For Performance Measurement

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

MATHEMATICS 4004/2

PAPER 2

SPECIMEN PAPER 2 hours 30 minutes

Additional materials:
Mathematical Instruments
Mathematical Tables
Non programmable Electronic Calculator
Plain Paper (1 sheet)
Graph paper (4 sheets)

Time 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your Name, Centre number and Candidate number in the spaces provided on the answer paper/answer booklet.

Answer **all questions** in Section A and **any four questions** from Section B.

Write your answered on the separate answer paper provided.
If you use more than one sheet of paper, fasten the sheets together.

All working must be clearly shown on the same sheet as the rest of the answer.
Omission of essential working will result in loss of marks.
If the degree of accuracy is not specified in the question and if the answer is not exact, the answer should be given correct to three significant figures. Answers in degrees should be given correct to one decimal place.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.
Mathematical tables and Non-programmable electronic calculators may be used to evaluate explicit numerical expressions.

This question paper consists of 11 printed pages and 1 blank page.

SECTION A (52 Marks)

Answer **all** questions in this section

1 **(a)** Simplify $4 - \left(1\frac{3}{4} + 1\frac{2}{3}\right)$ [2]

(b) It is given that y = 5, 3 and z = 4, 2, both given to 1 decimal place. Find the minimum possible value of yz. Give the answer correct to 2 decimal places. [2]

(c) A hotel has Executive rooms and General rooms in the ratio 3:5 respectively. A General room costs \$19, 00 per day. On a certain day, all the 2928 rooms were occupied by both Executive and General customers and the total takings from the rooms amounted to \$66 612, 00.

(i) Find the number of General rooms in the hotel. [2]

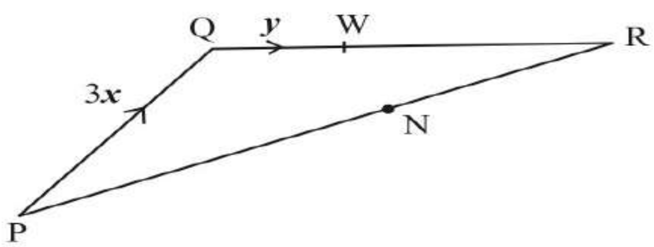
(ii) Calculate the cost per day of an Executive room. [3]

2 **(a)** Matrix A = $\begin{pmatrix} x+2 & 14 \\ 3 & 3 \end{pmatrix}$ .The determinant of Matrix A is less than 7.

(i) Find the largest integer value of x . [3]

(ii) Find A^{-1}, the inverse of matrix A using the value of x in **(a)(i)**. [2]

(b)



In the diagram $\overrightarrow{PQ} = 3\boldsymbol{x}$ and $\overrightarrow{QW} = \boldsymbol{y}$. **N** is a point on **PR** such that **PN = 2NR**. **QW** is produced to **R** such that **QW: WR** = 1: 5.
Express the following in terms of $\boldsymbol{x}$ and /or $\boldsymbol{y}$

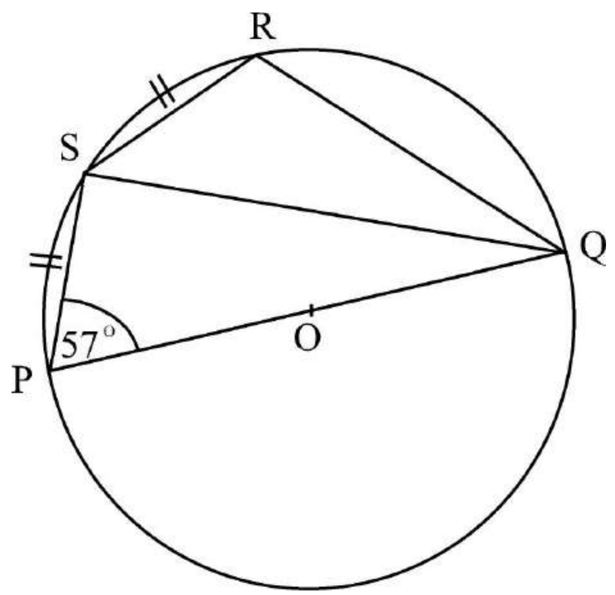
(i) $\vec{QR}$, [1]

(ii) $\vec{PR}$, [1]

(iii) $\vec{PN}$, [1]

(iv) $\vec{QN}$. [2]

3 **(a)**



In the diagram, **P, Q, R** and **S** are points on the circumference of a circle centre **O. POQ** is a diameter of the circle. Arcs **PS** and **SR** are equal.
$Q\hat{P}S = 57°$.

