbf{F_1}$) an "**action-reaction pair**" of forces, as in the case of a boot and a ball.

Five things to remember about Action-Reaction pairs:

The two forces ... have the same magnitude;
act in opposite directions;
act on different objects;
are the same kind of force (e.g. both are contact);
act simultaneously.

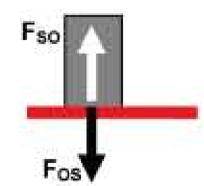


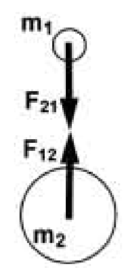
The last feature of action-reaction pairs is very important. When we speak of "action" and "reaction" it almost sounds as though the reaction follows the action. This is a **WRONG IDEA!** There can be no reaction without an action, so the two forces arise at exactly the same time! In other words, the action and reaction are SIMULTANEOUS.

Explaining action-reaction pairs

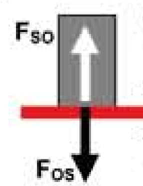
Explain the forces acting in these two cases. In the left hand diagram an object (**O**) is resting on a table. Identify the action-reaction pair and explain its origin.

In the right hand diagram two masses attract one another. The nature of this "gravitational attraction" will be explained in Lesson 4. For the moment all you need to know is that masses do attract one another. Of course you know this from seeing how an object falls towards Earth. You could imagine that $\mathbf{m_1}$ was a ball falling towards the earth and that $\mathbf{m_2}$ was the earth.

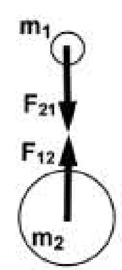




Explanation of two situations above



When an object (**O**) rests on a surface (**S**) it applies a downward Force ($\mathbf{F_{os}}$) on the surface. The reaction of the surface to this force is a force on the object ($-\mathbf{F_{so}}$), equal in size but in the opposite direction to $\mathbf{F_{os}}$.



When two masses ($\mathbf{m_1}$ and $\mathbf{m_2}$) exert a gravitational force on each other, the force ($\mathbf{F_{12}}$) with which the first mass ($\mathbf{m_1}$) attracts the second mass ($\mathbf{m_2}$) is the same size but in the opposite direction to the force with which the second mass attracts the first mass i.e. $-\mathbf{F_{21}}$.

MATHEMATICS PAPER – PAGE 1

DoE/November 2006

GRADE 10 MATHEMATICS P1

NOVEMBER 2006

MARKS: 100

TIME: 2 hours

QUESTION 1

1.1 Simplify:

1.1.1 $(3x-2)(x^2+1)-2$ (3)

1.1.2 $\dfrac{(2^2 \times 3)^{x+1}}{2^{2x} \times 3^x}$ (4)

1.1.3 $\dfrac{x^2-1}{3} \times \dfrac{1}{x-1} - \dfrac{1}{2}$ (4)

1.2 What must be added to $x^2 - x + 4$ to make it equal to $(x+2)^2$? (3)

1.3 It is given that $2\,000 = 2 \times M^3 \times N^3$, where M and N are whole numbers. Determine the value of $M \times N$. (3)

1.4 Factorise:

1.4.1 $3x^2 - 5x - 2$ (2)

1.4.2 $n^2 + 3n - 5n - 15$ (3)

1.5 Write down at least THREE rational numbers between $\sqrt{2}$ and $\sqrt{10}$. (3)

[25]

QUESTION 2

2.1 Solve the following equations:

2.1.1 $2x(x-1) = 4$ (4)

2.1.2 $3^x = 75$ (Answer rounded off correctly to ONE decimal place.) (3)

