MATHEMATICS

RESOURCE PACK
GRADE 10 TERM 4

GRADE: 10 TERM: 4

PROBABILITY

RESOURCE 1

LESSON 1

EXPERIMENTAL PROBABILITY AND RELATIVE FREQUENCY INVESTIGATION

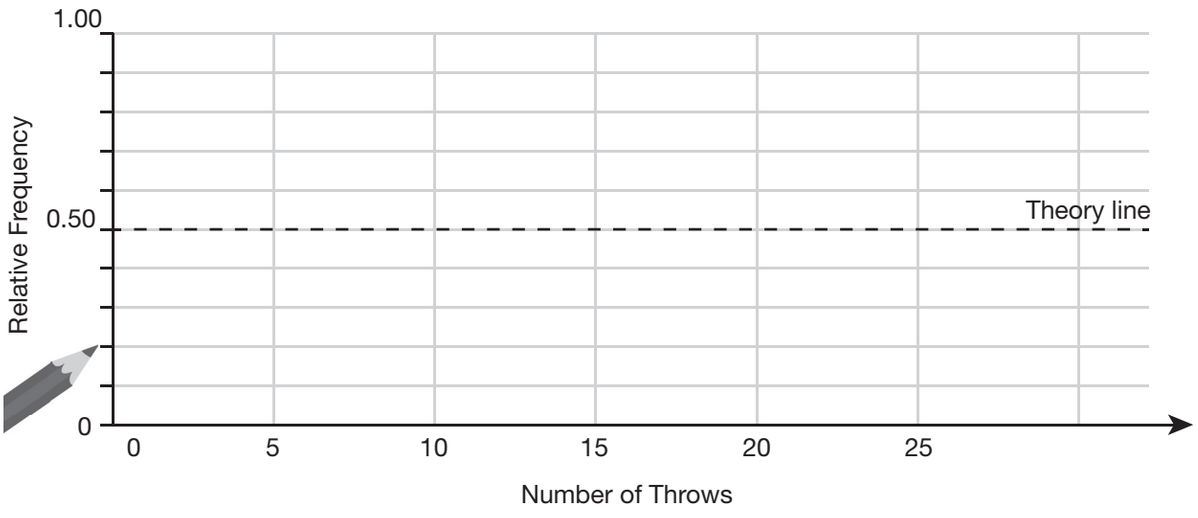
Flip a coin 30 times. Fill in the tables and complete the graph below.

Throw	1	2	3	4	5	6	7	8	9	10
Result										
Throw	11	12	13	14	15	16	17	18	19	20
Result										
Throw	21	22	23	24	25	26	27	28	29	30
Result										

Now consider the tails in the above table.

Remember: $Relative\ Frequency = \frac{number\ of\ tails}{number\ of\ throws}$

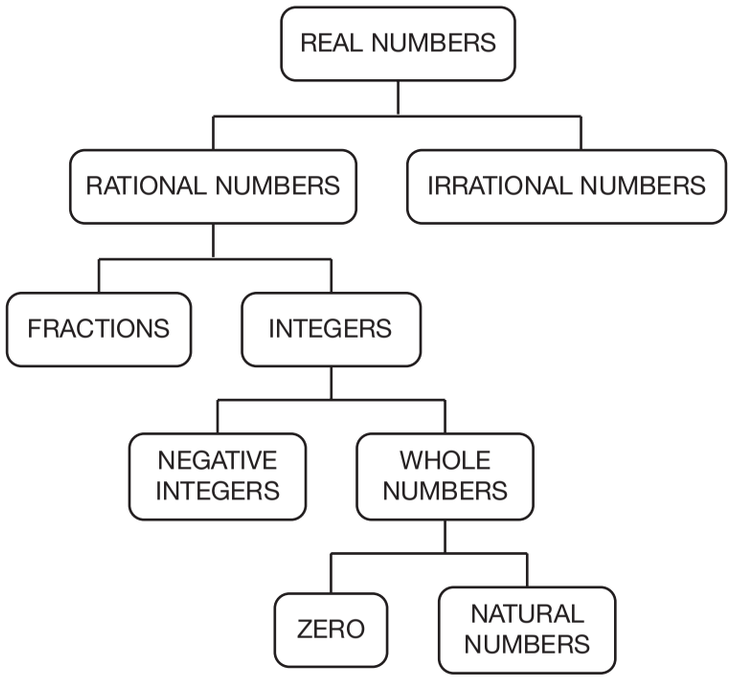
After…	5 Throws	10 Throws	15 Throws	20 Throws	25 Throws	30 Throws
Number of Tails						
Relative Frequency						



SUMMARY NOTES – PAPER 1

ALGEBRAIC EXPRESSIONS AND EXPONENTS

The Real Number system



Products

General Rule with brackets: All terms in one bracket must be multiplied by all terms in the other bracket.

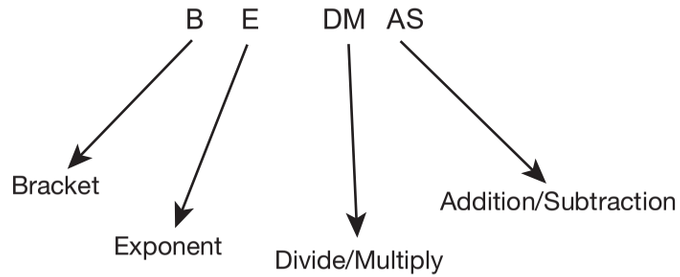
Binomial x Binomial: Use FOIL (first, outer, inner, last)

REMEMBER:

- "Names" don't change when adding and subtracting, only the coefficient does
  ($2ab + 4ab = 6ab$ not $6a^2b^2$)
- The sign to the left of a term belongs to it

If there is more than one set of brackets: Work from the inside out.

ORDER OF OPERATIONS is ALWAYS important and needs to be followed.



Factors

To factorise an expression is the opposite operation to finding the product.

1. Common factor (including grouping and sign changing)
   - Find HCF to take out
   - Remaining factors go into bracket
   - Original number of terms must equal the number of terms left over in the bracket.
     Example: $3x^2 - 9x^3 = 3x^2(1 - 3x)$

2. Grouping

- Four or more terms usually requires grouping
- Look at the ratios of the coefficients to help decide which terms group together
- There needs to be a sign between the brackets after grouping. If the sign in front of a bracket is '-' we need to change the sign in the bracket following it.
- Once grouping has been done, the common factor should be whatever is in the bracket.
  Example
  $6p^3 - 4q^3 + 3p^2q - 8pq^2$
  (6 & 3 gives the same ratio as 8 & 4)
  $= 3p^2(2p+q) - 4q^2(q+2p) \quad [2p+q = q+2p]$
  $= (2p+q)(3p^2 - 4q^2)$

3. Difference of two squares

- Always two terms separated by a minus sign
- Both terms must be perfect squares
- Remember *not* to multiply out first if brackets are involved
  For example, $(3a+b)^2 - 16$
  $= [(3a+b)+4][(3a+b)-4]$

4. Sum and Difference of 2 cubes

- Always 2 terms separated by a plus or minus sign
- Both terms must be perfect cubes
- Factors will always be a binomial and a trinomial
- Binomial bracket: Cube root each term and keep same sign
- Trinomial bracket:
  1st term: Square 1st term from binomial bracket
  2nd term: Find product of 2 terms from binomial bracket and change the sign
  3rd term: Square the 2nd term from the binomial Bracket
  Example, $27x^3 + 64y^3$
  $= (3x+4y)(9x^2 - 12xy + 16y^2)$

5. Trinomials

- Always 3 terms and factorises into two factors (hence the two brackets)
  If coefficient of x^2 is not 1:
- Choose the appropriate signs to match the product of the last term
- Find factors of the first term and last term
- Use cross multiplication to find the factors that work

Examples:

	Working (signs and factors) and solution
$10x^2+37x+7$	Last term positive ∴ need two signs the same 2nd term positive ∴ $(+)(+)$ Factors of term 1: 1×10 and 2×5 Factors of last term: 1×7 $2x \times 1$ $5x \times 7$ $5x \quad 14x$ Because the signs are the same these terms should add up to the middle term ($37x$). They do not – the combination needs re-thinking: $2x \times 7$ $5x \times 1$ $35x \quad 2x$ These add up to $37x$. The factors will make up the brackets Solution: $(5x+1)(2x+7)$
$8x^2-10x+3$	Last term positive ∴ need two signs the same 2nd term negative ∴ $(-)(-)$ Factors of term 1: 1×8 and 2×4 Factors of last term: 1×3 $4x \times 3$ $2x \times 7$ $6x \quad 4x$ Because the signs are the same these terms should add up to the middle term – they do. Solution: $(4x-3)(2x-1)$
$6x^2+5x-6$	Last term negative ∴ need two different signs Factors of term 1: 1×6 and 2×3 Factors of last term: 1×6 and 2×3 $2x \times 3$ $3x \times 2$ $9x \quad 4x$ Because the signs are different these terms should make a difference of the middle term – they do. Use the terms to decide which factors go with which signs. To get $+5x$, $+9x-4x$ is required. The sign of $4x$ moves directly above and the sign of $9x$ is placed between the top two factors. Solution: $(2x+3)(3x-2)$

$12x^2-11x-15$	Last term negative ∴ need two different signs Factors of term 1: 1×12 and 2×6 and 3×4 Factors of last term: 1×15 and 5×3 $3x$ — 5 $4x$ — 3 $20x$ $\quad$ $9x$ Because the signs are different these terms should make a difference of the middle term – they do. Use the terms to decide which factors go with which signs. To get $-11x$, $-20x+9x$ is required. The sign of $9x$ moves directly above and the sign of $20x$ is placed between the top two factors. Solution: $(2x+3)(3x-2)$

REMEMBER: ALWAYS look for a highest common factor first.

ALGEBRAIC FRACTIONS

1. Multiplication and Division

   - If division, change to multiplication and reciprocate
   - Factorise all numerators and denominators fully
   - Simplify by looking for common factors in any numerator and denominator (remember: you cannot simplify 'next to' an addition or subtraction)

Example

$$\frac{a^2-3a}{a^2-4}\div\frac{a^2-9}{a^2+a-6}=\frac{a^2-3a}{a^2-4}\times\frac{a^2+a-6}{a^2-9}$$
$$=\frac{a(a-3)}{(a+2)(a-2)}\times\frac{(a+3)(a-2)}{(a+3)(a-3)}$$
$$=\frac{a}{a+2}$$

2. Addition and Subtraction

   - Ensure all denominators are fully factorised
   - Find LCD (lowest common denominator)
   - Change numerators accordingly to ensure equivalent fractions
   - Collect like terms

For example, $\frac{2}{x^2-1}+\frac{3}{x^2+x-2}-\frac{1}{x^2+3x+2}$

$$=\frac{2}{(x+1)(x-1)}+\frac{3}{(x-1)(x+2)}-\frac{1}{(x+2)(x+1)}$$
$$=\frac{2(x+2)+3(x+1)-1(x-1)}{(x+1)(x-1)(x+2)}$$
$$=\frac{2x+4+3x+3-x+1}{(x+1)(x-1)(x+2)}$$
$$=\frac{4x+8}{(x+1)(x-1)(x+2)}$$
$$=\frac{4(x+2)}{(x+1)(x-1)(x+2)}$$
$$=\frac{4}{(x+1)(x-1)}$$

EXPONENTS

Rules:

When:		then:
multiplying powers that have the same base	$a^3 \times a^5 = a^8$	keep the base and add the exponents
dividing powers that have the same base	$\frac{a^{10}}{a^2} = a^8$	keep the base and subtract the exponents
raising a power to another power	$(a^5)^2 = a^{10}$	multiply the exponents
more than one base is raised to a power	$(ab)^3 = a^3b^3$	the exponent belongs to each base
a base is raised to a negative exponent	$a^{-2} = \frac{1}{a^2}$	reciprocate and change the sign of the exponent
a base has an exponent of zero	$a^0 = 1$	It will equal 1

NOTE CONCERNING ALL RULES: $2^3 \times 2^5 = 2^8$ (not 4^8)

The rules remain the same for bases of numerical values

EQUATIONS AND INEQUALITIES

1. **Linear equations**
   - If there are brackets, use the distributive law to remove all brackets
   - Collect like terms on each side
   - Get all the terms with the variable in them on LHS
   - Get all constants on RHS
     (but remember, whatever is done to one side of the equation must be done to the other side to keep the equation balanced)
   - Collect like terms on each side again
   - Get the variable on its own using division
2. **Equations with fractions**
   - Find LCD
   - Multiply ALL terms throughout equation by LCD in order to remove all fractions (no more denominators)
   - There should be NO fractions AT ALL in the next step.
   - Continue the same as for linear equations
3. **Quadratic Equations**
   - Recognisable by the “square”. You should be expecting two answers.
   - Get ALL terms on LHS so that RHS = 0
   - Factorise the LHS fully
   - Find the 2 possible solutions using the concept that two factors multiplied to equal zero will mean that each one of the factors could possibly equal zero.
4. **Simultaneous Equations** (Given two equations with two variables to solve for)
   <u>Substitution method</u>
   - Get ONE of the variables by itself in ONE of the equations
   - Use this information to substitute back into the second equation. You should now have an equation with only one unknown variable in
   - Solve for this variable

- Use the information just found to substitute back into the first equation and solve for the second variable.

  Elimination method (works well if one of the variables has the same co-efficient in each of the two equations).
- Place the two equations below each other ensuring all the like terms are underneath each other
- Subtract the one equation from the other (if the co-efficients have the same sign) to eliminate that variable

OR

- Add the 2 equations together (if the co-efficients have opposite signs) to eliminate one of the variables
- Solve the 'new' equation which has only one unknown
- Use the information just found to substitute back into one of the original equations to solve for the missing variable.

5. **Exponential equations**

- Bases must be the same to solve exponential equations – if the bases are the same, the exponents will be the same
- If bases are not the same, use prime factors to make them the same.

6. **Literal Equations**

- Treat as if it is an ordinary linear equation first (try and ignore the fact that there are many variables and few or no numbers)
- Focus on the variable you have been asked to solve for.
- Get all terms with this variable in on one side and all terms without this variable in on the other side.
- If the variable you are solving for is in more than one term (and they're all on one side now), factorise by taking this variable out as a common factor.
- Divide both sides by any other variables 'in the way' and get the variable you're solving for on its own.

7. **Linear inequalities**

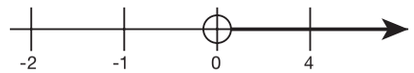
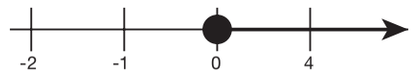
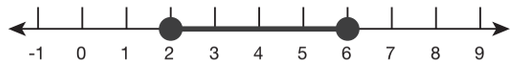
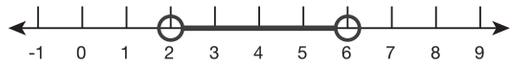
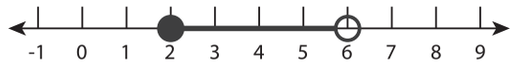
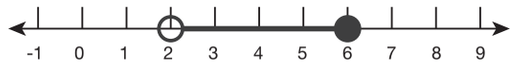
- Treat the same as a linear equation
- IF it is required to divide by a negative integer to get the variable alone, the sign (< or >) needs to be changed.
- These solutions may need to be represented on a number line.

Inequalities, Interval Notation and Representation on a number line

Inequality sign	words	Open/closed dot
$>$	Greater than	Open 
$\geq$	Greater than or equal to	Closed 
$<$	Less than	Open
$\leq$	Less than or equal to	Closed

$>$ and $\geq$ represent an arrow this way $\longrightarrow$
$<$ and $\geq$ represent an arrow this way $\longleftarrow$

Examples:

Inequality	Interval notation	
$x > 2$	$x \in (2;\infty)$	
$x \geq 2$	$x \in [2;\infty)$	
$2 \leq x \leq 6$	$x \in [2;6]$	
$2 < x < 6$	$x \in (2;6)$	
$2 \leq x < 6$	$x \in [2;6)$	
$2 < x \leq 6$	$x \in (2;6]$	

Interval Notation is used to represent a set of Real Numbers as it is impossible to list them.

NUMBER PATTERNS

Sequence: A set of numbers written in order according to some mathematical rule.

The numbers in a sequence are called terms.

The terms of a sequence are indicated by the symbol T_n

Example, T_2 is the second term of the sequence.