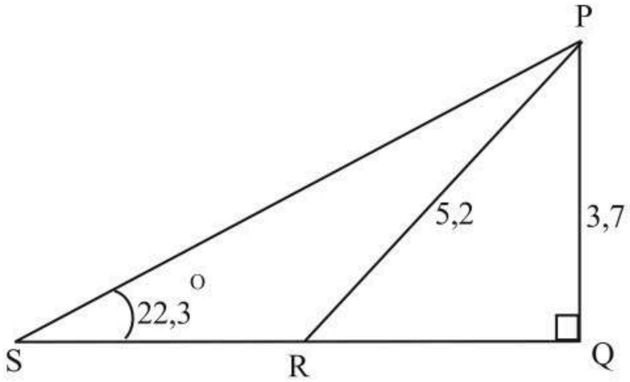
(i) Name the angle which is equal to $S\hat{Q}R$. [1]

(ii) Find $P\hat{Q}S$. [1]

(iii) Find $Q\hat{R}S$. [1]

(iv) Find $Q\hat{S}R$. [2]

(b)



In the diagram, triangle **PQS** is right-angled at **Q.** **SRQ** is a straight line.
PQ = 3,7 cm, **PR** = 5,2 cm and $P\hat{S}R = 22,3°$.

Calculate the

(i) the length of **PS**, [2]

(ii) $Q\hat{P}R$, [2]

(iii) $S\hat{P}R$. [2]

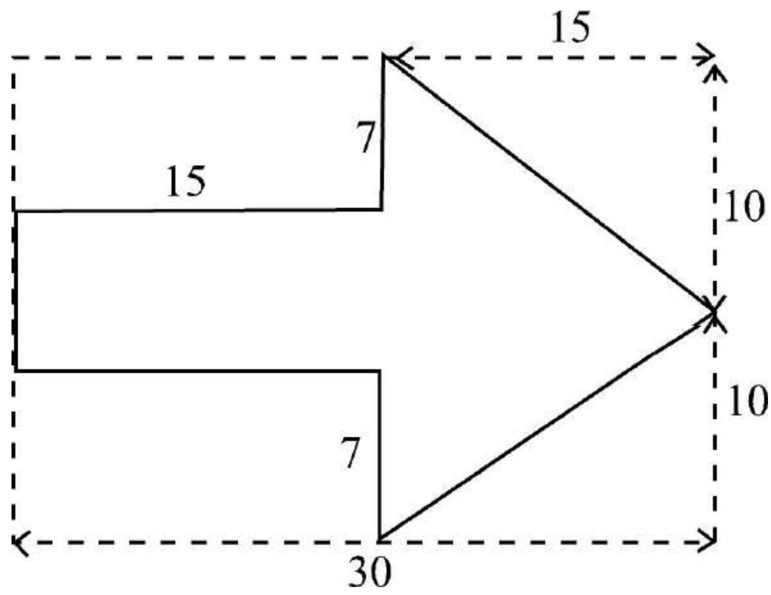
4 **(a)** A sweet shop sells cylindrical sweets each of diameter 3,8 cm and length 4,9 cm.

In this question take π to be $\frac{22}{7}$

(i) Calculate the volume of one sweet. [2]

(ii) If the mass of 1 cm^3 of the sweet is 0,63g, calculate the mass of a sweet, giving the answer to the nearest gramme. [2]

(b)



The diagram shows an arrow for a signpost cut from a rectangular sheet of metal measuring 30 cm by 20 cm.
Calculate the

(i) area of the arrow, [3]

(ii) perimeter of the arrow. [4]

5 **Answer the whole of this question on a sheet of plain paper provided.**

Use ruler and compasses only for all constructions and show clearly all construction lines and arcs.

All constructions should be done in a single diagram.

ABCD is a trapezium in which AB = 6,5 cm, AD= 5,2 cm, $A\hat{B}C = 120°$ and AD is perpendicular to AB. DC is parallel to AB.

(a) **(i)** Construct the trapezium ABCD. [6]

(ii) Construct the bisector of $A\hat{B}C$. [2]

(b) Describe the locus of points that the bisector of $A\hat{B}C$ represents. [2]

(c) Measure and write down the length of BC. [1]

SECTION B (48 Marks)

Answer **any four** questions from this section.

Each question carries **12** marks.

6 **(a)** Solve the equation

$$3^k = \frac{81^2 \times 3^5}{3^{11}}$$

[2]

(b) Factorise completely

(i) $6y^2 - 10y + 4$, [2]

(ii) $ax + b + a + bx$. [2]

(c) Express $\frac{6}{2x-x^2} - \frac{3}{x}$ as a single fraction in its simplest form. [3]

(d) It is given that $p \propto t^{-3}$ and that $p = 4$ when $t = 2$.