2.2 Solve the following inequality. Illustrate your answer on a number line if x is a real number.

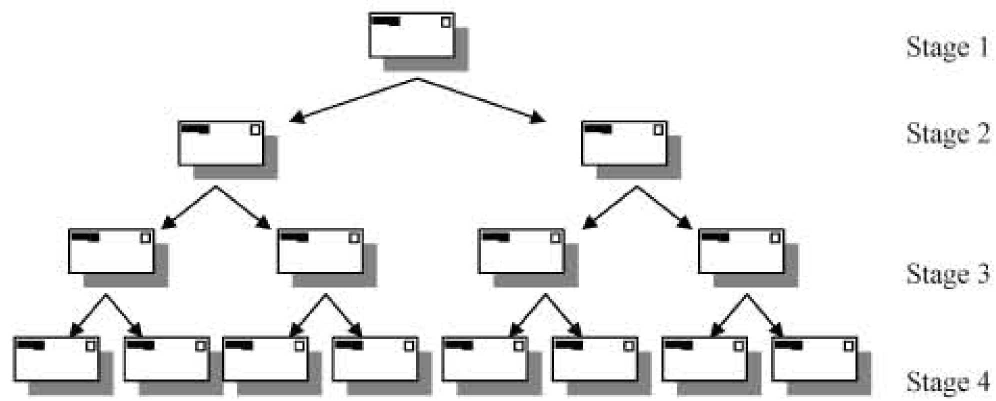
$-2 \leq x - 1 < 3$ (4)

MATHEMATICS PAPER – PAGE 2

[11]

QUESTION 3

3.1 Morwesi started a chain letter with a message of peace and goodwill. She sent it to Rosanne and Nathi and asked them to each send it to two other friends. These friends in turn have to each ask two friends to send it to two other friends. This process must continue and is illustrated below:



3.1.1 How many letters will be sent at stage 5? (1)

3.1.2 How many letters will be sent at stage 6? (1)

3.1.3 Write a conjecture about the number of letters that will be sent at any stage in the process. (2)

3.1.4 Use a variable to express your conjecture algebraically. (2)

3.2 Two chocolates and four packets of chips cost R32 and three of the same chocolates and eight of the same packets of chips cost R58.

Calculate the cost of a single chocolate and a single packet of chips.

(HINT: Let the cost of a chocolate be x and the cost of a packet of chips be y.) (6)

[12]

QUESTION 4

4.1

MATHEMATICS PAPER GRADE 10 – PAGE 3

Consider the advertisement above and answer the following question:

Zaida invested R2 750 at Community Savings Club for 4 years. How much money will she receive at the end of the investment period? (4)

4.2 There are 12 500 people in a small town. The population of the town increases every year by 5,5%. What will the population of the town be after 5 years? (5)

4.3 The Eteana family of three members from Nigeria, wishes to attend the Soccer World Cup in South Africa in 2010. A travel agency has advised them to save R17 000 per person to attend all games in 2010. This cost will include accommodation, airline tickets, et cetera.

How much money, in Nigerian currency, will the family require if the predicted exchange rate in 2010 is:

One Naira (Nigerian currency) = R18,85. (3)

[12]

QUESTION 5

5.1 Given the functions: $f(x) = -x^2 + 4$ and $g(x) = 2x + 4$

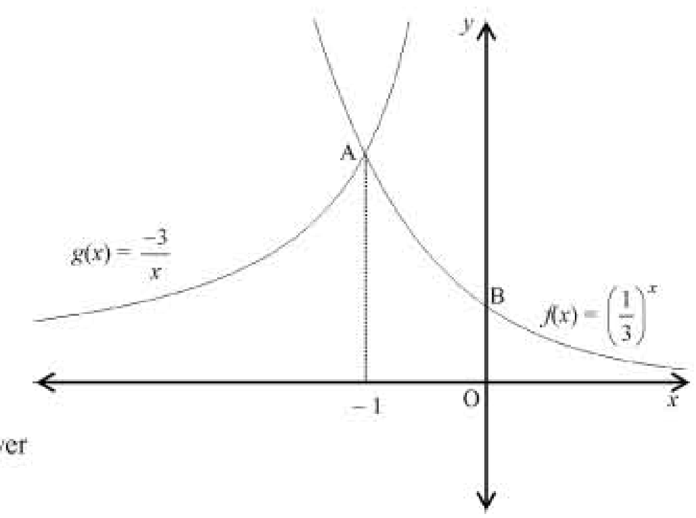
5.1.1 Draw f and g on the same system of axes. (6)

