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ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Advanced Level

PURE MATHEMATICS — 6042/1

PAPER 1

NOVEMBER 2020 SESSION — 3 hours

Additional materials:
- Answer paper
- Graph paper
- List of Formulae MF7
- Scientific calculator (Non-programmable)

TIME 3 hours

INSTRUCTIONS TO CANDIDATES

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

Answer **all** questions.

If a numerical answer cannot be given exactly, and the accuracy required is not specified in the question, then in the case of an angle it should be given correct to the nearest degree, and in other cases it should be given correct to 2 significant figures.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

The total number of marks for this paper is 120.

The use of a non-programmable scientific calculator is expected, where appropriate.

You are reminded of the need for clear presentation in your answers.

This question paper consists of 5 printed pages and 3 blank pages.

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1 Find in the form $ax + by + c = 0$ the equation of the line passing through $(2; -3)$ and parallel to the line $3x - 4y + 2 = 0$. [3]

2 Solve the equation $2^{3x-2} = 6$ leaving the answer correct to three significant figures. [3]

3 A curve has parametric equations $x = cos2t$ and $y = sin2t$.

Find the gradient function of the curve in terms of t. [3]

4 Given that $\sum_{r=1}^{n} r^2 = \frac{1}{6}n(n+1)(2n+1)$.

Evaluate $\sum_{r=10}^{50} r^2$. [3]

5 Simplify

(a) $\dfrac{a^{-\frac{3}{2}} \times a^{\frac{3}{4}}}{a^{-\frac{3}{4}}}$ [1]

(b) $\left(\dfrac{125a^3}{27b^6}\right)^{-\frac{1}{3}}$ [2]

6 The equation of a circle is $x^2 + y^2 - 2x - 6y + 1 = 0$.

Find the gradient of the circle at the point $(1; 0)$. [5]

7 (a) Express $f(x) = \sqrt{3}sinx + cosx$ in the form $Rcos(x - \alpha)$ where R is positive constant and $0 \leq \alpha < \pi$. [3]

(b) Sketch the graph the graphs $f(x) = \sqrt{3}\, Sinx + Cosx$ for $0 \leq x < 3\pi$. [2]

8 Solve the equation $cos\theta = 2cos2\theta + 1$ giving solution in the interval $0° \leq \theta \leq 360°$ to the nearest 0,1°. [6]

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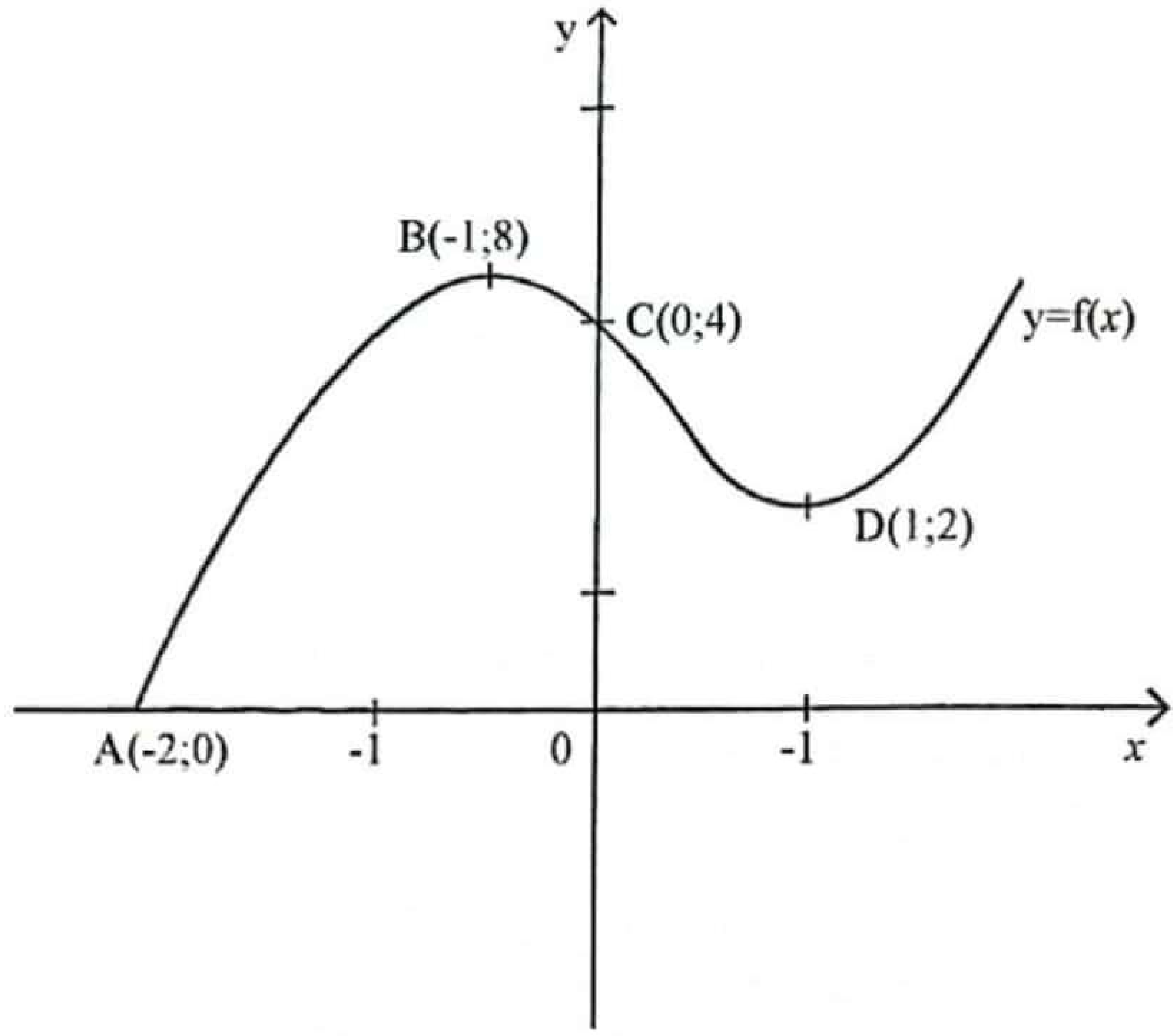
9 The diagram shows a graph of $y = f(x)$.