(i) Find a formula connecting p and t. [2]

(ii) Find the value of t when $p = \frac{1}{2}$. [1]

7 **(a)** During a sale, all prices were reduced by 15%.
Calculate the original price of a jacket that was bought for $55. [3]

(b) An extract from MS Neto's bank statement for the month of May is shown

DATE	Details	CR	DR	BALANCE
01.05.17	Balance Brought Forward			$10-00
29.05.17	Salary	$402-00		$412-00
30.05.17	Bank charges of 1% on Current Account Balance		X	Y
31.05.17	Withdrawal		Z	$292-88

Calculate the value of,

(i) X, [1]

(ii) Y, [1]

(iii) Z. [1]

(c) Omega decides to invest her pension of $600.
OPTION A: She can invest it in a bank that offers 4% per year **Simple** Interest.
OPTION B: She can invest it in a money market fund that offers 4% per year **Compound** Interest.

Calculate

(i) Omega's interest under Option A at the end of 3 years, [2]

(ii) Omega's interest under Option B at the end of 3 years. [3]

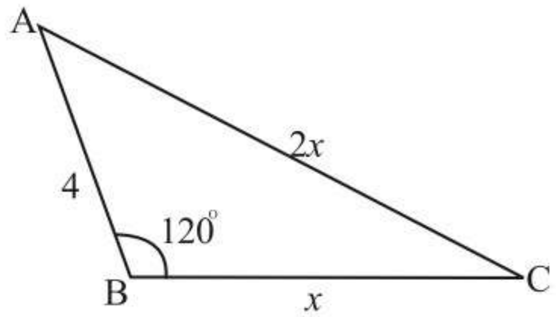
(iii) the difference between the amounts of interest from the two options. [1]

8 **(a)** It is given that $A = \dfrac{h(12+b)}{2}$.

(i) Find the value of A when b = 1, 5 and h = 0, 8. [2]

(ii) Express h in terms of A and b. [2]

(b)



In the diagram, ABC is a triangle in which AB = 4 cm, BC = x cm, AC = $2x$ cm and $A\hat{B}C = 120°$.

(i) Form an equation in x and show that it reduces to $3x^2 - 4x - 16 = 0$. [3]

(ii) Solve the equation $3x^2 - 4x - 16 = 0$, giving the answers correct to 3 significant figures. [5]

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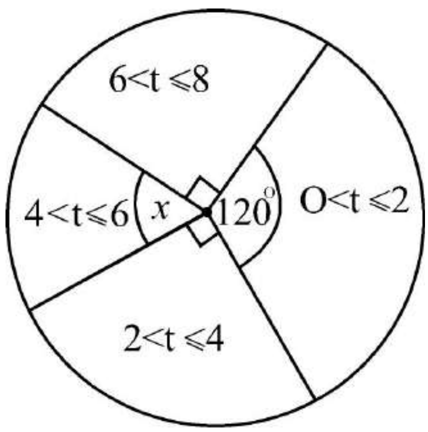

The pie chart represents the time, t, hours spent by 240 people on charity work.

(a) Find the value of x. [1]

(b) The following table shows the information contained in the pie chart.

Time (**t** hours)	$0 < t \leq 2$	$2 < t \leq 4$	$4 < t \leq 6$	$6 < t \leq 8$
Frequency	80	p	q	r

Find the value of

(i) p, [1]

(ii) q, [1]

(iii) r. [1]

(c) Calculate an estimate of the mean time spent on charity work. [3]

(d) Two people chosen at random from the whole group, find the probability that they both spent more than 4 hours doing charity work. [2]

(e) Draw a frequency polygon on a sheet of graph provided to show the information in the table in (b). Use a scale of 2 cm to 2 units on the x axis and 2 cm to 10 units on the y axis. [3]

10

The following is a table of values for the function $f(x) = x^3 - 4x^2 + 4$

x	-1	$-\frac{1}{2}$	0	$\frac{1}{2}$	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4
$f(x)$	-1	2,9	4	3,1	1	$-1,6$	-4	$-5,4$	p	$-2,1$	4

(a) Find the value of p. [1]

(b) Draw the graph of $f(x) = x^3 - 4x^2 + 4$ on a sheet of graph paper provided. Use a scale of 2 cm to 1 unit on both axes. [4]

(c) Use the graph to find the

(i) coordinates of the minimum turning point of the graph, [1]

(ii) roots of the equation $x^3 - 4x^2 + 4 = 0$ [3]

(iii) area bounded by the graph, x-axis, and the lines $x = 2$ and $x = 3$, [2]

(iv) the range of values of x for which $f(x) < -4$. [1]

11 **(a)** A school's agriculture department intends to plant beans and peas in its 5 hectare field.
Let x be the area in hectares required for beans and y the area in hectares under peas.
Write down an inequality in x and y which satisfies this condition. [1]

(b) Beans require 2 bags of fertilisers per hectare while peas require 4 bags of fertilisers per hectare. The department has 16 bags of fertilisers for this project.