5.1.2 Use your graphs to solve for x if:

$f(x) \leq g(x)$ (3)

5.1.3 Give the equation of p, the reflection of f in the x-axis. (2)

5.2 The graphs of $f(x) = \left(\frac{1}{3}\right)^x$ and $g(x) = \frac{-3}{x}$ where $x < 0$ are represented below:



Answer

MATHEMATICS PAPER GRADE 10 – PAGE 4

5.2.1 Write down the co-ordinates of A and B. (2)

5.2.2 Write down the domain of $f(x)$. (1)

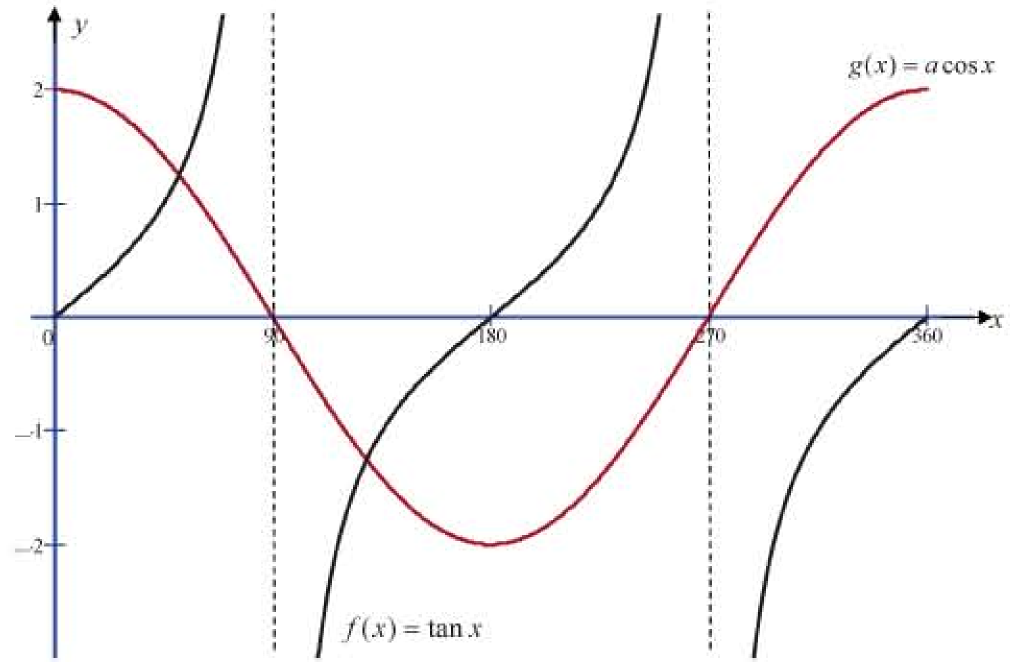
5.2.3 Write down the equation of the reflection of f in the y-axis. (2)

5.2.4 Give the equation of the asymptote of the graph of $y = g(x) + 2$. (2)

[18]

QUESTION 6

The following graphs have been drawn below: $f(x) = \tan x$ and $g(x) = a \cos x$



6.1 Determine the value of a. (2)

6.2 If $f(x)$ is shifted 2 units upwards, it represents the function h. State the defining equation of h. (2)

6.3 Write down the values of x for which $g(x) - f(x) = 2$. (2)

6.4 Write down the range of g. (1)

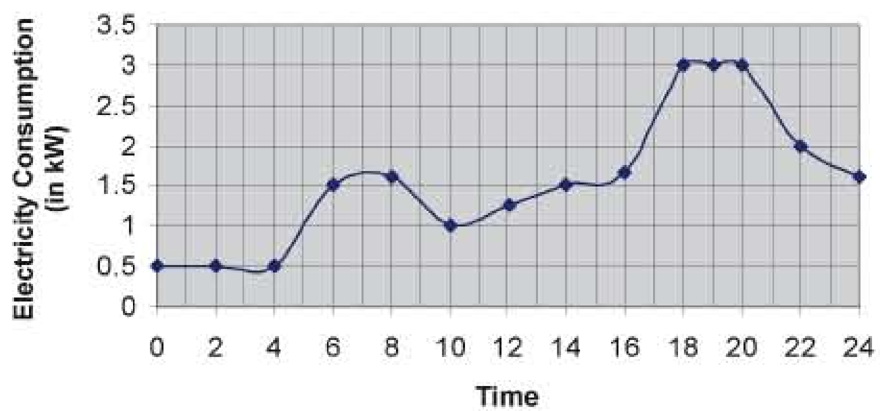
6.5 Write down the period of f. (1)