T_n, the nth term gives the rule for the sequence.

A sequence that goes up or down in equal steps is called an arithmetic sequence.

In an arithmetic sequence, a constant value is either added or subtracted to generate the next term in the sequence.

The difference between any 2 terms in an arithmetic sequence is known as the common difference.

LINEAR PATTERNS

All these patterns have a common difference between each term. In other words,

$$T_2 - T_1 = T_3 - T_2$$

The general term for a linear pattern can be written as

$$T_n = bn + c \text{ or } T_n = an + q$$

This form is like the standard form of the straight-line graph which shows it is a linear pattern. A pattern however would be represented by discrete points and not a continuous line.

To find the general pattern (also known as the nth term): ● Find the common difference ● Substitute into b in the general format Substitute 'n' with 1 to represent the 1st term and find what c (or q) should be to equal the first term. Example: Find the general term for the pattern 4 7 10 13 ... Common difference: 3 ($7-4=3$ and $10-7=3$)	$T_n = bn + c$ $T_n = 3n + c$ $3(1) + c = 4$ $c = 1$ $\therefore T_n = 3n + 1$
Given the position, looking for the term: substitute n with position given and find T_n Example. Find the 20th term of the above pattern	$T_n = 3n + 1$ $T_{20} = 3(20) + 1 = 61$
Given the term, looking for the position: make an equation and solve for n (substitute in T_n) Example: In which position will the term 151 be in the above pattern?	$T_n = 3n + 1$ $151 = 3n + 1$ $150 = 3n$ $50 = n$ 151 is the 50th term

FINANCE AND GROWTH

Simple Interest $A = P(1 + in)$	A = Final amount P = Principal amount i = interest rate n = number of times interest is calculated* *In simple interest it is always annually. *In Grade 10, in compound interest it is always annually.
Compound Interest $A = P(1 + i)^n$	
Hire Purchase (buying an item from a shop on credit - you are officially hiring the item until the final payment when you have finally purchased it)	● Always use simple interest formula $A = P(1 + i.n)$ ● If insurance is required, it is always on the total purchase price regardless of deposits paid ● Deposits are subtracted from purchase price to find amount needed to be 'borrowed'.
Inflation (The increase in an item over the course of time)	● Always use compound interest formula ● When working towards a previous time period then you usually have 'A' and are looking for 'P'.

Exchange rates	The rate of one country's money against another country's money. Use ratios to convert between one currency and another.
Percentage increase/ decrease $\frac{new-old}{old}\times 100$	If your answer has a 'minus' sign then it is a decrease - do not put the minus in your answer.

FUNCTIONS

There are two types of functions:

ONE-TO-ONE	MANY-TO-ONE
A single x-value for a particular y-value	More than one x-value for a particular y-value
THERE CAN ONLY BE <u>ONE</u> y-VALUE	

The straight-line graph (Linear function)

Standard form:	$y=ax+q$ Gradient: $a>0$: $a<0$: Vertical shift (up/down): y-intercept

To draw	Find the x-intercept (make $y=0$) Find the y-intercept (make $x=0$)
To find the equation	● Given the y-intercept and another point: Substitute y-intercept for 'q' Substitute other point (x; y) to find 'a' ● Given two points Use two points to find gradient ('a') Use any point to substitute and find 'q' Note: check the values 'a' of 'q' according to what they represent (for example, if you have found that $a<0$, check that the line has a negative slope)
Domain and Range	Domain (all possible x-values on the function): $x\in R$ Range (all possible y-values on the function): $y\in R$
Other	● If 2 lines are parallel, then $m_1=m_2$ ● If 2 lines are perpendicular, then $m_1\times m_2=-1$ ● A line perpendicular to the x-axis and parallel to the y-axis (a vertical line): the equation will be in the form $x=c$ ● A line perpendicular to the y-axis and parallel to the x-axis (a horizontal line): the equation will be in the form $y=c$

The parabola (Quadratic function)

Standard form:	$y = ax^2 + q$ $a > 0$: opens upward $a < 0$: opens downard Vertical shift (up/down) y-intercept
To draw	Find the x-intercept (make $y = 0$) Find the y-intercept (make $x = 0$) Find the axis of symmetry: $x = 0$ (In Gr 10 this is always the case) Find the turning point: $(0;q)$ (In Gr 10 this is always the case)
To find the equation	• Given the y-intercept and another point: Substitute y-intercept for 'q' Substitute other point (x; y) to find 'q' • Given two points Substitute each point to form two equations and solve simultaneously Note: check the values of 'a' & 'q' according to what they represent (for example, if you have found that $a < 0$, check that the parabola opens downwards/is upside down)

Domain and Range	Domain (all x-possible values on the function): $x \in R$ Range (all y-possible values on the function): If $a > 0$: $y \in [q;\infty)$ If $a < 0$: $y \in (-\infty;q]$
Other	Parabolas can have a minimum or a maximum value. • If $a > 0$, there is a minimum value The minimum value is $y = q$ • If $a < 0$, there is a maximum value The maximum value is $y = q$

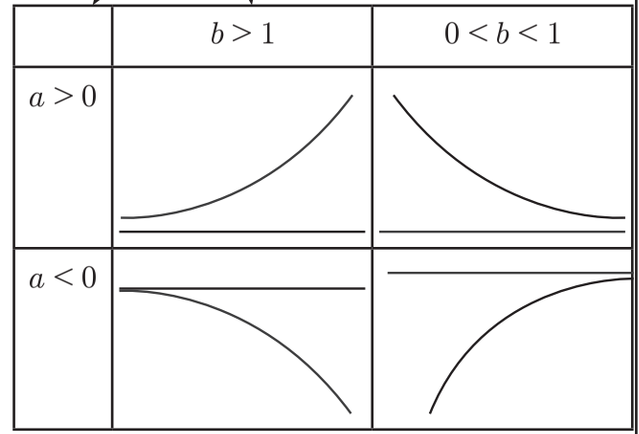
The hyperbola (Hyperbolic function)

Standard form:	$y = \frac{a}{x} + q$ $a > 0$: $a < 0$: Vertical shift (up/down) Horizontal asymptote ($y = q$)

To draw	Draw in the horizontal asymptote: $y = q$ Find the x-intercept (make $y = 0$) Find a few more points if necessary with possible x-values. Remember that the vertical asymptote is $x = 0$ (the y-axis)
To find the equation	● Given the horizontal asymptote and another point: Substitute the value of the asymptote for 'q' Substitute other point (x; y) to find 'a' ● Given two points Substitute each point to form two equations and solve simultaneously Note: check the values of 'a' & 'q' according to what they represent (for example, if you have found that $a < 0$, check that the hyperbola is in the correct quadrants)
Domain and Range	Domain (all possible x-values on the function): $x \in R;\ x \neq 0$ Range (all possible y-values on the function): $y \in R;\ y \neq q$
Other	A hyperbola has two axes of symmetry. ● One has a gradient of '1' and the other has a gradient of '-1' ● They both pass through the point where the asymptotes meet. $(0;q)$ (In Gr 10 this is always the case)

The exponential graph (Exponential function)

Standard form:	$y = a.b^x + q \quad (a \neq 0; b \neq 0)$ Vertical shift (up/down) Horizontal asymptote ($y = q$)
To draw	Draw in the horizontal asymptote: $y = q$ Find the y-intercept (make $x = 0$) Find a few more points if necessary with possible x-values.



To find the equation	• Given the asymptote and another point: Substitute the value of the asymptote for 'q' Substitute other point (x; y) to find 'a' • Given two points Substitute each point to form two equations and solve simultaneously • Note: check the values of 'a' or 'b' & 'q' according to what they represent (Only 2 values will be required)
Domain and Range	Domain (all possible x-values on the function): $x \in R$ Range (all possible y-values on the function): If $a > 0$: $y \in [q;\infty)$ If $a < 0$: $y \in (-\infty;q]$
Other	A hyperbola has two axes of symmetry. • One has a gradient of '1' and the other has a gradient of '-1' • They both pass through the point where the asymptotes meet. $(0;q)$ (In Gr 10 this is always the case)

GENERAL INFORMATION REGARDING FUNCTIONS

1. Find the values of for which:

$f(x) = g(x)$	Make the equations equal and solve for x. If the coordinates are asked for, substitute the x-value(s) into any function and solve for y.

For each of the questions below: First find the part of the graph that answers the question (highlight it if possible) Find the x-values that correspond to the part of the graph that satisfies the statement.	
$f(x) > g(x)$	Where is the function $f(x)$ greater than (in other words above) the function $g(x)$.
$f(x) < g(x)$	Where is the function $f(x)$ less than (in other words below) the function $g(x)$.
$f(x) \geq g(x)$	Where is the function $f(x)$ greater than (in other words above) or equal to the function $g(x)$.
$f(x) \leq g(x)$	Where is the function $f(x)$ less than (in other words below) or equal to the function $g(x)$.

2. Transformations of functions
   - Reflections

Reflection in the x-axis $(y = 0)$	Rule: $(x;y) \rightarrow (x;-y)$ In other words – leave the x-value the same and change the y-value to negative
Reflection in the y-axis $(x = 0)$	Rule: $(x;y) \rightarrow (-x;y)$ In other words – leave the y-value the same and change the x-value to negative

PROBABILITY

Probability is the likelihood of something happening or being true.

Probability is assigned a value from 0 (impossible) to 1 (certain).

The probabilities of the possible outcomes in a sample space must sum up to 1.

Probability of an event occurring and sample space

The probability of Event A occurring is: $\mathrm{P(A)} = \frac{\mathrm{n(A)}}{\mathrm{n(S)}}$

In general, A is the total number of ways a specific event can occur. S is the total number of possible outcomes for the event.

Theoretical and Relative frequency

Relative frequency is the probability found from performing an actual trial. For example, tossing a coin 100 times and finding that tails appeared 43 times. Therefore, the probability of getting tails, according to the experiment, is $\frac{43}{100}$.

In most cases, it takes many trials before experimental and theoretical probabilities approach the same value.

Notation

Probability of an event lies from 0 to 1. $A = \{1;2;3;4;5;6;7;8;9;10\}$ however means the elements that are part of Event A.

- $P(A)$ → The probability of Event A occurring
- $P(A')$ → The probability of Event A NOT occurring. It is also known as the complement of A
- $P(A\ or\ B) = P(A \cup B)$ → The probability of A or B occurring. $\cup$ is the symbol for 'or' and is also known as union.
- $P(A\ and\ B) = P(A \cap B)$ → The probability of A and B occurring. $\cap$ is the symbol for 'and' and is also known as intersection.
- $n(A)$ → the number of items in set A.

Inclusive events

Two events that can occur at the same time are inclusive.

$$P(A \cap B) \neq 0$$

$$P(A\ or\ B) = P(A) + P(B) - P(A\ and\ B)$$

Mutually Exclusive events

Two events that are mutually exclusive cannot occur at the same time. There is no intersection.

$$P(A \cap B) = 0$$

$$P(A\ or\ B) = P(A) + P(B)$$

Exhaustive events

Two events A and B are exhaustive if together they cover all the elements of the sample space.

$$P(A\ or\ B) = 1$$

Complementary events

Mutually exclusive, exhaustive events are complementary events. They are the only two possible outcomes. If one event does not occur, the other event must occur

$$P(not\ A) = P(A') = 1 - P(A)$$

The addition rule

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

If the events are mutually exclusive then: $(A \cup B) = P(A) + P(B)$, as $P(A\ and\ B) = 0$.

Venn diagrams

Venn diagrams are a graphical way of representing a sample space and its events. If two events can both happen at the same time, then a Venn diagram is a good way to represent the situation.

Tree diagrams

When there are 2 or more consecutive events taking place, it is often useful to represent the possible solutions on a tree diagram. Tree diagrams are constructed by showing all possible events. They can be used for dependent or independent events. When dealing with tree diagrams always multiply along the branches (horizontal) and add probabilities moving down branches (vertical) at the end. Write the probability of an event occurring at the top of the branches and the actual event at the end of the branch.

RESOURCE 3

REVISION: PAPER 1 2017

basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 10

MATHEMATICS P1

NOVEMBER 2017

MARKS: 100

TIME: 2 hours

This question paper consists of 7 pages.

XMATE1

EASTERN CAPE

Please turn over

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 7 questions.
2. Answer ALL the questions.
3. Clearly show ALL calculations, diagrams, graphs, et cetera that you have used to determine the answers.
4. Answers only will NOT necessarily be awarded full marks.
5. You must use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
6. Round off answers to TWO decimal places, unless stated otherwise.
7. Diagrams are NOT necessarily drawn to scale.
8. Number the answers correctly according to the numbering system used in this question paper.
9. Write neatly and legibly.

QUESTION 1

1.1 Given: $q = \sqrt{b^2 - 4ac}$

1.1.1 Determine the value of q if $a = 2$, $b = -1$ and $c = -4$. Leave your answer in simplest surd form. (2)

1.1.2 State whether q is rational or irrational. (1)

1.1.3 Between which TWO consecutive integers does q lie? (1)

1.2 Factorise the following expressions fully:

1.2.1 $t^2(r-s) - r + s$ (3)

1.2.2 $\dfrac{x^3+1}{x^2-x+1}$ (2)

1.3 Simplify the following completely:

1.3.1 $(2y+3)(7y^2-6y-8)$ (2)

1.3.2 $\dfrac{3}{x^2-9} + \dfrac{2}{(x-3)^2}$ (3)

1.3.3 $\dfrac{3^t - 3^{t-2}}{2.3^t - 3^t}$ (3)
[17]

QUESTION 2

2.1 Given: $4 - 2x < 16$ where $x \in R$

2.1.1 Solve the inequality. (2)

2.1.2 Hence, represent your answer to QUESTION 2.1.1 on a number line. (1)

2.2 Solve simultaneously for x and y:

$-2x - y = 10$ and $3x - 4y = -4$ (4)

2.3 Solve for x:

2.3.1 $\dfrac{x(x-5)}{6} - 1 = 0$ (3)

2.3.2 $c = \sqrt{a + 2x}$ (2)

2.4 Tabelo is currently four times as old as his daughter, Linda. Six years from now, Tabelo will be three times as old as Linda.

Calculate Linda's age currently. (4)
[16]

QUESTION 3

3.1 Consider the linear sequence: 5 ; 8 ; 11 ; b ; 17 ; …

3.1.1 Write down the value of b. (2)

3.1.2 Determine the n^{th} term of the sequence. (2)

3.1.3 Calculate the value of the 15th term of the sequence. (2)

3.1.4 Which term in the sequence is equal to 83? (2)

3.2 Consider the number pattern below created by using the numbers of the sequence 2 ; 6 ; 10 ; 14 ; 18 ; …

				2				
			6		10			
		14		18		22		
	26		30		34		38	
42		…		…		…		…

3.2.1 Calculate the sum of the numbers in the 8th row. (3)

3.2.2 Determine the mean of the numbers in the 20th row. (2)
[13]

QUESTION 4

4.1 Seven years ago, Mrs Grey decided to invest R18 000 in a bank account that paid simple interest at 4,5% p.a.

4.1.1 Calculate how much interest Mrs Grey has earned over the 7 years. (2)

4.1.2 Mrs Grey wants to buy a television set that costs R27 660,00 now. If the average rate of inflation over the last 5 years was 6,7% p.a., calculate the cost of the television set 5 years ago. (3)

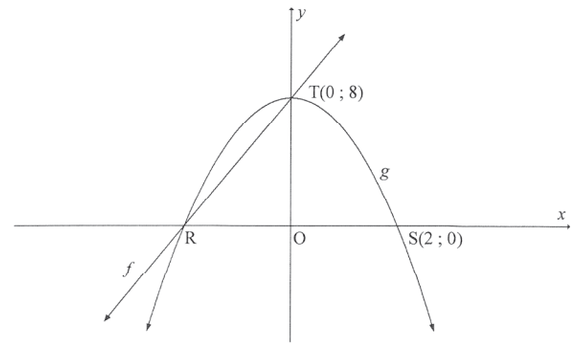
4.1.3 At what rate of simple interest should Mrs Grey have invested her money 7 years ago if she intends buying the television set now using only her original investment of R18 000 and the interest earned over the last 7 years? (3)

4.2 On a certain day the exchange rate between the US dollar and South African rand is \$1 = R12,91. At the same time the exchange rate between the British pound and the South African rand is £1 = R16,52.

