

Candidate Name

Centre Number

Candidate Number



**ZIMBABWE SCHOOL EXAMINATIONS COUNCIL**  
General Certificate of Education Ordinary Level

**ADDITIONAL MATHEMATICS**  
PAPER 1

**4026/1**

**SPECIMEN PAPER**

2 hours 30 minutes

Additional materials:

Graph paper  
Mathematical tables  
Data Booklet

**Allow candidates 5 minutes to count pages before the examination.**

**This booklet should not be punched or stapled and pages should not be removed.**

**TIME** 2 hours 30 minutes

**INSTRUCTIONS TO CANDIDATES**

Write your name, centre number and candidate number in the spaces at the top.

Write your centre and candidate number in the boxes on the top right corner of every page of this paper.

Check if the booklet has all the pages and ask the invigilator for a replacement if there are duplicate or missing pages.

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

Write your answers in the spaces provided on the question paper.

If working is needed for any question it must be shown in the space below that question.

Omission of essential working will result in loss of marks. Decimal answers which are not exact should be given to three significant figures unless stated otherwise.

**Electronic calculators may be used.**

**INFORMATION FOR CANDIDATES**

The number of marks is given in brackets [ ] at the end of each question or part question. If the degree of accuracy is not specified in the question and if the answer is not exact, the answer should be given to three significant figures. Answers in degrees should be given to one decimal place.

**This question paper consists of 14 printed pages and 2 blank pages.**

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## 2

### SECTION A [52 Marks]

Answer **all** questions in this section.

- 1** Given that the polynomial  $2x^3 + x^2 + px - 4$  has a factor  $x - 2$ .

**(a)** Find the value of  $p$ .

Answer \_\_\_\_\_ [2]

**(b)** Show that  $2x + 1$  is another factor of the polynomial.

[1]

**(c)** Find the third factor.

Answer \_\_\_\_\_ [3]

### 3

- 2 The line  $y = x + 2$  meets the curve  $y^2 = 4(2x + 1)$  at A and B.  
Find the coordinates of the midpoint of line AB.

Answer \_\_\_\_\_ [5]

- 3 Find the range of values of  $x$  which satisfy the inequality

$$\frac{3x-1}{2+x} > 1$$

Answer \_\_\_\_\_ [4]

- 4 Given that  $(a + b\sqrt{3}) = \left(\frac{6}{3+\sqrt{3}}\right)^2$ , where  $a$  and  $b$  are integers. Find the value of  $a$  and the value of  $b$ .

Answer \_\_\_\_\_ [5]

- 5 (a) Solve the following pair of simultaneous equations:

$$3x^2 - y^2 = 3$$

$$2x - y = 1$$

Answer  $x =$  \_\_\_\_\_

$y =$  \_\_\_\_\_ [4]

- (b) Given that

$$Ax^3 + Bx^2 + Cx - 2C = (3x - 2)(x + 1)(x + 2) + (x - 4).$$

Find the values of A, B and C.

Answer A = \_\_\_\_\_

B = \_\_\_\_\_

C = \_\_\_\_\_ [4]

6 Show that

$$\frac{1}{1+\sin \theta} + \frac{1}{1-\sin \theta} \equiv 2\sec^2 \theta.$$

[3]

7 Given that  $f: x \rightarrow \frac{x+p}{x-3}$ ;  $x \neq 3$  and  $f(4) = 9$ ,

Find,

(a) the value of  $P$ ,

Answer  $P =$  \_\_\_\_\_ [2]

(b)  $f^{-1}(-3)$ ,

Answer \_\_\_\_\_ [3]

(c)  $f^2(x)$ .

Answer \_\_\_\_\_ [3]

## 6

- 8 (a) A geometric series has a first term 1 and a common ratio  $r$ . Given that the sum to infinity of the series is 5, find the value of  $r$ .

Answer  $r =$  \_\_\_\_\_ [3]

- (b) Find the least value of  $n$  for which the sum of the first  $n$  terms of the series exceeds 4.9.

Answer  $n =$  \_\_\_\_\_ [3]

- 9 (a) Express  $\log p + 2\log q - 3\log r$  as a single logarithm.

Answer \_\_\_\_\_ [3]

- (b) Solve the equation

$$2^x + 2^{1-x} = 3.$$

Answer  $x =$  \_\_\_\_\_ [4]

## SECTION B [48 Marks]

Answer any **four** questions in this section

- 10 (a) A curve has an equation  $y = x^4 - 4x^3 + 27$ .

Find,

(i)  $\frac{dy}{dx}$ ,

Answer \_\_\_\_\_ [1]

- (ii) the coordinates of the stationary points on the curve.

Answer \_\_\_\_\_ [3]

- (iii) the nature of stationary points

Answer \_\_\_\_\_ [5]

## 8

- 10**    **(b)**    Find the equation of a curve which passes through the point (3;8) and has a gradient function