[8]

MATHEMATICS PAPER GRADE 10 – PAGE 5

QUESTION 7

Electricity Consumption of the Mbuli Family for 24 hours



7.1 What is the maximum and minimum amount of electricity used by the Mbuli's in any hour? (2)

7.2 When is the electricity consumption increasing and when is it decreasing? (4)

7.3 At what stage during the day does the electricity consumption increase most rapidly? (2)

7.4 Determine the average rate of kilowatts per hour used by the Mbuli's for the 24-hour period. (3)

7.5 Does your answer to QUESTION 7.4 fairly reflect the electricity consumption of the Mbuli's for the 24-hour period? Substantiate your answer. (3)

[14]

TOTAL: 100

MATHEMATICS PAPER GRADE 10 – ANSWERS

GRADE 10
MATHEMATICS P1

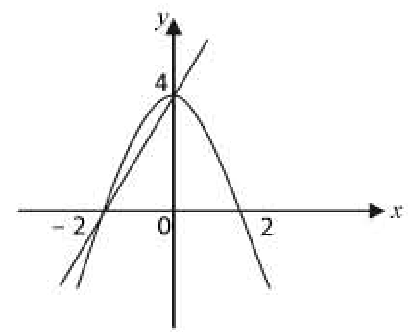
NOVEMBER 2006

1.1.1 $(3x-2)(x^2+1)-2$ $=3x^3-2x^2+3x-2-2$ $=3x^3-2x^2+3x-4$ (3)	✓✓ Removing brackets/Simplification ✓ Grouping of like terms
1.1.2 $\frac{(2^2\times 3)^{x+1}}{2^{2x}\times 3^x}$ $=\frac{2^{2x+2}\times 3^{x+1}}{2^{2x}\times 3^x}$ $=2^{2x+2-2x}\times 3^{x+1-x}$ $=2^2\times 3^1$ $=12$ (4)	✓ Application of exponent law ✓ Application of exponent law ✓ Simplification ✓ answer 4
1.1.3 $=\frac{(x-1)(x+1)}{3}\times\frac{1}{x-1}-\frac{1}{2}$ $=\frac{x+1}{3}-\frac{1}{2}$ $=\frac{2x+2-3}{6}$ $=\frac{2x-1}{6}$ (4)	✓ factorising ✓ Cancelling ✓ simplification ✓ answer
1.2. $(x+2)^2=x^2+4x+4$ $x^2-x+4=x^2-x+4+5x$ $\therefore$ Add $5x$ (3)	✓ Expansion ✓ Equivalent expression ✓ $5x$
1.3 $2000=2\times M^3\times N^3$ $1000=(M\times N)^3$ $10^3=(M\times N)^3$ $10=M\times N$ (3)	✓ dividing both sides by 2 ✓ writing as a cube ✓ answer 10
1.4 1.4.1 $3x^2-5x-2$ $(3x+1)(x-2)$ (2)	✓✓ One for each factor.
1.4.2 $n^2+3n-5n-15$ $=n(n+3)-5(n+3)$ $=(n+3)(n-5)$ (3)	✓ removal of common factor ✓✓ One for each factor
1.5 $\sqrt{4}=2$; $\sqrt{\frac{25}{9}}=\frac{5}{3}$; $\sqrt{9}=3$ (3)	✓✓✓ One for each answer (Any mathematically correct answer)
QUESTION TWO	
2.1.1 $2x(x-1)=4$ $x(x-1)=2$ $x^2-x-2=0$ $(x+1)(x-2)=0$ $\therefore x=-1$ or $x=2$ (4)	✓ Dividing by 2 ✓ standard form ✓ factoring trinomial ✓ both answers