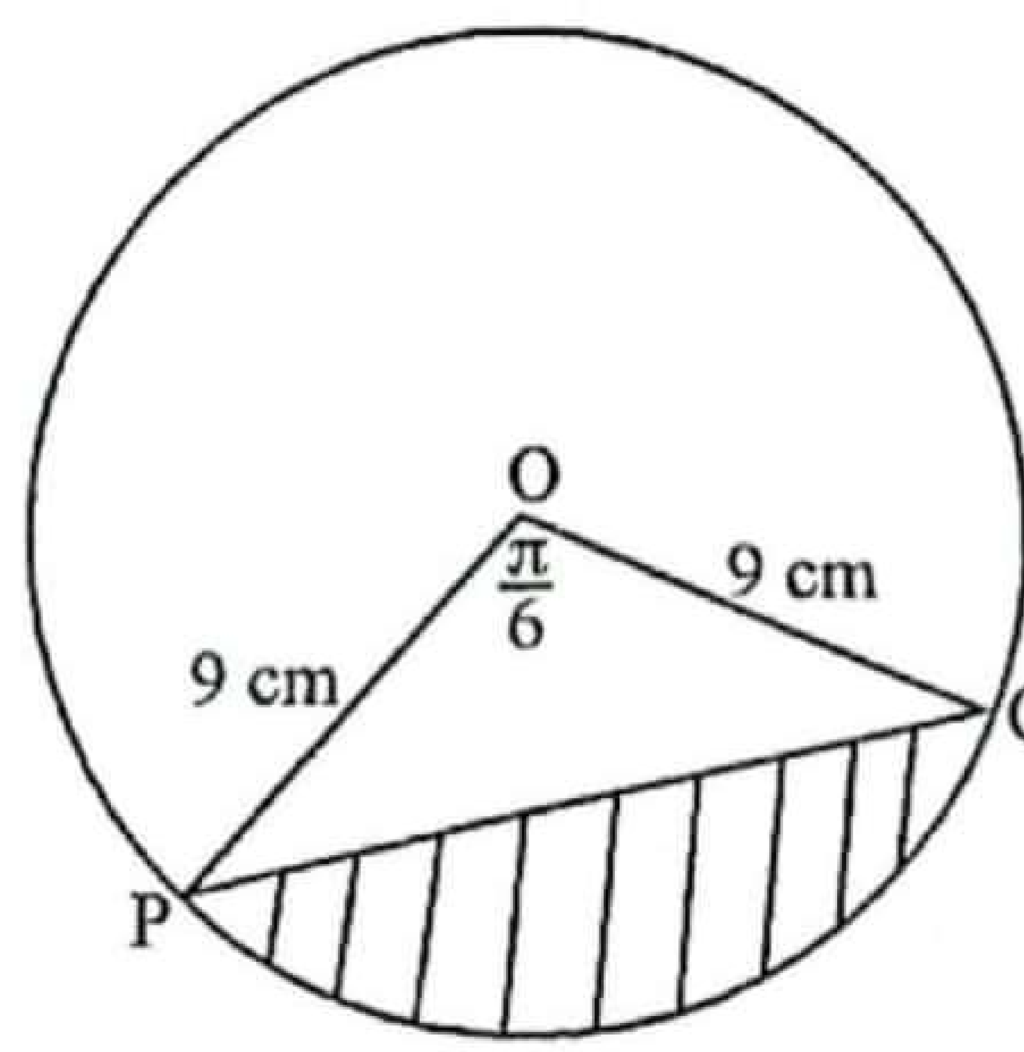
On separate diagrams, sketch the graphs showing clearly the co-ordinates of the marked points.

