Pearson Edexcel Level 3 GCE

Centre Number

Candidate Number

Mathematics

Advanced Subsidiary
Paper 1: Pure Mathematics

Practice Paper 1

Paper Reference

8MA0/01

You must have:
Mathematical Formulae and Statistical Tables, calculator

Total Marks

Candidates may use any calculator allowed by the regulations of the Joint Council for Qualifications. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

- Use black ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- Fill in the boxes at the top of this page with your name, centre number and candidate number.
- Answer all questions and ensure that your answers to parts of questions are clearly labelled.
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- The total mark for this part of the examination is 100. There are 15 questions.
- The marks for each question are shown in brackets
    – use this as a guide as to how much time to spend on each question.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Answer ALL questions.

1. (a) Given that $4 = 64^n$, find the value of n.

(1)

(b) Write $\sqrt{50}$ in the form $k\sqrt{2}$ where k is an integer to be determined.

(1)

(Total for Question 1 is 2 marks)

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2. Find the equation of the line parallel to $2x - 3y + 4 = 0$ that passes through the point $(5, 6)$.

Give your answer in the form $y = ax + b$ where a and b are rational numbers.

(Total for Question 2 is 3 marks)

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3. A student is asked to evaluate the integral $\displaystyle\int_1^2 \left(x^4 - \frac{3}{\sqrt{x}} + 2 \right) dx$.

The student's working is shown below.

$$\int_1^2 \left(x^4 - \frac{3}{\sqrt{x}} + 2 \right) dx = \int_1^2 (x^4 - 3x^{\frac{1}{2}} + 2)dx$$

$$= \left[\frac{x^5}{5} - 2x^{\frac{3}{2}} + 2x \right]_1^2$$

$$= \left(\frac{1}{5} - 2 + 2 \right) - \left(\frac{32}{5} - 2\sqrt{8} + 4 \right)$$

$$= -4.54 \ (3 \text{ s.f.})$$

(a) Identify two errors made by the student.

(2)

(b) Evaluate the definite integral, giving your answer correct to 3 significant figures.

(2)

(Total for Question 3 is 4 marks)

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4. Find all the solutions in the interval $0 \le x \le 180°$ of
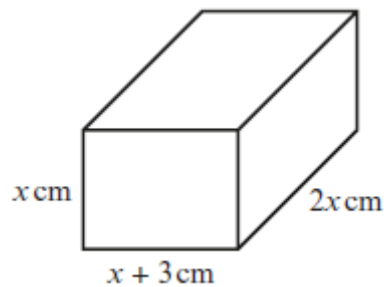
$$2 \sin^2 (2x) - \cos (2x) - 1 = 0,$$

giving each solution in degrees.

(Total for Question 4 is 7 marks)

5. A rectangular box has sides measuring x cm, $x + 3$ cm and $2x$ cm.

Figure 1

(a) Write down an expression for the volume of the box.

(1)

Given that the volume of the box is 980 cm³,

(b) show that $x^3 + 3x^2 - 490 = 0$.

(2)

(c) Show that $x = 7$ is a solution to this equation.

(1)

(d) Prove that the equation has no other real solutions.

(4)

(Total for Question 5 is 8 marks)

6.
$$f(x) = x^3 - 5x^2 - 2 + \frac{1}{x^2}.$$

The point P with x-coordinate -1 lies on the curve $y = f(x)$.

Find the equation of the normal to the curve at P.
Give your answer in the form $ax + by + c = 0$ where a, b and c are positive integers.

(Total for Question 6 is 7 marks)

7. The population, P, of a colony of endangered Caledonian owlet-nightjars can be modelled by the equation $P = ab^t$ where a and b are constants and t is the time, in months, since the population was first recorded.
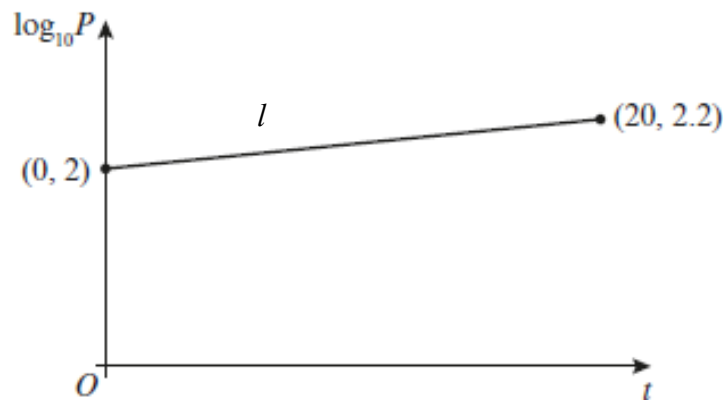
Figure 2