Write down another inequality in x and y and show that it reduces to $x + 2y \leq 8$. [2]

(c) The department wishes to plant at least one hectare of each crop.
Write down two inequalities, one in x and the other in y, that satisfy these conditions. [2]

(d) Answer this part of the question on a sheet of graph paper provided. Use a scale of 2 cm to 2 units on both axes.
The point $(x; y)$ represents x hectares and y hectares under beans and peas respectively.
Show by drawing the inequalities in (a), (b), (c) and shading the **unwanted** regions, the region in which $(x; y)$ must lie. [4]

(e) **(i)** The estimated profit is \$30,00 per hectare for beans and \$40,00 per hectare for peas.

Find the area of each crop that should be planted for maximum profit to be realised. [2]

(ii) Find the expected maximum profit that may be realised. [1]

12 Answer some parts of this question on a sheet of graph paper provided. Use a scale of 2 cm to 2 units on both axes.

(a) Triangle A has vertices at (– 5; 2), (– 2; 2) and (– 2; 4) and triangle B has vertices at (2; 3), (2; 0) and (4; 0).

Draw and label

(i) triangle A, [1]

(ii) triangle B, [1]

(b) Triangle C is the image of triangle B under an enlargement with centre (2; – 1) and enlargement factor of $-1\frac{1}{2}$.

Draw and label triangle C. [3]

(c) Point (– 2; 2) is translated onto (6; – 2).
Find the translation vector. [1]

(d) Triangle D is the image of triangle A under a transformation represented by the matrix $\begin{pmatrix} 1 & 0 \\ -2 & 1 \end{pmatrix}$

Find the coordinates of the vertices of triangle D. [3]

(e) Describe fully the single transformation that maps triangle A onto triangle B. [3]

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ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

PURE MATHEMATICS 4027/2

PAPER 2

SPECIMEN PAPER 2 hours 30 minutes

Additional materials: Answer paper; Mathematical Data booklet MF 7; Non-programmable electronic calculator; Mathematical instruments; Mathematical tables

TIME 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your Name, Centre number and Candidate number in the spaces provided on the answer paper/answer booklet.

Answer **all** questions in **Section A** and any **four** from **Section B**.

Write your answers on the separate answer paper provided.

If you use more than one sheet of paper, fasten the sheets together.

All working must be clearly shown on the same sheet as the rest of the answer.

Omission of essential working will result in loss of marks.

Decimal answers which are not exact should be given correct to three significant figures unless stated otherwise. Decimal answers in degrees should be given to one decimal place.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.
Non-programmable Electronic calculators or Mathematical tables may be used to evaluate explicit numerical expressions.

This Specimen paper consists of 5 printed pages.

Section A [52 marks]

*Answer **all** questions in this Section.*

1 Simplify

(a) $\left(2\frac{1}{4}\right)^{-\frac{1}{2}}$, [3]

(b) $\frac{3+\sqrt{2}}{2+\sqrt{3}} + \sqrt{6} - 2\sqrt{2}$. [3]

(c) $\text{Log}15 + 2\log 2 - \log 6$. [3]

2 **(a)** **(i)** Show that $x^3 + 4x^2 + x - 6$ is divisible by $x + 3$. [2]

(ii) Hence factorise completely $x^3 + 4x^2 + x - 6$. [3]

(b) Express $\frac{x-3}{(x+1)(x+2)}$ in partial fractions. [5]

3 **(a)** **(i)** Express $3x^2 - 6x$+1 in the form $a(x + b)^2 + c$ where *a*, *b* and *c* are intergers. [3]

(ii) Hence or otherwise state the minimum value of $3x^2 - 6x + 1$. [1]

(b) Solve the equations:

$a + 3b = 1$
$ab = -2$ [3]

(c) Find the value of k: $k \neq 0$ so that the equation $kx^2 + 2kx + 1 = 0$ has equal roots. [4]

4 **(a)** Use the substitution $y = 3^x$ to solve the equation $3^x + 3^{-x} = 2$. [4]