MATHEMATICS PAPER GRADE 10 – ANSWERS

2.1.2 By trial and error $3^2 = 9$ $3^3 = 27$ $3^4 = 81$ Therefore x is between 3 and 4 By trial and error answer is $x = 3.9$ (3)	✓ Calculating powers ✓ Estimation, between values ✓ Estimation of value
	✓✓ solving for x ✓✓ Number line representation
QUESTION 3	
3.1.1 $8 \times 2 = 16\ (2^4)$ (1)(1) 3.1.2 $16 \times 2 = 32\ (2^5)$ (1) 3.1.3 The number of letters sent will always be a power of 2. The power is always 1 less than the stage. 3.1.4 nth stage $= 2^{n-1}$ (2)	 ✓ answer ✓ answer ✓✓ Any acceptable explanation . ✓✓
3.2 Let cost of Chocolate be x Let cost of Chips be y Then $2x + 4y = 32$ (1) $3x + 8y = 58$ (2) Now (1) × 2 : $4x + 8y = 64$ (3) $(3) - (2) x = 6$ Substituting $x = 6$ in (1) we have $2(6) + 4y = 32$ $4y = 20$ $y = 5$ ∴ Cost of Chocolate = R6 and Cost of Chips = R5 (6)	✓ Equation (1) ✓ Equation (2) ✓ Equation (3) ✓ x = R6 ✓ Substitution for x ✓ Cost of Chips, y
QUESTION 4	
4.1 Simple Interest $= \frac{Pt}{100}$ $\frac{2750 \times 8{,}4 \times 4}{100} = 935$ ∴ Zaida receives R2750 + R935 = R3685 (4) 4.2 $A = P\left(\frac{1+r}{100}\right)^n$ $= 12500(1{,}055)^5$ $= 16337$ people (5) 4.3.1 Total need in rands is 3 × R17 000 = R51 000 ∴ Amount needed in Nigerian currency is $\frac{51000}{18{,}85} = 2705.57$ Naira (3)	✓ Correct Formula ✓ Correct substitution ✓ SI ✓ Answer ✓ Correct formula ✓✓✓ Substitution in formula ✓ Correct answer ✓ Rand value R51 000 ✓✓ Correct conversion

MATHEMATICS PAPER GRADE 10 – ANSWERS

QUESTION 5	
5.1.1  5.1.2 $x < -2$ or $x > 0$ (3) 5.2.1 A(-1 ; 3) ; B(0 ; 1) (2) 5.2.2 x R (1) 5.2.3 y = 2 (2)	✓ Shape – parabola ✓✓ x-intercepts ✓ y-intercept ✓ shape straight line ✓ x or y-intercept ✓✓ for each critical value ("or") ✓ inequality signs ✓✓ equation ✓✓ 1 for each ✓ ✓✓ equation. ✓✓ correct equation
QUESTION 6	
6.1 $a = -2$ 6.2 $h(x) = \tan x + 2$ 6.3 $x = 0°$ or $x = 360°$ 6.5 $x = 180°$	✓ $q = -2$ ✓✓ 1 mark for each term ✓✓ 1 mark for each value ✓ correct answer ✓✓ 1 mark for each answer ✓ correct x value
QUESTION 7	
7.1 Maximum – about 0.4 Kw Minimum – about 3 Kw 7.2 Increasing – between 04:00 and 10:00 between 10:00 and 18:00 Decreasing – between 07:30 and 10:00 between 20:00 and 24:00 7.3 Between 16:00 and 18:00 7.4 Ave. rate $= \frac{1{,}5 - 0{,}5}{24}$ $= 0{,}04$ Kw 7.5 No – Acceptible motivation in terms of given data	✓ ✓ These are estimations in terms of the graph – allow slight discrepancies 1 mark for each period ✓✓ ✓✓✓ ✓ No ✓✓ Motivation