Calculate the exchange rate between the British pound and US dollar on that day. (2)
[10]

QUESTION 5

The diagram shows the graphs of $g(x) = ax^2 + q$ and $f(x) = mx + c$.
R and S(2 ; 0) are the x-intercepts of g and T(0 ; 8) is the y-intercept of g.
Graph f passes through R and T.



5.1 Write down the range of g. (1)

5.2 Write down the x-coordinate of R. (1)

5.3 Calculate the values of a and q. (3)

5.4 Determine the equation of f. (3)

5.5 Use the graphs to determine the value(s) of x for which:

5.5.1 $f(x) = g(x)$ (2)

5.5.2 $x \cdot g(x) \leq 0$ (3)

5.6 The graph h is obtained when g is reflected along the line $y = 0$.
Write down the equation of h in the form $h(x) = px^2 + k$. (2)
[15]

QUESTION 6

6.1 The function $p(x) = k^x + q$ is described by the following properties:

- $k > 0; k \neq 1$
- x-intercept at (2 ; 0)
- The horizontal asymptote is $y = -9$

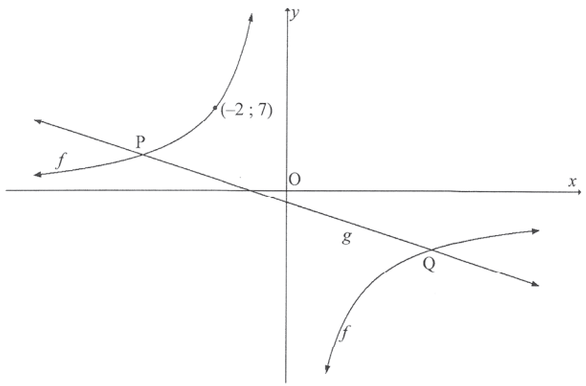
6.1.1 Write down the range of p. (1)

6.1.2 Determine the equation of p. (3)

6.1.3 Sketch the graph of p. Show clearly the intercepts with the axes and the asymptote. (3)

6.2 The sketch below shows the graphs of $f(x) = \frac{k}{x} + w$ and $g(x) = -x - 1$.

The graph g is an axis of symmetry of f. The graphs f and g intersect at P and Q.



6.2.1 Write down the value of w. (1)

6.2.2 The point (–2 ; 7) lies on f. Calculate the value of k. (2)

6.2.3 Calculate the x-coordinates of P and Q. (4)

6.2.4 Write down the values of x for which $\frac{-16}{x} > -x$. (2)
[16]

QUESTION 7

7.1 Two events, A and B, are complementary and make up the entire sample space. Also, $P(A') = 0{,}35$.

7.1.1 Complete the statement: $P(A) + P(B) = \ldots$ (1)

7.1.2 Write down the value of $P(A \text{ and } B)$. (1)

7.1.3 Write down the value of $P(B)$. (1)

7.2 A survey was conducted among 150 learners in Grade 10 at a certain school to establish how many of them owned the following devices: smartphone (S) or tablet (T).

The results were as follows:

- 8 learners did not own either a smartphone or a tablet.
- 20 learners owned both a smartphone and a tablet.
- 48 learners owned a tablet.
- x learners owned a smartphone.

7.2.1 Represent the information above in a Venn diagram. (4)

7.2.2 How many learners owned only a smartphone? (3)

7.2.3 Calculate the probability that a learner selected at random from this group:

(a) Owned only a smartphone (1)

(b) Owned at most one type of device (2)
[13]

TOTAL: 100

SUMMARY NOTES – PAPER 2

ANALYTICAL GEOMETRY

All three formulae require two points: $(x_1;y_1)$ and $(x_2;y_2)$

Gradient

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Distance between two points (the length of a line segment)

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Midpoint (the middle coordinate of a line segment)

$$\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right)$$

USEFUL INFORMATION:

1. Collinear points: points that lie on a straight line
   To prove three points (A, B & C) collinear, prove ${}_mAB = {}_mBC = {}_mAC$ (only two pairs required)

2. Two lines are parallel if their gradients are equal.

3. Two lines are perpendicular if the product of their gradients equals -1.

4. To find the y-intercept of any graph, let $x = 0$
   To find the x-intercept of any graph, let $y = 0$

5. To show that two lines bisect each other: Find the midpoints of each line and if they are the same, then the lines bisect each other.

6. To show that a point lies on a graph: substitute the point and compare the LHS and RHS. If they equal each other, then the point lies on the graph.

7. To find where two graphs intersect, get both into standard form ($y = \ldots$), then let the 2 y-values equal each other and solve for x.
   To find the corresponding y-values, substitute back into any equation.

8. Properties of quadrilaterals (often needed):
   - Diagonals of rhombus bisect each other at 90°
   - Diagonals of a rectangle are equal in length.

9. To prove a quadrilateral is a parallelogram, prove one of the following:
   - diagonals bisect (same mid-point)
   - both pairs of opposite sides parallel (equal gradients)
   - both pairs of opposite sides equal (equal lengths)
   - one pair of opposite sides parallel and equal (equal lengths & equal gradients)

Finding the equation of a straight line

Examples:

Determine the equation of a straight which is:

a) Parallel to the line $=-3x+4$; passing through the point $\mathrm{A}(4;7)$.

$y=-3x+c \rightarrow$ line is $\parallel$

Sub $\mathrm{A}(4;7)$

$\therefore\ 7=-3(4)+c$

$\therefore\ 19=c$

$\therefore\ y=-3x+17$

b) Perpendicular to the line $=\frac{-2}{3}x+2$; with a y-intercept of -3.

$y=\frac{3}{2}x+c \rightarrow$ line is $\perp$ to $y=\frac{-2}{3}x+2$

Sub $c=-3$

$\therefore y=\frac{3}{2}x-3$

c) Parallel to the x-axis and passes through the point $(-4;3)$.

$y=3$ (A line parallel to the x-axis is a horizontal line.)

d) Parallel to the y-axis and passes through the point $(-4;3)$.

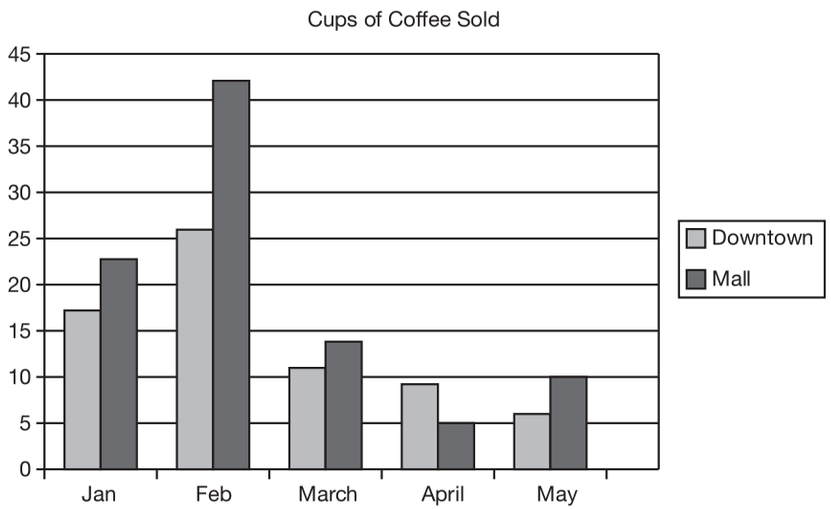
$x=-4$ (A line parallel to the y-axis is a vertical line.)

STATISTICS

Ungrouped data

Representing ungrouped data graphically:

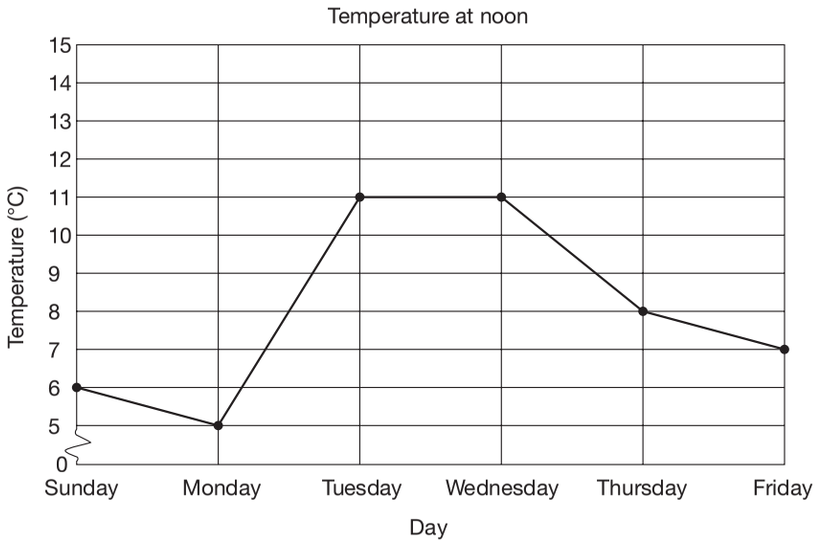
Bar Graph



Bar graphs:

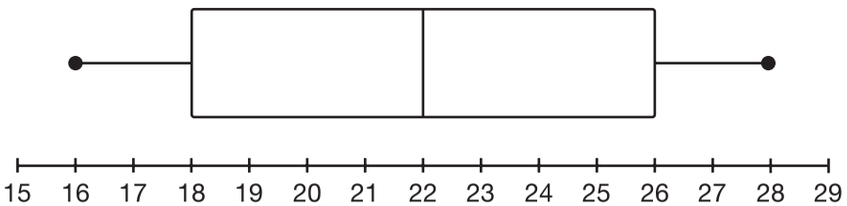
- are drawn to display discrete data.
- have "bins" that can be figured out easily by looking at the data (in this case, months).
- usually has spaces between the bars
- can be used to compare a small number of values (allowance per person, or income per company for example).

Broken line graphs



Broken line graphs represent changes in data over time, such as changes in stock market prices throughout a day or changes in daily temperatures. In such graphs, convention *dictates the independent variable is represented horizontally on the x-axis and the dependant variable is represented vertically on the y-axis.*

Box-and-whisker plot

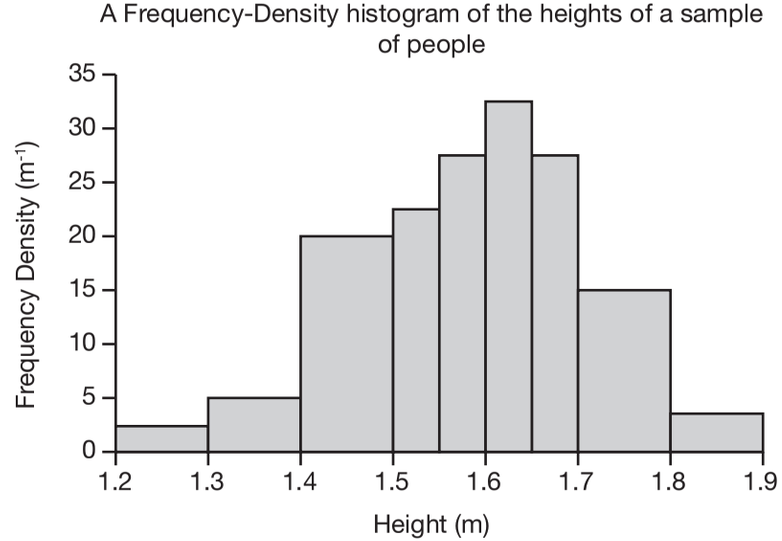


This type of graph is used to show the shape of the distribution, its central value, and its variability. In a box and whisker plot: the ends of the box are the upper and lower quartiles, so the box spans the interquartile range. the median is marked by a vertical line inside the box.

Grouped data

Representing grouped data graphically:

Histogram



Histograms are drawn to display continuous data.
Therefore the bars are touching.

Discrete data has clear separation between the different possible values, while continuous data doesn't. We use bar graphs for displaying discrete data, and histograms for displaying continuous data.

MEASURES OF CENTRAL TENDENCY

Ungrouped data

Mean	Example: List of shoe sizes: 7,9,12,9,8,6,9,12,13,17
Most commonly used measure of central tendency Add all data and divide by number of items in data set. The mean is distorted by outliers	$\frac{7+9+12+9+8+6+9+12+13+17}{10}$ $=\frac{102}{10}$ $=10,2$
Median	
Middlemost score (odd number of data) or average of the two middle scores (even number of data). Numbers need to be ordered	6 7 8 9 9 9 12 12 13 17 $\frac{9+9}{2}=\frac{18}{2}=9$
Mode	
The most frequently occurring score Can have more than one mode	9

Grouped data

Estimate of the mean:

- Calculate the midpoint of each class
- Multiply each midpoint by the frequency for that interval
- Add up and divide by the total number of scores

The modal class:

- This is the interval in which the data occurs most frequently

The median:

- The best way to calculate the median is by drawing a cumulative frequency curve (Ogive
- A way of representing grouped data
- Never goes down and should form an S-shape
- Can also be used to estimate median, quartiles and percentiles

Measures of Dispersion (spread of data)

1. Range:

The difference in the largest and the smallest value in the data set. The bigger the range the more spread out the data is.

2. Quartiles:

Measures of dispersion around the median. The median divides the data into two halves. The lower and upper quartiles divide the data further into quarters.

To find: Lower quartile – $Q_1: \frac{1}{4}(n+1)$

Median – $Q_2: \frac{1}{2}(n+1)$

Upper quartile – $Q_3: \frac{3}{4}(n+1)$

Remember: This gives the *position*!

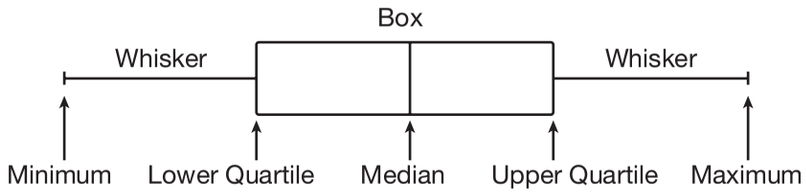
3. Inter-quartile range (IQR)

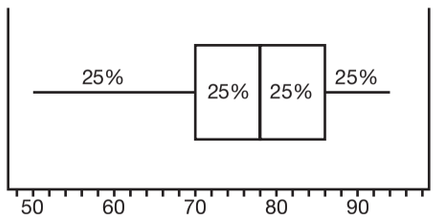
The difference between the upper quartile and lower quartile $(Q_3 - Q_1)$

4. Five number summary:

- Minimum: The smallest value in the set of data
- Lower quartile: The median of the lower half of the values
- Median: The value that divides the data into halves
- Upper quartile: The median of the upper half of the values
- Maximum: The largest value in the data.

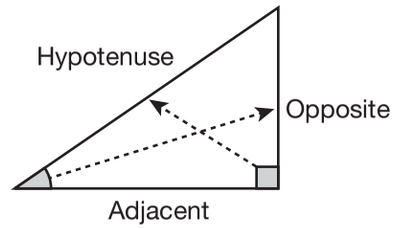
The box and whisker plot is a graphical representation of the five number summary.