$$\frac{dy}{dx} = 2x^2 - 5.$$

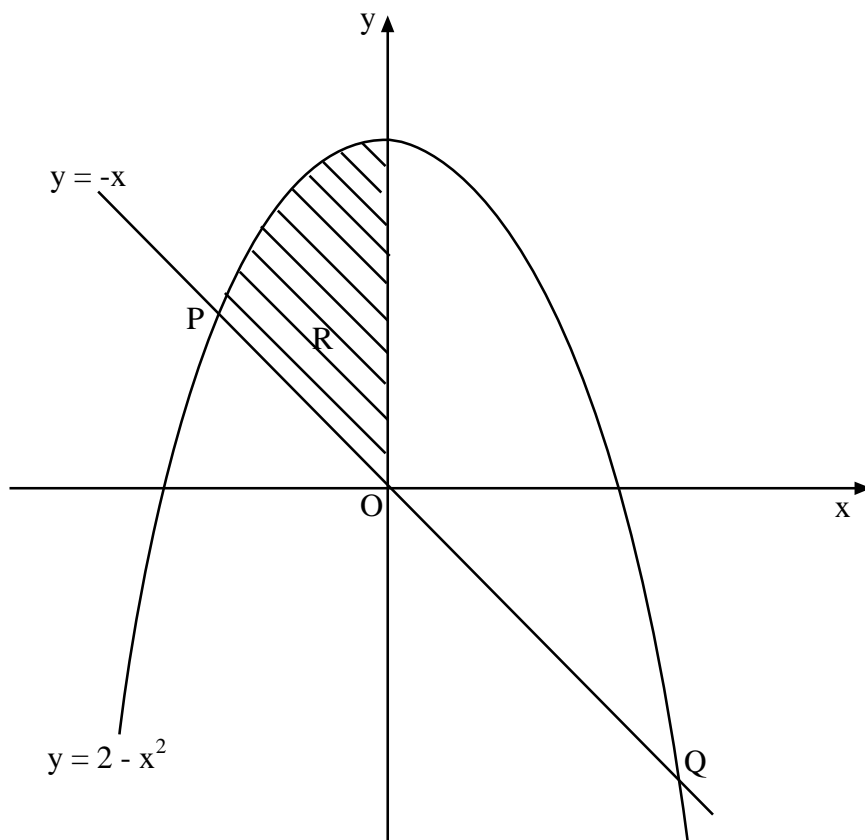
Answer \_\_\_\_\_ [3]

- 11**    **(a)**    Evaluate  $\int_0^4 \sqrt{2x+1} \, dx$ .

Answer \_\_\_\_\_ [3]



- 11 (b) The diagram shows the graph of  $y = 2 - x^2$  and the line  $y = -x$ .



Find,

- (i) the coordinates of P and Q,

Answer P = \_\_\_\_\_

Q = \_\_\_\_\_ [4]

- (ii) the shaded area,  $R$ .

Answer \_\_\_\_\_ [5]

## 10

- 12** The straight line  $L$  has an equation  $2y - x + 7 = 0$ . The straight line  $M$  passes through the point  $P$   $(-1; 6)$  and is perpendicular to line  $L$ .

**(a)** Find the,

- (i)** equation of line  $M$ , giving your answer in the form  $ax + by + c = 0$ ,

Answer \_\_\_\_\_ [3]

- (ii)** coordinates of the point of intersection of line  $L$  and line  $M$ .

Answer \_\_\_\_\_ [3]

- (b)** Find the perpendicular distance from  $P$  to line  $L$ .

Answer \_\_\_\_\_ [3]

- (c)** Given that the points  $Q(-7;-7)$  and  $R(9; 1)$  lie on line  $L$ , find the exact area of the triangle  $PQR$ .

Answer \_\_\_\_\_ [3]

## 11

- 13 (a) (i) Express  $3 \cos \theta + 5 \sin \theta$  in the form

$$R \cos(\theta - \alpha),$$

where  $R > 0$  and  $0^\circ < \alpha < 90^\circ$ .

State the exact value of  $R$  and give the value of  $\alpha$  correct to 1 decimal place

Answer \_\_\_\_\_ [3]

- (ii) Hence, solve the equation

$$3 \cos \theta + 5 \sin \theta = 1$$

giving all solutions in the interval  $0^\circ < \theta < 360^\circ$

Answer \_\_\_\_\_ [3]

## 12

13 (b) The equation of a curve is  $x^3 + y^3 = 6xy$ .

(i) Show that

$$\frac{dy}{dx} = \frac{2y-x^2}{y^2-2x}$$

Answer \_\_\_\_\_ [4]

(ii) Find the equation of the tangent to the curve at the point (2; 4), giving your answer in the form  $ax + by = c$

Answer \_\_\_\_\_ [2]

14 (a) Evaluate the first 4 terms of each sequence whose  $r^{th}$  term is given and determine the nature of the sequences, starting with  $r = 1$

(i)  $Ur = \frac{1}{r^2}$

terms \_\_\_\_\_

nature \_\_\_\_\_ [2]

# 13

14 (a) (ii)  $Ur = 2^r$

terms \_\_\_\_\_  
nature \_\_\_\_\_ [2]

(iii)  $Ur = (-1)^{r+1}r$

terms \_\_\_\_\_  
nature \_\_\_\_\_ [2]

(b) Evaluate  $\sum_{n=0}^{n-3} 2^n + n^2$

Answer \_\_\_\_\_ [2]

(c) The first 3 terms of an arithmetic series are -2; 1; 4.

Find the number of terms for which the sum of the arithmetic series is 208.

Answer \_\_\_\_\_ [4]

## 14

- 15**    **(a)**    A particle  $P$  moves in a straight line such that  $t$  seconds after passing through a fixed point  $O$ , its velocity  $V \text{ ms}^{-1}$  is given by  $V = 4 - t^2$ .

Find the

- (i)**      acceleration of  $P$  after 4 seconds,

Answer \_\_\_\_\_ [3]

- (ii)**     distance of  $P$  from  $O$  after 6 seconds,

Answer \_\_\_\_\_ [3]

- (iii)**    displacement of  $P$  from  $O$  when  $P$  is instantaneously at rest.

Answer \_\_\_\_\_ [3]

- (b)**    The parametric equations of a curve are

$$x = 3t^2 \text{ and } y = t^4 - 3t^2 \text{ for } 0 \leq t \leq 3$$

Find  $\frac{dy}{dx}$ .

Answer \_\_\_\_\_ [3]

**15**

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