(b) Solve the inequality $x(x + 1)(x - 1) < 0$. [4]

(c) Expand and simplify $(1 + x)^4$ [3]

5 **(a)** Solve the equation $3sin2\theta - 2 = 0$, for $0° \leq \theta \leq 360°$. [7]

(b) Solve the equation $2^{x+1} = 3$ giving the answer to two decimal places. [4]

Section B [48 marks]

*Answer any **four** questions in this section.*

Each question in this section carries 12 marks

6 The position vectors of points **A**, **B** and **C** are $2\boldsymbol{i} + 3\boldsymbol{j} + 5\boldsymbol{k}$, $\boldsymbol{i} + 7\boldsymbol{j} - 3\boldsymbol{k}$ and $-2\boldsymbol{i} + 3\boldsymbol{j}$ respectively.

Find

(a) |**BC**|, [3]

(b) the unit vector in the direction of **AC**, [3]

(c) the angle between **AB** and **BC**, [4]

(d) the area of triangle **ABC**. [2]

7 **(a)** Show that the equation $x^3 + 3x^2 - 5x = 0$ has a root between 1 and 2. [3]

(b) **(i)** Differentiate $x^3 + 3x^2 - 5x$, with respect to x. [2]

(ii) Use the Newton-Raphson method, once to estimate the root of the equation $x^3 + 3x^2 - 5x = 0$ starting with $x_0 = 1{,}25$. Give the answer correct to four significant figures. [2]

(c) Use the trapezium rule with 4 ordinates to estimate the area of the region bounded by the curve $y = 3 + 2x - x^2$, the x-axis and the lines $x = 0$ and $x = 3$. [5]

8 Points A, B and C have coordinates (1;3), $(2; -1)$ and $(-2; -2)$ respectively.

Find the

(a) gradient of line segment AB, [2]

(b) equation of line AB, [2]

(c) distance from C to the mid-point of AB, leaving the answer in surd form. [4]

(d) area of triangle ABC. [4]

9 **(a)** In an arithmetic progression, the second term is $3\frac{1}{2}$ and the fourth term is $4\frac{1}{2}$.

Find the

(i) first term and the common difference, [3]

(ii) ninth term. [2]

(iii) sum of the first 17 terms. [2]

(b) In a geometric progression the first term is $\frac{1}{4}$ and the common ratio is 2.

Find the

(i) eighth term, [2]

(ii) value of n, given that the sum of the first n terms is 255,75. [3]

10 Given that $f(x) = x^3 + 2x^2 + x + 2$

Find the

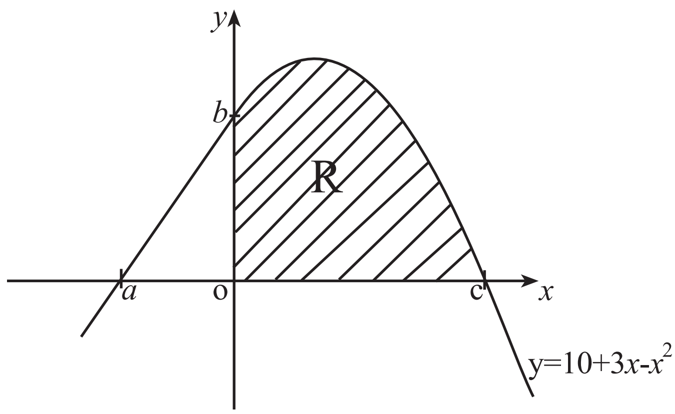
(a) gradient of $f(x)$ at $x = 1$, [2]

(b) equation of the tangent to the curve $f(x)$ at $x = 1$. [3]

(c) equation of the normal to the curve at $x = 1$. [3]

(d) coordinates of the stationary points of $f(x)$. [4]

11



The diagram shows the graph of $y = 10 + 3x - x^2$. The region bounded by the curve between $x = 0$ and $x = c$ is denoted by **R**.

(a) Find the values of

(i) a, [1]

(ii) b, [1]

(iii) c. [1]

(b) Find the area of the region **R**. [4]

(c) Find the volume generated by rotating the region **R** through 360º about the x-axis. [5]

12 The functions f and g are such that $f: x \to \frac{3}{x} - 4$ and $g: x \to (x-1)^2 + 2$

(a) State the domain and range of g. [2]

(b) Give a reason why function f is one to one. [1]

(c) Find the inverse of f. [3]

(d) Find gof. [2]

(e) Sketch the graph of g. [3]

(f) Give a reason why g has no inverse. [1]