TRIGONOMETRY

Right-angled triangles



SOH $\mathbf{S}\text{in}\theta = \dfrac{\mathbf{O}\text{pposite}}{\mathbf{H}\text{ypoteneuse}}$

CAH $\mathbf{C}\text{os}\theta = \dfrac{\mathbf{A}\text{djacent}}{\mathbf{H}\text{ypoteneuse}}$

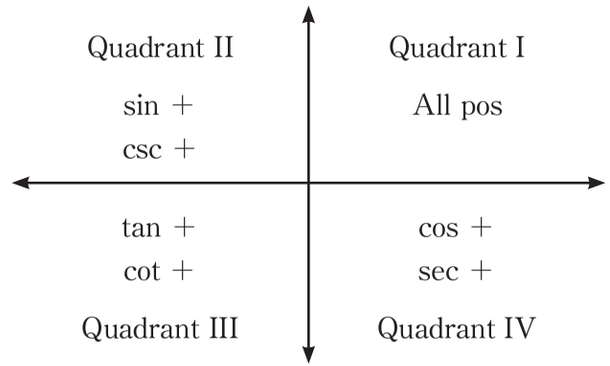
TOA $\mathbf{T}\text{an}\theta = \dfrac{\mathbf{O}\text{pposite}}{\mathbf{A}\text{djacent}}$

$\sin\theta = \dfrac{y}{r}$ $\cos\theta = \dfrac{x}{r}$ $\tan\theta = \dfrac{y}{x}$

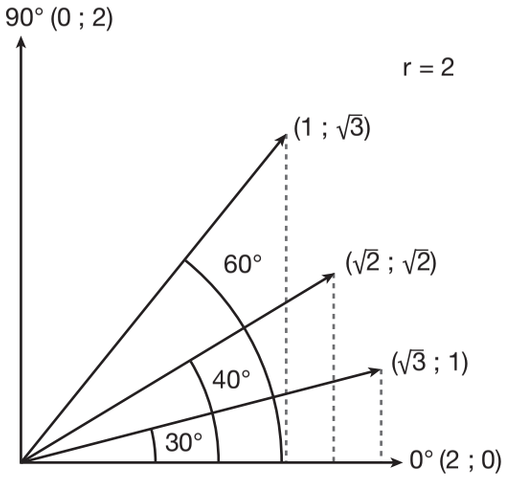
Reciprocal functions

$\sin\theta = \dfrac{1}{\csc\theta}$	$\cos\theta = \dfrac{1}{\sin\theta}$
$\cos\theta = \dfrac{1}{\sec\theta}$	$\sec\theta = \dfrac{1}{\cos\theta}$
$\tan\theta = \dfrac{1}{\cot\theta}$	$\cot\theta = \dfrac{1}{\tan\theta}$

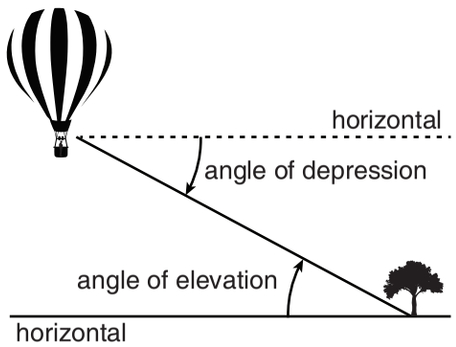
Quadrants



Special angles

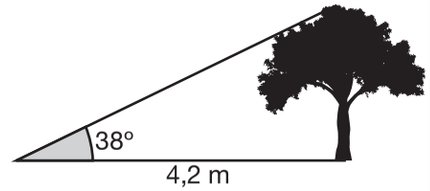


2-dimensional problems



Example

Find the height of the tree



$$\tan 38^o = \frac{\text{tree}}{4,2}$$
$$4,2 \times \tan 38^o = \text{tree}$$
$$3,28\text{m} = \text{tree}$$

Solving trigonometric equations (finding the size of an angle)

Steps:

- Get the trig function of the angle on its own on one side
- Use the 2nd function on the calculator: shift ; trig function ; ratio

Examples:

$$\cos\theta = 0,85$$
(shift ; cos ; 0,85)
$$\therefore \theta = 31,79^o$$

$$2\sin(x + 20^o) = 1,53$$
$$\sin(x + 20^o) = \frac{1,53}{2}$$
(shift ; sin ; $\frac{1,53}{2}$)
$$\therefore x + 20^o = 49,91^o$$
$$\therefore x = 29,91^o$$

Using diagrams to determine numerical values of ratios (Pythagoras questions)

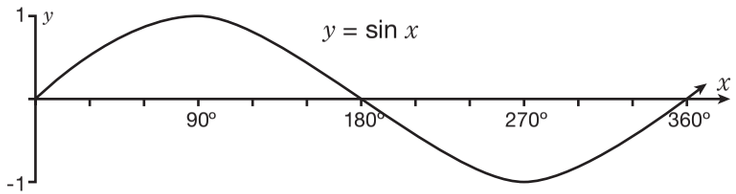
Steps:

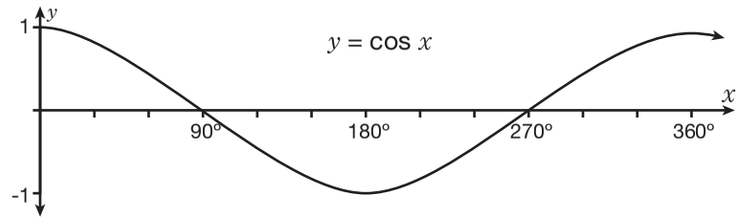
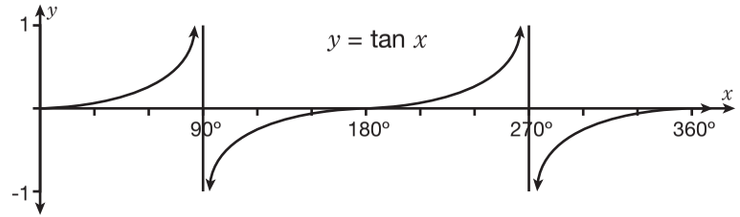
- Using BOTH pieces of info, decide which quadrant you need to work in
- Make a sketch, drawing the triangle in the correct quadrant.
- Fill in the two known sides from the given info
- Use Pythagoras to find the third side
- Summarise the info you now know regarding what x, y and r are all equal to
  (Be careful of signs here!)
- Use this information to complete the question using substitution.

NB: Need to know trig ratios in terms of x, y and r

Don't even consider the 'question' (find…) until the groundwork is done.

Trig graphs

Sine graph	A function of the form $y = \sin x$ with a period of 360° 

Cosine graph	A function of the form $y = \cos x$ with a period of 360° 
Tangent graph	A function of the form $y = \tan x$ with a period of 360° 

Period: The number of degrees it takes for the graph to complete a pattern before it gets repeated

Amplitude: The maximum deviation from the x-axis.
Can be found by using: ½ (distance between maximum and minimum values)

Vertical shifts of the sine, cosine and tangent graphs

$$y = \sin x + q \quad y = \cos x + q \quad y = \tan x + q$$

'q' represents the units the basic graph shifts vertically (up or down)

It will change the maximum and minimum value and therefore the range.

It will NOT change the amplitude or period.

The vertical distance (size) remains the same.

Amplitude shifts of the sine and cosine graphs:

$$y = a \sin x \qquad y = a \cos x$$

The graph is 'stretched' or 'squashed' from its original position. The vertical distance (size) changes – it becomes longer or shorter.

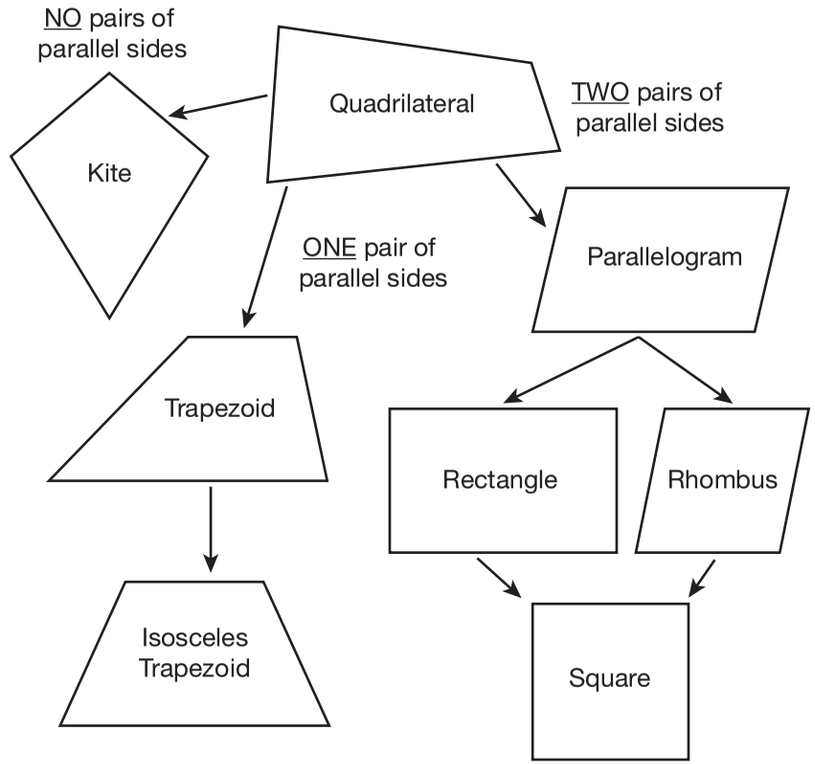
The value of 'a':

- gives the new amplitude. If 'a' is negative, this affects the direction of the graph
- changes the maximum and minimum value and therefore the range.
- does NOT change the period. It remains 360°.

a	Amplitude	Stretches ($a > 1$) or squashes ($0 < a < 1$) or flips over if $a < 0$
q	Vertical shift	Number of units shifted up or down the y-axis

EUCLIDEAN GEOMETRY AND MEASUREMENT

Family tree of quadrilaterals showing how they relate to each other



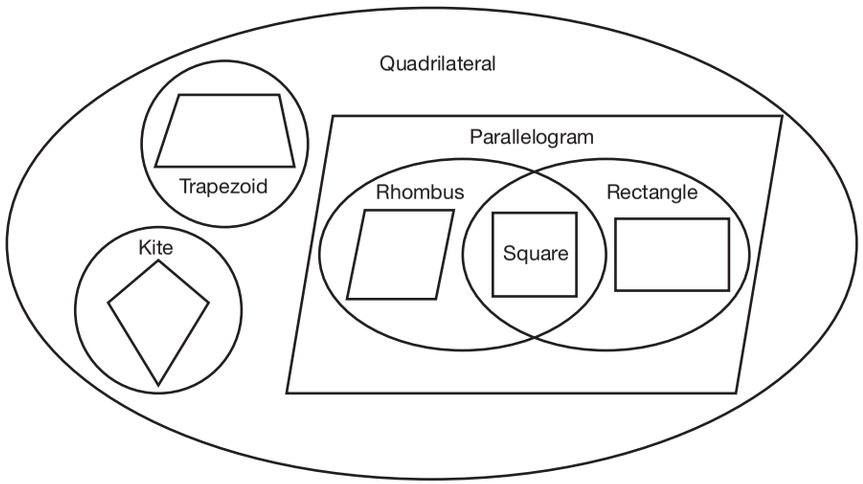
Definitions of the 6 quadrilaterals

Parallelogram	A quadrilateral with both pairs of opposite sides parallel
Rectangle	A parallelogram with 4 right angles
Rhombus	A parallelogram with 4 equal sides

Square	A parallelogram with 4 equal sides and 4 right angles
Kite	A quadrilateral with 2 pairs of adjacent sides equal and no opposite sides equal.
Trapezium	A quadrilateral with one pair of opposite sides parallel

Properties of quadrilaterals

This diagram shows how each shape relates to another. For example, the rhombus is inside the parallelogram which is inside the quadrilateral – therefore, the rhombus is a quadrilateral and more specifically it is also a parallelogram but then has at least one extra feature (4 equal sides) that make it a rhombus. The diagram shows how the quadrilateral is a very general shape whereas the square is a more specific shape. This can also be seen in the summary of properties below.



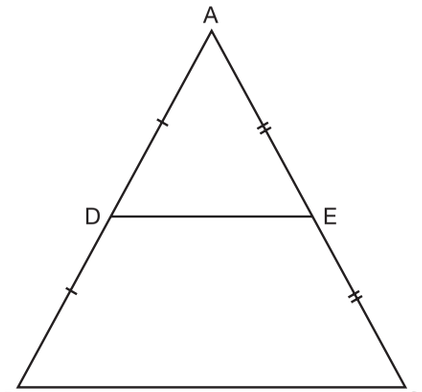
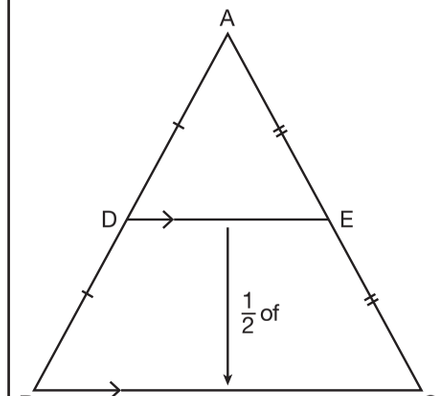
Property	Parallelo-gram	Rectangle	Rhombus	Square
Opposite sides parallel	✓	✓	✓	✓
Opposite angles equal	✓	✓	✓	✓
Opposite sides equal	✓	✓	✓	✓
Diagonals bisect each other	✓	✓	✓	✓
Diagonals are equal		✓		✓
Diagonals are perpendicular			✓	✓
Diagonals bisect opposite angles			✓	✓
All sides equal			✓	✓
All angles right angles		✓		✓

How to prove a quadrilateral is a:

1. Parallelogram ● both pairs of opposite sides parallel or ● both pairs of opposite sides equal or ● one pair of opposite sides equal and parallel or ● diagonals bisect each other or ● opposite angles equal	**2. Rectangle** It must be a parallelogram with: ● equal diagonals or ● one right angle
3. Rhombus It must be a parallelogram with: ● 4 equal sides or ● diagonals bisect at right angles	**4. Square** It must be a ● rhombus with one right angle or ● rectangle with 2 adjacent sides equal

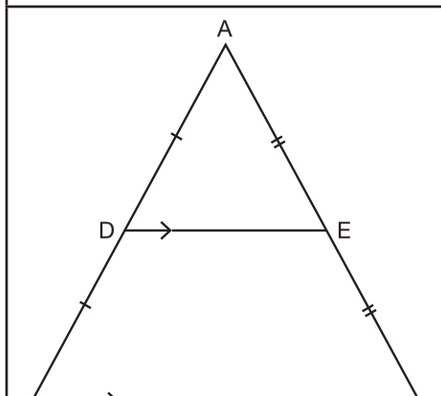
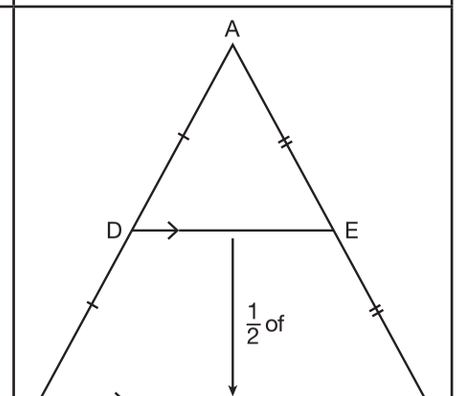
The midpoint theorem

The line joining the midpoints of two sides of a triangle is parallel to the third side and equal to half the length of the third side. (Abbreviated reason – midpt theorem)

Given:	Then:
	

Converse of midpoint theorem

The line drawn from the midpoint of one side of a triangle, parallel to another side, bisects the third side. (Abbreviated reason – line through midpt ∥ to 2nd side

Given:	Then:
	

MEASUREMENT

Volume

The space taken up by a 3D object. To find volume, the area of the base is multiplied by the perpendicular height. This only works for right prisms

VOLUME OF:	AREA OF BASE × HEIGHT
Cube	$(l \times l) \times ht = l \times l \times l = l^3$
Rectangular prism	$(l \times b) \times h = lbh$
Triangular prism	$(\frac{1}{2}b \times h) \times H$ Note: The first 'h' represents the height of the triangle in order to find the area of the base. The 2nd 'H' represents the height of the prism.
Cylinder	$\pi r^2 \times ht = \pi r^2 h$

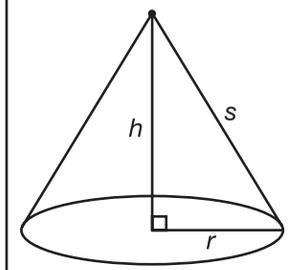
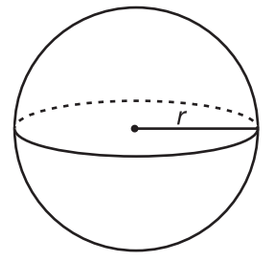
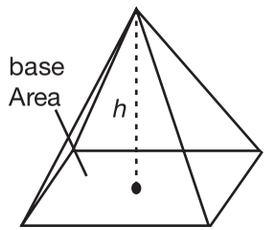
Surface Area

The area taken up by the net of a 3D solid. The sum of the area of all the faces.The following basic shape formulae are needed to find the area of the faces on any 3-dimensional shape.