(a) $y = 2f(x)$, [2]

(b) $y = f(x-3)$, [2]

(c) $y = f(-x)$. [2]

10



The diagram shows a circle centre O, radius 9 cm and $P\hat{O}Q = \frac{\pi}{6}$. PQ is a chord to the circle.

Find the

(a) length of the minor arc PQ in terms of π, [2]

[redacted]

(b) area of the triangle POQ, [2]

(c) area of the shaded segment in terms of π. [2]

11 The function f is defined by $f: x \rightarrow x^2 - 4x$, where $x \in R$.

(a) Sketch the graph of f showing the intercepts and turning points. [3]

(b) State the range of f. [1]

(c) (i) If $x \geq k$, f is a one to one function. State the value of k. [1]

(ii) Using this value of k find the inverse of f stating its domain. [3]

12 The polynomial $p(x) = 6x^3 - 11x^2 + ax + b$ where a and b are constants. When $p(x)$ is divided by $(x + 1)$, it leaves a remainder of -24. Given that $(x - 1)$ is a factor of $p(x)$,

(a) find the values of a and b, [5]

(b) factorise $p(x)$ completely, [2]

(c) find the roots of $p(x) = 0$. [3]

13 (a) Sketch on the same axes the graphs of $y = |x^2 - 2|$ and $y = |x|$. [3]

(b) Hence or otherwise solve the equation $|x^2 - 2| = |x|$. [5]

(c) State the range of values of x for which $|x^2 - 2| < |x|$. [1]

14 The functions f and g are defined as follows:

$f: x \longrightarrow x^2 - 2x + 2, \quad x \in R$

$g: x \longrightarrow x + 3, \quad x \in R$

(a) Find the set of values of x for which $f(x) > 10$. [4]

(b) Find the range of f and state with a reason whether f has an inverse. [2]

(c) Show that the equation $gf(x) = 0$ has no distinct roots. [3]

15 (a) Obtain the first three terms in the expansion of $\frac{1-y}{\sqrt{4-y}}$. [4]

(b) Taking $y = \frac{2}{5}$ show that $\frac{1-y}{\sqrt{4-y}} = \frac{\sqrt{10}}{10}$. [4]

(c) Calculate the value of $\sqrt{10}$, using $y = \frac{2}{5}$ in the expansion. [2]

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16 **(a)** Solve the equation $ln(5 + e^{-2x}) = 3$ giving the answer to 3 significant figures. [3]

(b) Two variables x and t are related by the equation $x = mn^{-t}$ where m and n are constants. The values of lnx are plotted against the values of t, and the points lie on a straight line with gradient –2. 3 and crossing the vertical axis at (0; 3).

Find the value of m and the value of n. [4]

(c) Solve $|x - 3| < 5$. [2]

17 It is given that $f(x) = \sqrt{9 - x}$,

(a) Find the inverse of the function $f(x)$ stating its domain. [2]

(b) Sketch the graphs of $y = f^{-1}(x)$ and $y = f(x)$ on the same axes. [4]

(c) State the relationship between the graphs of $y = f(x)$ and $y = f^{-1}(x)$. [2]

(d) Find the x – coordinate of the point where the graphs of $y = f(x)$ and $y = f^{-1}(x)$ intersect. [2]

18 It is given that $f(x) = \frac{3x+4}{(x-4)(x^2-8)}$.

(a) Express $f(x)$ in partial fractions. [5]

(b) Hence or otherwise find the series expansion of $f(x)$ when x is small such that terms in x^4 and higher are neglected. [7]

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