The line l shown in figure 2 shows the relationship between t and $\log_{10}P$ for the population over a period of 20 years.

(a) Write down an equation of line l.

(3)

(b) Work out the value of a and interpret this value in the context of the model.

(3)

(c) Work out the value of b, giving your answer correct to 3 decimal places.

(2)

(d) Find the population predicted by the model when $t = 30$.

(1)

(Total for Question 7 is 9 marks)

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8. Prove that $1 + \cos^4 x - \sin^4 x \equiv 2\cos^2 x$.
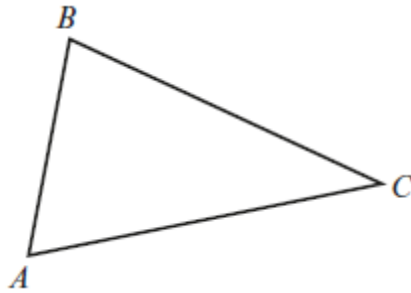
(Total for Question 8 is 4 marks)

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9. Relative to a fixed origin, point A has position vector $6\mathbf{i} - 3\mathbf{j}$ and point B has position vector $4\mathbf{i} + 2\mathbf{j}$.

Find the magnitude of the vector $\overrightarrow{AB}$ and the angle it makes with the unit vector $\mathbf{i}$.

(Total for Question 9 is 5 marks)

10. A triangular lawn ABC is shown in figure 3.

Figure 3

Given that $AB = 7.5$ m, $BC = 10.6$ m and $AC = 12.7$ m,

(a) find angle BAC.

(3)

Grass seed costs £1.25 per square metre.

(b) Find the cost of seeding the whole lawn.

(5)

(Total for Question 10 is 8 marks)

11.
$$g(x) = (x - 2)^2(x + 1)(x - 7)$$

(a) Sketch the curve $y = g(x)$, showing the coordinates of any points where the curve meets or cuts the coordinate axes.

(4)

(b) Write down the roots of the equation $g(x + 3) = 0$.

(1)

(Total for Question 11 is 5 marks)

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12. Given that $9^{2x} = 27^{x^2 - 5}$, find the possible values of x.

(Total for Question 12 is 6 marks)

13.
$$f(x) = (1 - 3x)^5.$$

(a) Expand f(x), in ascending powers of x, up to the term in x^2, giving each term in its simplest form.

(3)

(b) Hence find an approximate value for 0.97^5.

(2)

(c) State, with a reason, whether your approximation is greater or smaller than the true value.

(2)

(Total for Question 13 is 7 marks)

14.
$$f'(x) = \frac{\sqrt{x} - x^2 - 1}{x^2}, \quad x > 0.$$

(a) Show that f(x) can be written as $f(x) = -\dfrac{x^2 + 2\sqrt{x} - 1}{x} + c$, where c is a constant.

(5)

Given that f(x) passes through the point $(3, -1)$,

(b) find the value of c.

Give your answer in the form $p + q\sqrt{r}$ where p, q and r are rational numbers to be found.

(4)

(Total for Question 14 is 9 marks)

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15. A circle, C, has equation $x^2 + y^2 - 4x + 6y = 12$

(a) Show that the point $A(5, 1)$ lies on C and find the centre and radius of the circle.

(5)

(b) Find the equation of the tangent to C at point A. Give your answer in the form $y = ax + b$ where a and b are rational numbers.

(4)

(c) The curve $y = x^2 - 2$ intersects this tangent at points P and Q. Given that O is the origin, find, as a fraction in simplest form, the exact area of the triangle POQ.

(7)

(Total for Question 15 is 16 marks)

TOTAL FOR PURE MATHEMATICS 1 IS 100 MARKS