SHAPE	AREA FORMULA
Square	$l \times l = l^2$
Rectangle	$l \times b$
Triangle	$\frac{1}{2}b \times height$
Circle	πr^2

Cones, pyramids and spheres

(These formulae are given in an assessment)

Shape	Surface Area	Volume
Cone  	$\pi rs + \pi r^2$ (the slant height is sometimes named l)	$\frac{1}{3}\pi r^2 h$
Sphere  	$4\pi r^2$	$\frac{4}{3}\pi r^3$
Pyramid  	Sum of the areas of: ● the base and ● the triangles* *the number of triangles depends on the type of base	$\frac{1}{3}$ (area of base) $\times h$ (remember that the base could be any polygon but generally the square, rectangle and triangle would be used)

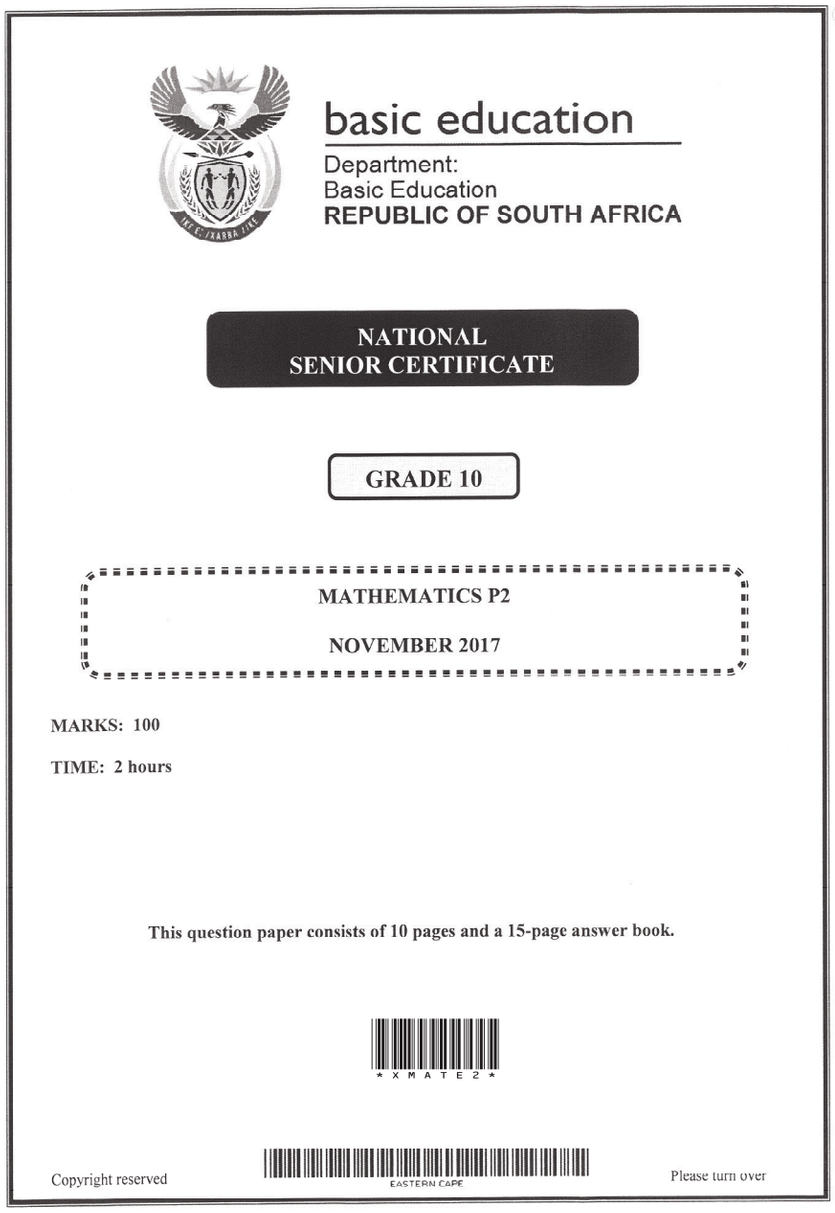
The effect on volume when multiplying any dimension by a constant factor k:

- If only one dimension is changed by a value of k, the volume will be k times bigger
- If only two dimensions are changed by a value of k, the volume will be k^2 times bigger
- If all three dimensions are changed by a value of k, the volume will be k^3 times bigger.

REVISION

RESOURCE 5

REVISION WEEK 2: PAPER 2 2017



basic education

Department:
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NATIONAL
SENIOR CERTIFICATE

GRADE 10

MATHEMATICS P2

NOVEMBER 2017

MARKS: 100

TIME: 2 hours

This question paper consists of 10 pages and a 15-page answer book.

XMATE2

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EASTERN CAPE

Please turn over

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 9 questions.
2. Answer ALL the questions in the SPECIAL ANSWER BOOK provided.
3. Clearly show ALL calculations, diagrams, graphs, et cetera that you have used to determine the answers.
4. Answers only will NOT necessarily be awarded full marks.
5. Round off answers to TWO decimal places, unless stated otherwise.
6. Diagrams are NOT necessarily drawn to scale.
7. You must use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
8. Write neatly and legibly.

QUESTION 1

The data below shows the number of laptops sold by 15 sales agents during the last financial year.

43 48 62 52 46 90 58 37 48 73 84 68 54 34 78

1.1 Determine the median of the number of laptops sold. (2)

1.2 Calculate the range of the data. (2)

1.3 Calculate the interquartile range (IQR). (3)

1.4 Draw a box and whisker diagram for the data above. (3)
[10]

QUESTION 2

A learner did a project on climate change. At 14:00 each day, she recorded the temperature (in °C) for a certain town. The information is given in the frequency table below.

TEMPERATURE (IN °C)	FREQUENCY
$20 \leq T < 24$	2
$24 < T < 28$	4
$28 \leq T < 32$	9
$32 \leq T < 36$	5
$36 \leq T < 40$	7
$40 \leq T < 44$	3

2.1 For how many days did the learner collect the data? (1)

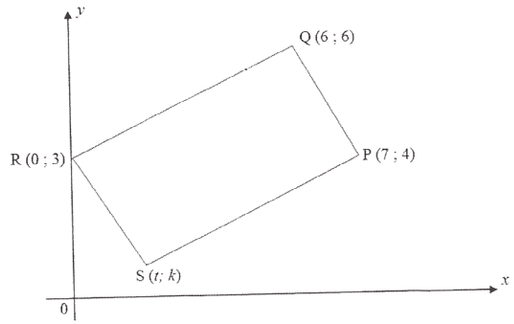
2.2 Write down the modal class for the data. (1)

2.3 Estimate the mean of the data. (3)

2.4 Calculate the percentage of days on which the temperature was at least 28 °C. (2)
[7]

QUESTION 3

In the diagram below, P(7 ; 4), Q(6 ; 6), R(0 ; 3) and S(t ; k) are the vertices of quadrilateral PQRS.



3.1 Calculate the length of PQ. Leave your answer in surd form. (2)

3.2 If $T\left(\frac{7}{2};\frac{7}{2}\right)$ is the midpoint of QS, determine the coordinates of S. (3)

3.3 If the coordinates of S are (1 ; 1), show that PR = QS. (2)

3.4 Show that QR $\perp$ RS. (4)

3.5 Hence, what type of special quadrilateral is PQRS? Motivate your answer. (2)

3.6 Calculate the size of $R\hat{S}Q$. (3)
[16]

QUESTION 4

4.1 Given $4\cot\theta + 3 = 0$ and $0° < \theta < 180°$.

4.1.1 Use a sketch to determine the value of the following. DO NOT use a calculator.

(a) $\cos\theta$ (4)

(b) $\frac{3\sin\theta\sec\theta}{\tan\theta}$ (4)

4.1.2 Hence, show that $\sin^2\theta - 1 = -\cos^2\theta$. (3)

4.2 Simplify the following expression WITHOUT using a calculator:

$\cos 30°\tan 60° + \text{cosec}^2 45°\sin^2 60°$ (3)

4.3 Solve for θ correct to TWO decimal places, if

$\frac{4}{3}\sin\theta = \cos 37°$ and $0° \le \theta \le 90°$. (2)
[16]

QUESTION 5

Given $f(x) = \sin x - 1$ and $g(x) = 2\cos x$ for $0° \le x \le 270°$.

5.1 Sketch, on the grid provided in the ANSWER BOOK, the graph of f and g for $0° \le x \le 270°$. (6)

5.2 Write down the following:

5.2.1 Amplitude of g (1)

5.2.2 Range of f (2)

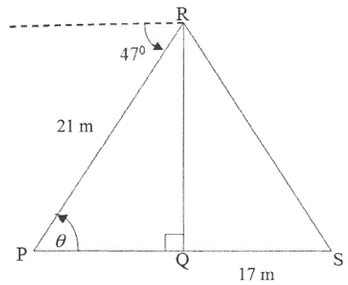
5.3 Use your graph to determine the following:

5.3.1 Number of solutions to $f(x) = g(x)$ in the interval $0° \le x \le 270°$ (1)

5.3.2 Value(s) of x in the interval $0° \le x \le 180°$ for which $\sin x - 2 + 2\cos x$ (3)
[13]

QUESTION 6

RQ is a vertical pole. The foot of the pole, Q, is on the same horizontal plane as P and S. The pole is anchored with wire cables RS and RP. The angle of depression from the top of the pole to point P is 47°. PR is 21 m and QS is 17 m. $R\hat{P}Q = \theta$.



6.1 Write down the size of θ. (1)

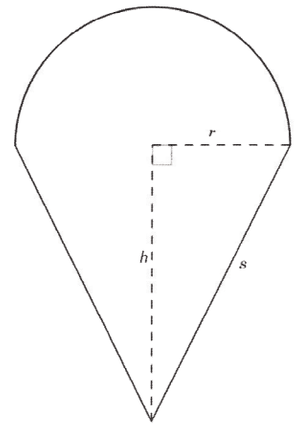
6.2 Calculate the length of RQ. (3)

6.3 Hence, calculate the size of $\hat{S}$. (2)

6.4 If P, Q and S lie in a straight line, how far apart are the anchors of the wire cables? (4)
[10]

QUESTION 7

The diagram below shows the cross-section of a solid made up of a hemisphere placed on top of a right circular cone with radius r and slant height s. The perpendicular height of the cone, h, is 6,5 cm and the volume of the cone is 83,38 cm^3.



Formulae:

Surface area of sphere = $4\pi r^2$

Volume of sphere = $\frac{4}{3}\pi r^3$

Surface area of cone = $\pi r^2 + \pi r s$

Volume of cone = $\frac{1}{3}\pi r^2 h$

Calculate, correct to TWO decimal places:

7.1 The radius, r, of the cone (2)

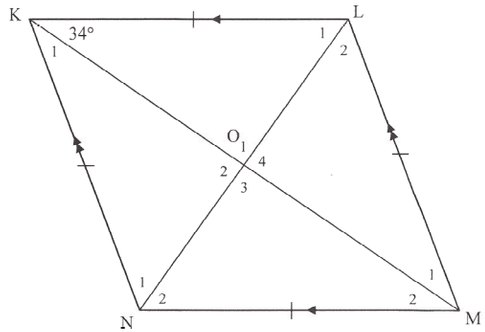
7.2 The slant height, s, of the cone (2)

7.3 The surface area of the solid (2)
[6]

Give reasons for ALL statements in QUESTIONS 8 and 9.

QUESTION 8

8.1 KLMN is a rhombus with diagonals intersecting at O. $L\hat{K}M = 34°$.

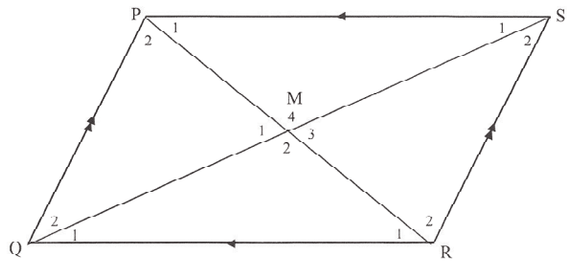


8.1.1 Write down the size of $\hat{O}_1$. (1)

8.1.2 Calculate the size of $\hat{L}_1$. (2)

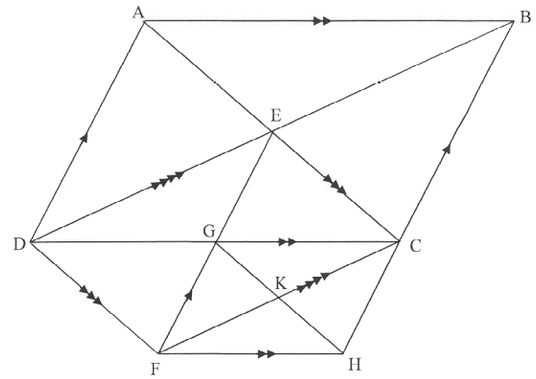
8.1.3 Calculate the size of $K\hat{N}M$. (2)

8.2 Given parallelogram PQRS with diagonals PR and QS intersecting at M.



Prove that the diagonals bisect each other. (4)

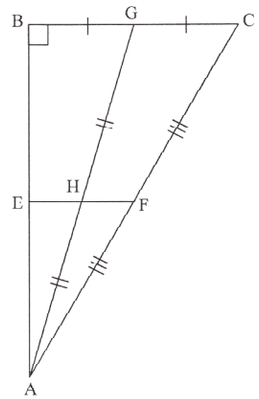
8.3 In the diagram, ABCD is a parallelogram with diagonals intersecting at E. The diagonals of parallelogram DECF intersect at G. The diagonals of parallelogram FGCH intersect at K.



Prove that DB = 4KC. (4)
[13]

QUESTION 9

ΔABC is right-angled at B. F and G are the midpoints of AC and BC respectively. H is the midpoint of AG. E lies on AB such that FHE is a straight line.



9.1 Prove that E is the midpoint of AB. (3)

9.2 If EH = 3,5 cm and the area of $\Delta AEH = 9{,}5 cm^2$, calculate the length of AB. (3)

9.3 Hence, calculate the area of ΔABC. (3)
[9]

TOTAL: 100

GRADE: 10 TERM: 4

REVISION

RESOURCE 6

REVISION WEEK 3: PAPER 1 EXEMPLAR

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NATIONAL SENIOR CERTIFICATE

GRADE 10

MATHEMATICS P1

EXEMPLAR 2012

MARKS: 100

TIME: 2 hours

This question paper consists of 6 pages.

 Please turn over

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 7 questions.
2. Answer ALL the questions.
3. Clearly show ALL calculations, diagrams, graphs, et cetera that you have used in determining your answers.
4. Answers only will NOT necessarily be awarded full marks.
5. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
6. If necessary, round off answers to TWO decimal places, unless stated otherwise.
7. Diagrams are NOT necessarily drawn to scale.
8. Number the answers correctly according to the numbering system used in this question paper.
9. Write neatly and legibly.

QUESTION 1

1.1 Simplify the following expressions fully:

1.1.1 $(m-2n)(m^2-6mn-n^2)$ (3)

1.1.2 $\frac{x^3+1}{x^2-x+1}-\frac{4x^2-3x-1}{4x+1}$ (5)

1.2 Factorise the following expressions fully:

1.2.1 $6x^2-7x-20$ (2)

1.2.2 $a^2+a-2ab-2b$ (3)

1.3 Determine, **without the use of a calculator**, between which two consecutive integers $\sqrt{51}$ lies. (2)

1.4 Prove that $0,\dot{2}\dot{4}\dot{5}$ is rational. (4)
[19]

QUESTION 2

2.1 Determine, **without the use of a calculator**, the value of x in each of the following:

2.1.1 $x^2-4x=21$ (3)

2.1.2 $96=3x^{\frac{5}{4}}$ (3)

2.1.3 $R=\frac{2\sqrt{x}}{3S}$ (2)

2.2 Solve for p and q simultaneously if:

$$6q+7p=3$$
$$2q+p=5$$

(5)
[13]

QUESTION 3

3.1 $3x + 1$; $2x$; $3x - 7$….. are the first three terms of a linear number pattern.

3.1.1 If the value of x is three, write down the FIRST THREE terms. (3)

3.1.2 Determine the formula for T_n, the general term of the sequence. (2)

3.1.3 Which term in the sequence is the first to be less than – 31? (3)

3.2 The multiples of three form the number pattern: 3 ; 6 ; 9 ; 12 ; ...
Determine the 13^{th} number in this pattern that is even. (3)
[11]

QUESTION 4

4.1 Thando has R4 500 in his savings account. The bank pays him a compound interest rate of 4,25% p.a. Calculate the amount Thando will receive if he decides to withdraw the money after 30 months. (3)

4.2 The following advertisement appeared with regard to buying a bicycle on a hire-purchase agreement loan:

Purchase price	*R5 999*
Required deposit	*R600*
Loan term	*Only 18 months, at 8% p.a. simple interest*

4.2.1 Calculate the monthly amount that a person has to budget for in order to pay for the bicycle. (6)

4.2.2 How much interest does one have to pay over the full term of the loan? (1)

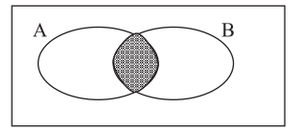
4.3 The following information is given:

1 ounce = 28,35 g
$1 = R8,79

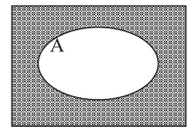
Calculate the rand value of a 1 kg gold bar, if 1 ounce of gold is worth $978, 34. (4)
[14]

QUESTION 5

5.1 What expression BEST represents the shaded area of the following Venn diagrams?

5.1.1 

(1)

5.1.2 

(1)

5.2 State which of the following sets of events is mutually exclusive:

A Event 1: The learners in Grade 10 in the swimming team
Event 2: The learners in Grade 10 in the debating team

B Event 1: The learners in Grade 8
Event 2: The learners in Grade 12

C Event 1: The learners who take Mathematics in Grade 10
Event 2: The learners who take Physical Sciences in Grade 10 (1)

5.3 In a class of 40 learners the following information is TRUE:

- 7 learners are left-handed
- 18 learners play soccer
- 4 learners play soccer and are left-handed
- All 40 learners are either right-handed or left-handed

Let L be the set of all left-handed people and S be the set of all learners who play soccer.

5.3.1 How many learners in the class are right-handed and do NOT play soccer? (1)

5.3.2 Draw a Venn diagram to represent the above information. (4)

5.3.3 Determine the probability that a learner is:

(a) Left-handed or plays soccer (3)

(b) Right-handed and plays soccer (2)
[13]

QUESTION 6

Given: $f(x)=\frac{3}{x}+1$ and $g(x)=-2x-4$

6.1 Sketch the graphs of f and g on the same set of axes. (4)

6.2 Write down the equations of the asymptotes of f. (2)

6.3 Write down the domain of f. (2)

6.4 Solve for x if $f(x)=g(x)$. (5)

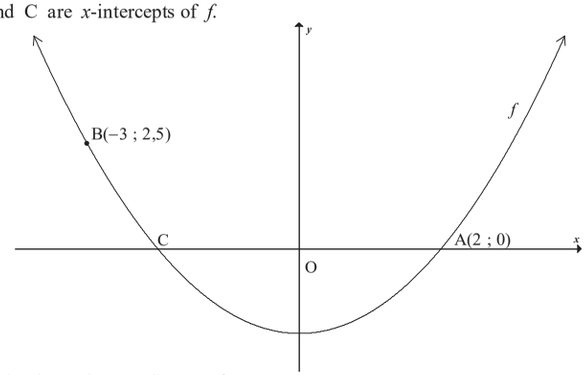
6.5 Determine the values of x for which $-1\le g(x)<3$. (3)

6.6 Determine the y-intercept of k if $k(x) = 2g(x)$. (2)

6.7 Write down the coordinates of the x- and y-intercepts of h if h is the graph of g reflected about the y-axis. (2)
[20]

QUESTION 7

The graph of $f(x)=ax^2+q$ is sketched below.
Points A(2 ; 0) and B(– 3 ; 2,5) lie on the graph of f.
Points A and C are x-intercepts of f.



7.1 Write down the coordinates of C. (1)

7.2 Determine the equation of f. (3)

7.3 Write down the range of f. (1)

7.4 Write down the range of h, where $h(x)=-f(x)-2$. (2)

7.5 Determine the equation of an exponential function, $g(x) = b^x + q$, with range $y > -4$ and which passes through the point A. (3)
[10]

TOTAL: 100

GRADE: 10 TERM: 4

REVISION

RESOURCE 7

REVISION WEEK 3: PAPER 2 EXEMPLAR

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GRADE 10

MATHEMATICS P2

EXEMPLAR 2012

MARKS: 100

TIME: 2 hours

This question paper consists of 10 pages and 1 diagram sheet.

 Please turn over

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of 9 questions.
2. Answer ALL the questions.
3. Clearly show ALL calculations, diagrams, graphs, et cetera which you have used in determining the answers.
4. Answers only will NOT necessarily be awarded full marks.
5. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
6. If necessary, round off answers to TWO decimal places, unless stated otherwise.
7. Diagrams are NOT necessarily drawn to scale.
8. ONE diagram sheet for QUESTION 6.1.1 and QUESTION 9 is attached at the end of this question paper. Write your centre number and examination number on this sheet in the spaces provided and insert the sheet inside the back cover of your ANSWER BOOK.
9. Number the answers correctly according to the numbering system used in this question paper.
10. Write neatly and legibly.

QUESTION 1

A baker keeps a record of the number of scones that he sells each day. The data for 19 days is shown below.

31	36	62	74	65	63	60	34	46	56
37	46	40	52	48	39	43	31	66	

1.1 Determine the mean of the given data. (2)

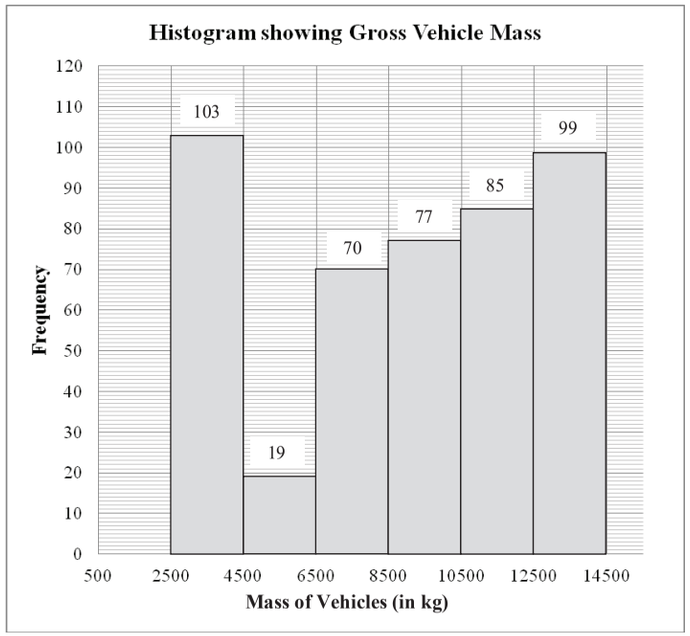
1.2 Rearrange the data in ascending order and then determine the median. (2)

1.3 Determine the lower and upper quartiles for the data. (2)

1.4 Draw a box and whisker diagram to represent the data. (2)
[8]

QUESTION 2

Traffic authorities are concerned that heavy vehicles (trucks) are often overloaded. In order to deal with this problem, a number of weighbridges have been set up along the major routes in South Africa. The gross (total) vehicle mass is measured at these weigh bridges. The histogram below shows the data collected at a weighbridge over a month.



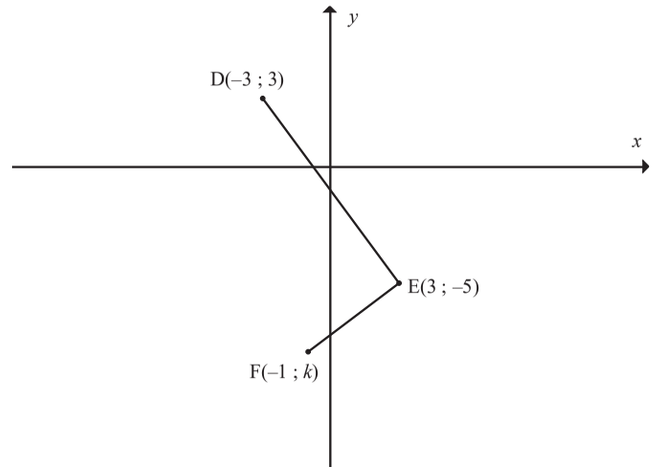
2.1 Write down the modal class of the data. (1)

2.2 Estimate the mean gross vehicle mass for the month. (5)

2.3 Which of the measures of central tendency, the modal class or the estimated mean, will be most appropriate to describe the data set? Explain your choice. (1)
[7]

QUESTION 3

3.1 In the diagram below, D(–3 ; 3), E(3 ; –5) and F(–1 ; k) are three points in the Cartesian plane.



3.1.1 Calculate the length of DE. (2)

3.1.2 Calculate the gradient of DE. (2)

3.1.3 Determine the value of k if $D\hat{E}F = 90°$. (4)

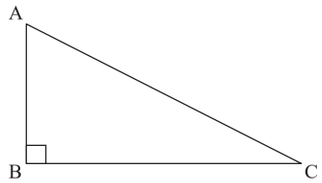
3.1.4 If $k = -8$, determine the coordinates of M, the midpoint of DF. (2)

3.1.5 Determine the coordinates of a point G such that the quadrilateral DEFG is a rectangle. (4)

3.2 C is the point (1 ; –2). The point D lies in the second quadrant and has coordinates (x ; 5). If the length of CD is $\sqrt{53}$ units, calculate the value of x. (4)
[18]

QUESTION 4

4.1 In the diagram below, ΔABC is right-angled at B.



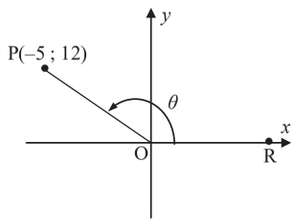
Complete the following statements:

4.1.1 $\sin C = \frac{AB}{\ldots}$ (1)

4.1.2 $\ldots A = \frac{AB}{BC}$ (1)

4.2 **Without using a calculator**, determine the value of: $\frac{\sin 60° . \tan 30°}{\sec 45°}$ (4)

4.3 In the diagram, P(–5 ; 12) is a point in the Cartesian plane and $R\hat{O}P = \theta$.



Determine the value of:

4.3.1 $\cos\theta$ (3)

4.3.2 $\text{cosec}^2\theta + 1$ (3)
[12]

QUESTION 5

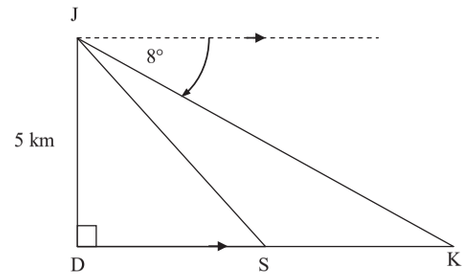
5.1 Solve for x, correct to ONE decimal place, in each of the following equations where $0° \leq x \leq 90°$.

5.1.1 $5\cos x = 3$ (2)

5.1.2 $\tan 2x = 1{,}19$ (3)

5.1.3 $4\sec x - 3 = 5$ (4)

5.2 An aeroplane at J is flying directly over a point D on the ground at a height of 5 kilometres. It is heading to land at point K. The angle of depression from J to K is 8°. S is a point along the route from D to K.



5.2.1 Write down the size of $J\hat{K}D$. (1)

5.2.2 Calculate the distance DK, correct to the nearest metre. (3)

5.2.3 If the distance SK is 8 kilometres, calculate the distance DS. (1)

5.2.4 Calculate the angle of elevation from point S to J, correct to ONE decimal place. (2)
[16]

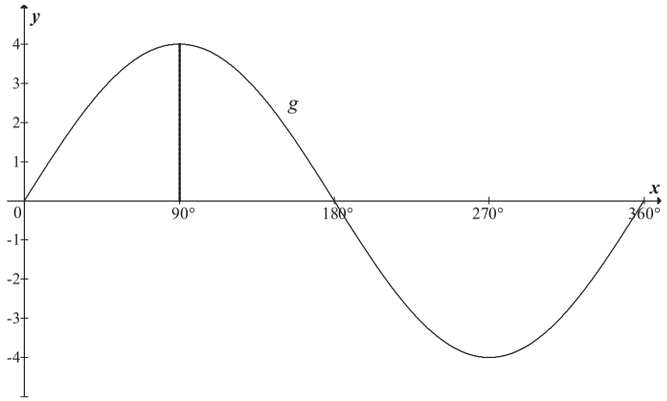
QUESTION 6

6.1 Consider the function $y = 2\tan x$.

6.1.1 Make a neat sketch of $y = 2\tan x$ for $0° \le x \le 360°$ on the axes provided on DIAGRAM SHEET 1. Clearly indicate on your sketch the intercepts with the axes and the asymptotes. (4)

6.1.2 If the graph of $y = 2\tan x$ is reflected about the x-axis, write down the equation of the new graph obtained by this reflection. (1)

6.2 The diagram below shows the graph of $g(x) = a\sin x$ for $0° \le x \le 360°$.

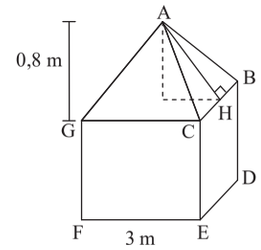


6.2.1 Determine the value of a. (1)

6.2.2 If the graph of g is translated 2 units upwards to obtain a new graph h, write down the range of h. (2)
[8]

QUESTION 7

7.1 The roof of a canvas tent is in the shape of a right pyramid having a perpendicular height of 0,8 metres on a square base. The length of one side of the base is 3 metres.



7.1.1 Calculate the length of AH. (2)

7.1.2 Calculate the surface area of the roof. (2)

7.1.3 If the height of the walls of the tent is 2,1 metres, calculate the total amount of canvas required to make the tent if the floor is excluded. (2)

7.2 A metal ball has a radius of 8 millimetres.

7.2.1 Calculate the volume of metal used to make this ball, correct to TWO decimal places. (2)

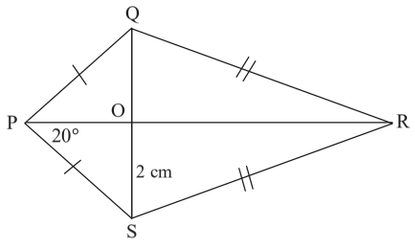
7.2.2 If the radius of the ball is doubled, write down the ratio of the new volume : the original volume. (2)

7.2.3 You would like this ball to be silver plated to a thickness of 1 millimetre. What is the volume of silver required? Give your answer correct to TWO decimal places. (2)
[12]

Give reasons for your statements in the answers to QUESTIONS 8 and 9.

QUESTION 8

PQRS is a kite such that the diagonals intersect in O.
OS = 2 cm and $O\hat{P}S = 20°$.



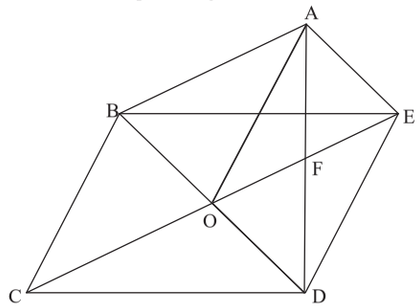
8.1 Write down the length of OQ. (2)

8.2 Write down the size of $P\hat{O}Q$. (2)

8.3 Write down the size of $Q\hat{P}S$. (2)
[6]

QUESTION 9

In the diagram, BCDE and AODE are parallelograms.



9.1 Prove that OF || AB. (4)

9.2 Prove that ABOE is a parallelogram. (4)

9.3 Prove that $\Delta ABO \equiv \Delta EOD$. (5)
[13]

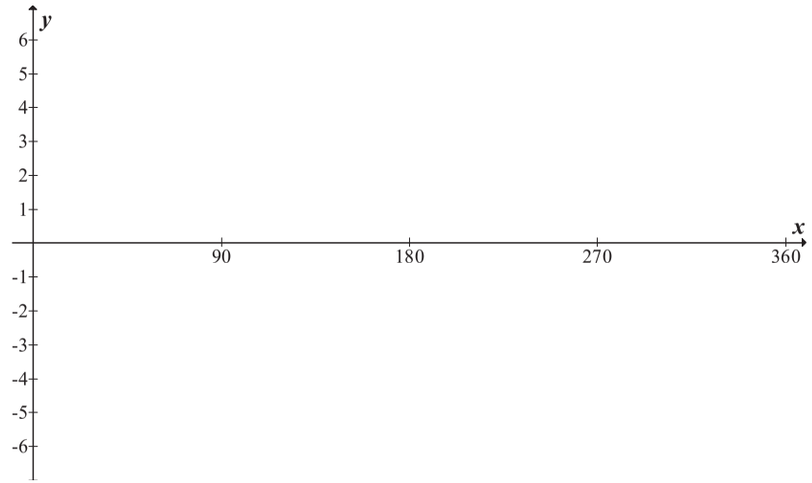
TOTAL: 100

CENTRE NUMBER:

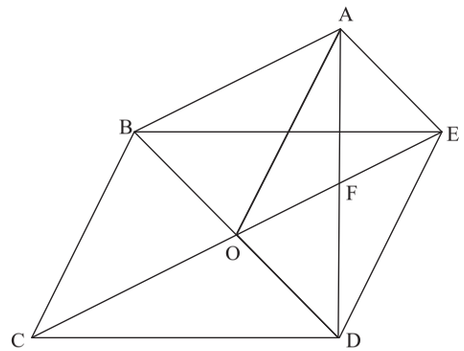
EXAMINATION NUMBER:

DIAGRAM SHEET 1

QUESTION 6.1.1



QUESTION 9



GRADE: 10 TERM: 4

REVISION

RESOURCE 8

REVISION WEEK 3: MEMORANDUM PAPER 1 EXEMPLAR

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GRADE 10

MATHEMATICS P1

EXEMPLAR 2012

MEMORANDUM

MARKS: 100

This memorandum consists of 7 pages.

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QUESTION 1

1.1.1	$(m-2n)(m^2-6mn-n^2)$ $=m^3-6m^2n-mn^2-2m^2n+12mn^2+2n^3$ $=m^3-8m^2n+11mn^2+2n^3$	✓ expansion ✓ m^3 ; $+2n^3$ ✓ $-8m^2n+11mn^2$ (3)
1.1.2	$\frac{x^3+1}{x^2-x+1}-\frac{4x^2-3x-1}{4x+1}$ $=\frac{(x+1)(x^2-x+1)}{x^2-x+1}-\frac{(4x+1)(x-1)}{4x+1}$ $=x+1-(x-1)$ $=2$	✓✓ $(x+1)(x^2-x+1)$ ✓ $(4x+1)(x-1)$ ✓ $x+1-(x-1)$ ✓answer (5)
1.2.1	$6x^2-7x-20$ $=(3x+4)(2x-5)$	✓ $(3x+4)$ ✓ $(2x-5)$ (2)
1.2.2	$a^2+a-2ab-2b$ $=a(a+1)-2b(a+1)$ $=(a+1)(a-2b)$	✓grouping ✓ $(1+a)$ ✓ $(a-2b)$ (3)
1.3	Since $7^2=49$ and $8^2=64$ and $49<51<64$, $7<\sqrt{51}<8$ i.e. $\sqrt{51}$ lies between 7 and 8	✓ $49<51<64$ ✓ answer (2)
1.4	Let $x=0,\dot{2}\dot{4}\dot{5}$ Then $1000x=245,\dot{2}\dot{4}\dot{5}$ i.e. $999x=245$ i.e. $x=\frac{245}{999}$ Therefore x is a rational number.	✓ introduce variable ✓ $1000x=245,\dot{2}\dot{4}\dot{5}$ ✓ $999x=245$ ✓ $x=\frac{245}{999}$ (4) **[19]**

QUESTION 2

2.1.1	$x^2-4x=21$ $x^2-4x-21=0$ $(x+3)(x-7)=0$ $x+3=0$ or $x-7=0$ $x=-3$ $x=7$	✓ standard form ✓ factors ✓ answers (3)
2.1.2	$96=3x^{\frac{5}{4}}$ $32=x^{\frac{5}{4}}$ $x=(32)^{\frac{4}{5}}$ $=\left(2^5\right)^{\frac{4}{5}}$ $=2^4$ $=16$	✓ $32=x^{\frac{5}{4}}$ ✓ $x=(32)^{\frac{4}{5}}$ ✓ answer (3)
2.1.3	$R=\frac{2\sqrt{x}}{3S}$ $\frac{3RS}{2}=\sqrt{x}$ $x=\frac{9R^2S^2}{4}$	✓ Multiply by 3S and divide by 2 ✓ Squaring both sides (2)
2.2	$6q+7p=3$.....Equation 1 $2q+p=5$.....Equation 2 $6q+7p=3$.....Equation 1 $14q+7p=35$.....multiply Equation 2 with 7 .....Equation 3 Equation 3 – Equation 1: $8q=32$ $q=4$ $2(4)+p=5$ $p=-3$	✓ $14q+7p=35$ ✓ $8q=32$ ✓ $q=4$ ✓ substitution ✓ $p=-3$ (5) **[13]**

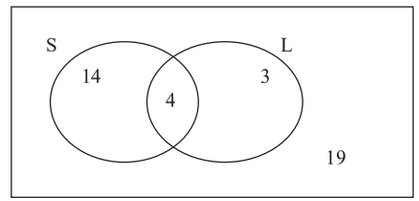
QUESTION 3

3.1.1	10 ; 6 ; 2	✓ 10 ✓ 6 ✓ 2 (3)
3.1.2	$d = -4$ $T_n = -4n + 14$	✓ $-4n$ ✓ 14 (2)
3.1.3	$-4n + 14 < -31$ $-4n < -45$ $n > 11{,}25$ $n = 12$	✓ $-4n + 14 < -31$ ✓ $n > 11{,}25$ ✓ answer (3)
3.2	$T_n = 6n$ $T_{13} = 6(13)$ **OR** $T_{26} = 3(26)$ $= 78$ $= 78$	✓ $6n$ ✓ substitution of 13 ✓ answer (3) **OR** ✓ $3n$ ✓ substitution of 26 ✓ answer (3) **[11]**

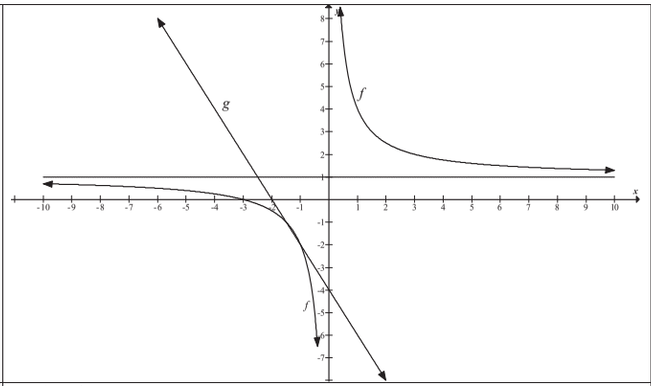
QUESTION 4

4.1	$A = P(1+i)^n$ $= 4500\left(1+\frac{4.25}{100}\right)^{2.5}$ $= R\ 4993.47$	✓$n = 2.5$ ✓substitution ✓answer (3)
4.2.1	Loan amount = R5 999 – R600 = R5 399 Total amount owed = 5 399[1+(0,08)(1,5)] = R6 046,88 Monthly instalment = $\frac{6046.88}{18}$ = R335,94	✓ $y = 0$ ✓5 399 ✓$n = 1{,}5$ ✓Substitution ✓R6 046,88 ✓÷ 18 ✓R335,94 (6)
4.2.2	R6 046,88 - R5 399 = R647,88	✓ answer (1)
4.3	1 kg = 1 000 g $\frac{1000}{28{,}35} = 35{,}27336861\ldots$ ounces 35,27336861… x 978,34 x 8,79 = R303 337,16	✓conversion ✓division ✓multiplication ✓answer (4) **[14]**

QUESTION 5

5.1.1	A ∩ B **OR** A and B	✓ answer (1)
5.1.2	A′ **OR** not A	✓ answer (1)
5.2	B	✓ answer (1)
5.3.1	19 learners are right-handed and do not play soccer.	✓ answer (1)
5.3.2		✓ 15 ✓ 4 ✓ 2 ✓ 19 (4)
5.3.3 (a)	P(L OR S) $= \frac{14+4+3}{40}$ $= \frac{21}{40}$	✓ 15 + 4 + 2 ✓ 40 ✓ answer (3)
5.3.3 (b)	P(R AND S) $= \frac{14}{40}$ $= \frac{7}{20}$	✓ $\frac{15}{40}$ ✓ answer (2) **[13]**

QUESTION 6

6.1		✓shape of f ✓ x-int of f ✓ x-intercept of g ✓ y-intercept of g (4)
6.2	$x = 0$ and $y = 1$	✓ answer ✓ answer (2)
6.3	$(-\infty\,;0)\cup(0\,;\infty)$	✓ values ✓ notation (2)
6.4	$\frac{3}{x}+1=-2x-4$ $\frac{3}{x}=-2x-5$ $3=-2x^2-5x$ $2x^2+5x+3=0$ $(2x+3)(x+1)=0$ $x=-\frac{3}{2}$ or $x=-1$	✓$\frac{3}{x}+1=-2x-4$ ✓ standard form ✓ factors ✓✓ answers (5)
6.5	$-1\le -2x-4<3$ $3\le -2x<7$ $-1{,}5\ge x>-3{,}5$ $-3{,}5<x\le -1{,}5$ OR $x\in(-3{,}5\,;-1{,}5]$	✓ $-1\le -2x-4<3$ ✓ $3\le -2x<7$ ✓ answer (3)
6.6	$k(x)=2(-2x-4)$ $=-4x-8$ y-intercept: $(0\,;-8)$	✓ equation of $k(x)$ ✓ answer (2)
6.7	x-intercept: $(2\,;0)$ y-intercept: $(0\,;-4)$	✓ x-intercept ✓ y-intercept (2) **[20]**

QUESTION 7

7.1	C(– 2 ; 0)	✓ answer (1)
7.2	$f(x)=ax^2+q$ $f(x)=a\left(x^2-4\right)$ $2{,}5=a((-3)^2-4)$ $2{,}5=5a$ $a=\frac{1}{2}$ $f(x)=\frac{1}{2}\left(x^2-4\right)$	✓ $f(x)=a\left(x^2-16\right)$ ✓ substitution of (– 5 ; 2,25) ✓ answer (3)
7.3	Range of f: $[-2\,;\infty)$	✓ answer (1)
7.4	Range of h: $(-\infty\,;0]$	✓ notation ✓ critical values (2)
7.5	$g(x)=b^x-4$ $0=b^2-4$ $4=b^2$ $b=2$ $g(x)=2^x-4$	✓ $g(x)=b^x-4$ ✓ substitution ✓ answer (3) **[10]**

TOTAL: 100

GRADE: 10 TERM: 4

REVISION

RESOURCE 9

REVISION WEEK 3: MEMORANDUM PAPER 2 EXEMPLAR

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GRADE 10

MATHEMATICS P2

EXEMPLAR 2012

MEMORANDUM

MARKS: 100

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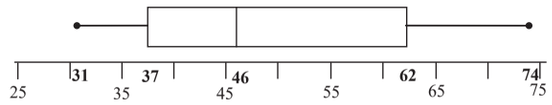
NOTE:

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- If a candidate has crossed out an attempt of a question and not redone the question, mark the crossed out version.
- Consistent accuracy applies in ALL aspects of the marking memorandum.
- Assuming answers/values in order to solve a problem is NOT acceptable.

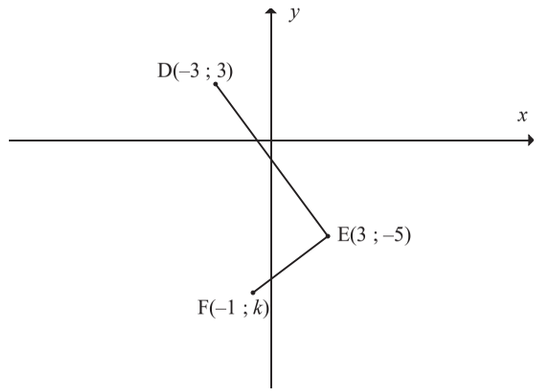
QUESTION 1

1.1	Mean $= \frac{\sum_{i=1}^{n} x_i}{n} = \frac{929}{19} = 48{,}89$	✓ $\frac{929}{19}$ ✓answer (2)
1.2	31 ; 31 ; 34 ; 36 ; 37 ; 39 ; 40 ; 43 ; 46 ; 46 ; 48 ; 52 ; 56 ; 60 ; 62 ; 63 ; 65 ; 66 ; 74. Median = 46	✓arranging in ascending order ✓median (2)
1.3	Lower quartile = 37 Upper quartile = 62	✓ lower quartile ✓ upper quartile (2)
1.4		✓ box with median ✓ whisker (2) **[8]**

QUESTION 2

2.1	The modal class is $2500 \le x < 4500$	✓ $2500 \le x < 4500$ (1)
2.2	<table><tr><th>Gross Vehicle Mass (GVM) (in kg)</th><th>Frequency</th><th>Midpoint</th><th>Frequency × midpoint</th></tr><tr><td>$2500 \le x < 4500$</td><td>103</td><td>3500</td><td>360 500</td></tr><tr><td>$4500 \le x < 6500$</td><td>19</td><td>5500</td><td>104 500</td></tr><tr><td>$6500 \le x < 8500$</td><td>70</td><td>7500</td><td>525 000</td></tr><tr><td>$8500 \le x < 10500$</td><td>77</td><td>9500</td><td>731 500</td></tr><tr><td>$10500 \le x < 12500$</td><td>85</td><td>11500</td><td>977 500</td></tr><tr><td>$12500 \le x < 14500$</td><td>99</td><td>13500</td><td>1 336 500</td></tr><tr><td>Sum</td><td>453</td><td></td><td>4 035 500</td></tr></table> Estimated mean $(\overline{X}) = \frac{4035500}{453} = 8908{,}39\,\text{kg}$.	✓ midpoints ✓✓ frequencies × midpoint ✓4 035 500 ✓ answer (5)
2.3	The estimated mean. It is more at the centre of the data set. The modal class is found at the extreme left-hand side of the data set.	✓ estimated mean with reason (1) **[7]**

QUESTION 3



3.1.1	$DE = \sqrt{(-3-3)^2 + (3-(-5))^2}$ $= \sqrt{100}$ $= 10$	✓ substitution into distance formula ✓answer (2)
3.1.2	$m_{DE} = \frac{-5-3}{3-(-3)}$ $= -\frac{4}{3}$	✓ substitution into gradient formula ✓answer (2)
3.1.3	$m_{EF} = \frac{3}{4}$ EF ⊥ DE $\frac{-5-k}{3-(-1)} = \frac{3}{4}$ $\frac{-5-k}{4} = \frac{3}{4}$ $-20-4k = 12$ $-4k = 32$ $k = -8$	✓ $m_{EF} = \frac{3}{4}$ ✓ $\frac{-5-k}{3-(-1)} = \frac{3}{4}$ ✓ simplification ✓ $k = -8$ (4)
3.1.4	$M\left(\frac{(-3)+(-1)}{2}; \frac{3+(-8)}{2}\right)$ $= \left(-2; -\frac{5}{2}\right)$	✓ substitution into midpoint formula ✓answer (2)

3.1.5	If DEFG is a rectangle then M is also the midpoint of EG. Let the coordinates of G be $(x ; y)$ $\left(\frac{x+3}{2}; \frac{y+(-5)}{2}\right) = \left(-2; -\frac{5}{2}\right)$ $\frac{x+3}{2} = -2$ and $\frac{y-5}{2} = -\frac{5}{2}$ $x+3 = -4$ and $y-5 = -5$ $x = -7$ $y = 0$ ∴G(–7 ; 0) **OR** The translation that sends E(3 ; –5) to F(–1; –8) also sends D(–3 ; 3) to G. (–1 ; –8) = (3 – 4 ; –5 – 3) ∴ G = (– 3 – 4 ; 3 – 3) = (– 7 ; 0) **OR** The translation that sends E(3 ; –5) to D(–3 ; 3) also sends F(–1; –8) to G. (– 3 ; 3) = (3 – 6 ; – 5 + 8) ∴ G = (–1 – 6 ; – 8 + 8) = (– 7 ; 0)	✓ $\frac{x+3}{2} = -2$ ✓ $x = -7$ ✓ $\frac{y-5}{2} = -\frac{5}{2}$ ✓ $y = 0$ (4) ✓method ✓ $x-4$ ✓ $y-3$ ✓ answer (4) ✓method ✓ $x-6$ ✓ $y+8$ ✓ answer (4)
3.2	$\sqrt{(x-1)^2 + (5-(-2))^2} = \sqrt{53}$ $(x-1)^2 + 49 = 53$ $x^2 - 2x + 1 + 49 - 53 = 0$ $x^2 - 2x - 3 = 0$ $(x+1)(x-3) = 0$ $x = -1$ or $x = 3$ but D is in the second quadrant ∴ only $x = -1$ is valid	✓equation using distance formula ✓ standard form ✓ factorisation ✓ answer must exclude 3 (4) **[18]**

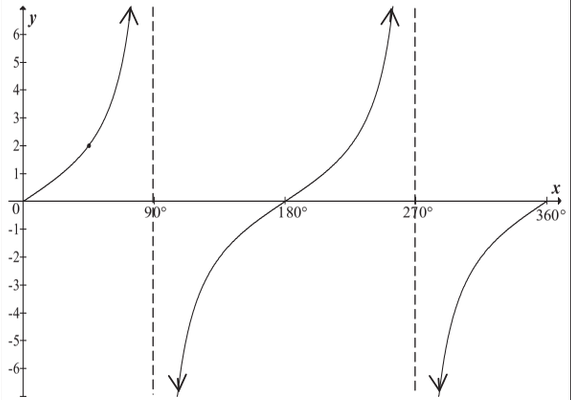
QUESTION 4

4.1.1	$\sin C = \frac{AB}{AC}$	✓ AC (1)
4.1.2	$\cot A = \frac{AB}{BC}$	✓ $\cot A$ (1)
4.2	$\frac{\sin 60°.\tan 30°}{\sec 45°}$ $= \frac{\left(\frac{\sqrt{3}}{2}\right)\left(\frac{1}{\sqrt{3}}\right)}{\sqrt{2}}$ $= \frac{\frac{1}{2}}{\sqrt{2}}$ $= \frac{1}{2} \times \frac{1}{\sqrt{2}}$ $= \frac{1}{2\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}}$ $= \frac{\sqrt{2}}{4}$	✓✓ substitution ✓ simplification ✓answer (4)
4.3.1	$r^2 = (-5)^2 + (12)^2$ $r^2 = 169$ $r = 13$ $\cos\theta = -\frac{5}{13}$	✓ $r^2 = (-5)^2 + (12)^2$ ✓ $r = 13$ ✓answer (3)
4.3.2	$\text{cosec}^2\theta + 1$ $= \left(\frac{13}{12}\right)^2 + 1$ $= \frac{169}{144} + \frac{144}{144}$ $= \frac{313}{144}$	✓ $= \frac{13}{12}$ ✓simplification ✓answer (3) **[12]**

QUESTION 5

5.1.1	$5\cos x = 3$ $\cos x = \frac{3}{5}$ $x = \cos^{-1}\left(\frac{3}{5}\right)$ $x = 53{,}1°$	✓ $\cos x = \frac{3}{5}$ ✓ answer (2)
5.1.2	$\tan 2x = 1{,}19$ $2x = \tan^{-1}(1{,}19)$ $2x = 49{,}95845.....°$ $x = 25°$	✓✓ $2x = 49{,}958....°$ ✓ answer (3)
5.1.3	$4\sec x - 3 = 5$ $4\sec x = 8$ $\sec x = 2$ $\frac{1}{\sec x} = \frac{1}{2}$ $\cos x = \frac{1}{2}$ $x = \cos^{-1}\left(\frac{1}{2}\right)$ $x = 60°$	✓ $\sec x = 2$ ✓ inverting both sides ✓ $\cos x$ ✓ answer (4)
5.2.1	$J\hat{K}D = 8°$ alternate angles	✓ answer (1)
5.2.2	$\tan 8° = \frac{5}{DK}$ $DK = \frac{5}{\tan 8°}$ DK = 35,57684..... km DK = 35 577 m	✓ $\tan 8° = \frac{5}{DK}$ ✓ $DK = \frac{5}{\tan 8°}$ ✓ answer (3)
5.2.3	DS = 35,58 – 8 = 27,58 km	✓ answer (1)
5.2.4	$\tan D\hat{S}J = \frac{5}{27{,}58}$ $D\hat{S}J = \tan^{-1}\left(\frac{5}{27{,}58}\right)$ $D\hat{S}J = 10{,}3°$	✓ $\tan D\hat{S}J = \frac{5}{27{,}58}$ ✓ answer (2) **[16]**

QUESTION 6

6.1.1		✓correct x-intercepts ✓correct y-intercept ✓ asymptotes ✓ shape (must pass through (45° ; 2)) (4)
6.1.2	$y = -2\tan x$	✓ answer (1)
6.2.1	$g(x) = a\sin x$ $4 = a\sin 90°$ $4 = a(1)$ $a = 4$	✓ $a = 4$ (1)
6.2.2	Range is $-2 \le y \le 6$.	✓ -2 ✓ 6 (2) **[8]**

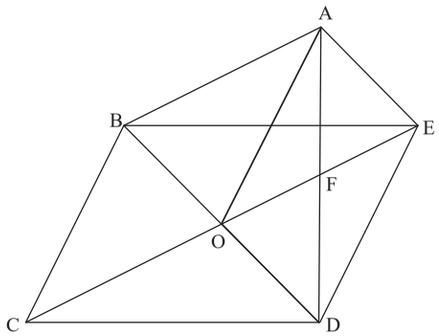
QUESTION 7

7.1.1	$AH^2 = 0{,}8^2 + 1{,}5^2$ $AH^2 = 2{,}89$ $AH = 1{,}7$	✓ $AH^2 = 0{,}8^2 + 1{,}5^2$ ✓ $AH = 1{,}7$ (2)
7.1.2	Surface area of roof $= 4\times\frac{1}{2}(3\times1{,}7)$ $= 10{,}2\ m^2$	✓ $4\times\frac{1}{2}(3\times1{,}7)$ ✓answer (2)
7.1.3	Surface area of walls $= 4\times3\times2{,}1$ $= 25{,}2\ m^2$ Total surface area = $10{,}2\ m^2 + 25{,}2\ m^2 = 35{,}4\ m^2$	✓ $25{,}2\ m^2$ ✓ answer (2)
7.2.1	Volume $= \frac{4}{3}\pi(8)^3$ $= 2144{,}66\ mm^3$	✓$\frac{4}{3}\pi(8)^3$ ✓ answer (2)
7.2.2	New volume : original volume $= 2^3 : 1$ $= 8 : 1$	✓ 2^3 ✓ answer (2)
7.2.3	Volume including silver $= \frac{4}{3}\pi(9)^3 = 3\ 053{,}63\ mm^3$. Volume of silver = 3 053,63 – 2144,66 $= 908{,}97\ mm^3$	✓ $\frac{4}{3}\pi(9)^3$ ✓ answer (2) **[12]**

QUESTION 8

8.1	OQ = 2 cm	…. (the long diagonal of a kite bisects the shorter diagonal)	✓ 2 cm ✓ correct reason (2)
8.2	$P\hat{O}Q = 90°$	…. (the diagonals of a kite intersect at right angles)	✓ 90° ✓correct reason (2)
8.3	$Q\hat{P}O = 20°$ $\therefore Q\hat{P}S = 20° + 20° = 40°$	…. (the longer diagonal bisects the angles of a kite)	✓ $Q\hat{P}O = 20°$ with correct reason ✓ $Q\hat{P}S = 40°$ (2) **[6]**

QUESTION 9



9.1	O is the midpoint of BD. …. (Diagonals of parm BCDE bisect each other) F is the midpoint of OE. …. (Diagonals of parm AODE bisect each other) ∴ OF ‖ AB …. (The line joining the midpoints of two sides in a Δ is ‖ to third side)	✓ O is the midpoint of BD ✓ reason – diagonals of parm ✓ F is the midpoint of OE ✓ reason – midpoint theorem (4)
9.2	AE ‖ OD …. (Opp sides of parm AODE are parallel) ∴ AE ‖ OB OF ‖ AB …. (proven above) ∴OE ‖ AB ∴ ABOE is a parallelogram …. (both pairs of opposite sides of quad are parallel)	✓ AE ‖ OB ✓ reason ✓ OE ‖ AB ✓ reason – opp sides parallel (4)
9.3	In ΔABO and ΔEOD 1. AB = EO …(Opp sides of parm ABOE are equal) 2. AO = ED …(Opp sides of parm AODE are equal) 3. BO = DO …(Diagonals of parm BCDE bisect each other) ∴ΔABO ≡ ΔEOD (S, S, S)	✓ AB = EO ✓ AO = ED ✓ reason – opp sides are equal ✓ BO = DO ✓ reason – diagonals of parm (5) **[13]**

TOTAL: 100

Gr 10

MATHEMATICS TEST

QUESTION	DESCRIPTION	MAXIMUM MARK	ACTUAL MARK
1	Algebra	32	
2	Probability	18	
	TOTAL	50	

QUESTION 1 **32 MARKS**

1.1 Factorise the following:

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

1.1.2 $x^2 + px - mx - mp$ (2)

1.1.3 $2x^2 - 5x - 3$ 2)

1.1.4 $27x^3 - 8$ (3)

1.2 Simplify the following:

1.2.1 3^{-2} (1)

1.2.2 $\left[\frac{(2x)^{-1}}{(4x)^0}\right]^{-2}$ (2)

1.2.3 $(2x+5)(x^2-2x+3)$ (3)

1.3 Solve for x:

1.3.1 $4x(2-5) = 28$ (2)

1.3.2 $(x+2)(x-3) = 6$ (4)

1.3.3 $ax - b = c$ (2)

1.3.4 $2.3^x = 54$ (2)

1.3.5 $3 - 4x \geq x + 5$ (2)

1.4 Three chocolates and five packets of chips cost R54. One packet of chips and 10 chocolates cost R86.

1.4.1 If $3x + 5y = 54$ represents part of the above information, write down an equation to represent the second part of the information. (1)

1.4.2 Use the equations to solve for x and y and state the cost of one packet of chips and one chocolate. (5)

QUESTION 2 **18 MARKS**

2.1 A survey was done with 150 learners to determine how many had been to a live soccer match and a music festival. The following results were obtained:

- 85 had been to a music festival
- 125 had been to a live soccer match
- 70 had been to both a music festival and a live soccer match

2.1.1 How many learners had been to a music festival or a live soccer match? (3)

2.1.2 Represent the information provided in a Venn diagram (4)

2.1.3 Determine the probability that a learner chosen at random (simplifying is not essential):

(i) Had attended a music festival

(ii) Had attended a live soccer match but not a music festival

(iii) Had not attended a live soccer match or a music festival (3)

2.2 Complete the following statements:

2.2.1 If A and B are complementary events, then $P(A) = \ldots$ (2)

2.2.2 If P and Q are mutually exclusive events, then $P(P \text{ and } Q) = ...$ (2)

2.3 Consider the word SEPTEMBER. A letter is chosen at random. What is the probability that the letter is an:

2.3.1 R (2)

2.3.2 E (2)

Gr 10 Mathematics Test

MEMO

QUESTION	DESCRIPTION	MAXIMUM MARK	ACTUAL MARK
1	Algebra	32	
2	Probability	18	
	TOTAL	50	

QUESTION 1 — 32 MARKS

1.1 Factorise the following:

1.1.1 $x^2 - 3x$

$= x(x-3)$ ✓ (1)

1.1.2 $x^2 + px - mx - mp$

$= x(x+p) - m(x+p)$ ✓

$= (x+p)(x-m)$ ✓ (2)

1.1.3 $2x^2 - 5x - 3$

$= (2x+1)(x-3)$ ✓✓ (2)

1.1.4 $27x^3 - 8$

$= (3x-2)(9x^2+6x+4)$

✓ ✓✓ (3)

1.2 Simplify the following:

1.2.1 3^{-2}

$= \frac{1}{9}$ ✓ (1)

1.2.2 $\left[\frac{(2x)^{-1}}{(4x)^0}\right]^{-2}$

$= [2^{-1}x^{-1}]^{-2}$ ✓

$= 2^2x^2$

$= 4x^2$ ✓ (2)

1.2.3 $(2x+5)(x^2-2x+3)$

$= 2x^3 - 4x^2 + 6x + 5x^2 - 10x + 15$ ✓

$= 2x^3 + x^2 - 4x + 15$

✓ ✓ (3)

1.3 Solve for x:

1.3.1 $4x(2-5)=28$

$8x-20x=28$ ✓

$-12x=28$

$x=-\frac{7}{3}$ ✓ (2)

1.3.2 $(x+2)(x-3)=6$

$x^2-x-6-6=0$ ✓

$x^2-x=0$

$x(x-1)=0$ ✓

$x=0$ ✓ or $x-1$ ✓ (4)

1.3.3 $ax-b=c$

$ac=c+b$ ✓

$x=\frac{c+b}{a}$ ✓ (2)

1.3.4 $2.3^x=54$

$3^x=27$ ✓

$3^x=3^3$

$x=3$ ✓ (2)

1.3.5 $3-4x\geq x+5$

$-4x-x\geq 5-3$

$-5x\geq 2$ ✓

$x\leq -\frac{2}{5}$ ✓ (2)

1.4 Three chocolates and five packets of chips cost R54. One packet of chips and 10 chocolates cost R86.

1.4.1 If $3x+5y=54$ represents part of the above information, write down an equation to represent the second part of the information.

$10x+y=86$ ✓ (1)

1.4.2 Use the equations to solve for x and y and state the cost of one packet of chips and one chocolate.

$10x+y=86$

$y=86-10x$ ✓

$\therefore y=86-10(8)$

$y=6$ ✓

$3x+5y=54$ ✓

$3x+5(86-10x)=54$

$3x+430-50x=54$

$-47x=-376$

$x=8$ ✓

$\therefore$ one chocolate costs R8 and one packet of chips costs R6 ✓ (5)

QUESTION 2 18 MARKS

2.1 A survey was done with 150 learners to determine how many had been to a live soccer match and a music festival. The following results were obtained:

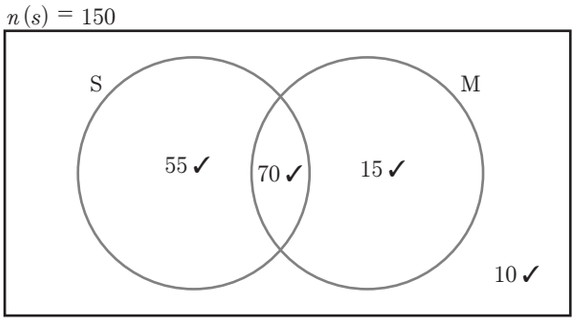
- 85 had been to a music festival
- 125 had been to a live soccer match
- 70 had been to both a music festival and a live soccer match

2.1.1 How many learners had been to a music festival or a live soccer match?

$$n(M\ or\ S) = n(M) + n(S) - n(M\ and\ S)$$
$$= 85 + 125 - 70 \quad \checkmark\checkmark$$
$$= 140 \quad \checkmark$$

(4)

2.1.2 Represent the information provided in a Venn diagram



(4)

2.1.3 Determine the probability that a learner chosen at random (simplifying is not essential):

(i) Had attended a music festival $\frac{85}{150}$ ✓

(ii) Had attended a live soccer match but not a music festival $\frac{55}{150}$ ✓

(iii) Had not attended a live soccer match or a music festival $\frac{10}{150}$ ✓ (3)

2.2 Complete the following statements:

2.2.1 If A and B are complementary events, then $P(A) = 1 - P(B)$ ✓✓ (2)

2.2.2 If P and Q are mutually exclusive events, then $P(P \text{ and } Q) = 0$ ✓✓ (2)

2.3 Consider the word SEPTEMBER. A letter is chosen at random. What is the probability that the letter is an:

2.3.1 R

$$P(R) = \frac{1}{9} \quad \checkmark\checkmark$$

(2)

2.3.2 E

$$P(E) = \frac{3}{9} = \frac{1}{3} \quad \checkmark\checkmark$$

(2)

Question	Knowledge	Routine	Complex	Problem Solve	
1.1.1	1				
1.1.2	2				
1.1.3		2			
1.1.4			3		
1.2.1	1				
1.2.2			2		
1.2.3		3			
1.3.1	2				
1.3.2			4		
1.3.3		2			
1.3.4		2			
1.3.5			2		
1.4.1				1	
1.4.2				5	
2.1.1			3		
2.1.2		4			
2.1.3(i)-(iii)		3			
2.2.1			2		
2.2.2		2			
2.3.1	2				
2.3.2	2				
Totals	10	18	16	6	50