NAME:

Date to be handed in:

MARK (out of 100):

Qu	1	2	3	4	5	6	7	8	9	10	11	12	13

Mathematics
Advanced Subsidiary
Paper 1: Pure Mathematics

Practice Paper A:
Time 2 hours

Paper Reference
8MA0/01

You must have:
Mathematical Formulae and Statistical Tables, calculator

Total Marks

Candidates may use any calculator permitted by Pearson regulations.
Calculators must not have the facility for algebraic 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** the questions and ensure that your answers to parts of questions are
  clearly labelled.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- You should show sufficient working to make your methods clear. Answers
  without working may not gain full credit.

Questions to revise:

1. Prove that, for all values of x,

$$x^2 + 6x + 18 > 2 - \frac{1}{2}x.$$

(Total 4 marks)

---

2. (*a*) Find an equation of the straight line passing through the points with coordinates $(4, -7)$ and $(-6, 11)$, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers.

(3)

The line crosses the x-axis at point A and the y-axis at point B and O is the origin.

(*b*) Find the area of triangle AOB.

(3)

(Total 6 marks)

---

3. Find, to 1 decimal place, the values of θ in the interval $0 \leqslant \theta \leqslant 180°$ for which

$$4\sqrt{3} \sin (3\theta + 20°) = 4 \cos (3\theta + 20°).$$

(Total 6 marks)

---

4. $\log_{11} (2x - 1) = 1 - \log_{11}(x + 4)$.

Find the value of x showing detailed reasoning.

(Total 6 marks)

---

5. Given that the resultant of the vectors $\mathbf{a} = 2p\mathbf{i} - 5\mathbf{j}$ and $\mathbf{b} = 6\mathbf{i} - 3p\mathbf{j}$ is parallel to the vector $\mathbf{c} = 4\mathbf{i} - 5\mathbf{j}$,

(*a*) find the value of p,

(4)

(*b*) find the resultant of the vectors $\mathbf{a}$ and $\mathbf{b}$.

(2)

(Total 6 marks)

---

6. The population, P, of bacteria in an experiment can be modelled by the formula $P = 100e^{0.4t}$, where t is the time in hours after the experiment began.

(a) Use the model to estimate the population of bacteria 7 hours after the experiment began.

(2)

(b) Interpret the meaning of the constant 100 in the model.

(1)

(c) How many whole hours after the experiment began does the population of bacteria first exceed 1 million, according to the model?

(3)

(Total 6 marks)

---

7. The line with equation $mx - y - 2 = 0$ touches the circle with equation $x^2 + 6x + y^2 - 8y = 4$.

Find the two possible values of m, giving your answers in exact form.

(Total 7 marks)

---

8. Given that point A has the position vector $4\mathbf{i} + 7\mathbf{j}$ and point B has the position vector $10\mathbf{i} + q\mathbf{j}$, where q is a constant, find

(a) the vector $\overrightarrow{AB}$ in terms of q.

(2)

(b) Given further that $\left|\overrightarrow{AB}\right| = 2\sqrt{13}$, find the two possible values of q showing detailed reasoning in your working.

(5)

(Total 7 marks)

---

9. (a) Find the first four terms, in ascending powers of x, of the binomial expansion of $(2 + px)^9$.
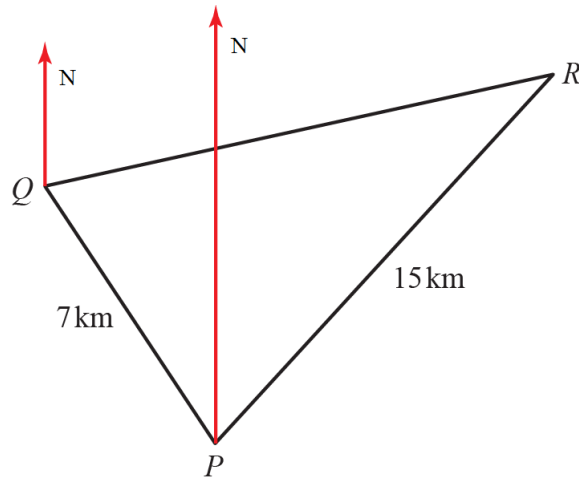
(4)

Given that the coefficient of the x^3 term in the expansion is -84.

(b) (i) Find the value of p.

(2)

(ii) Find the numerical values for the coefficients of the x and x^2 terms.

(2)

(8 marks)

10. The diagram shows the position of three boats, P, Q and R. Boat Q is 7 km from boat P on a bearing of 327°. Boat R is 15 km from boat P on a bearing of 041°.

(a) Find the distance between boats Q and R to 1 decimal place.

(5)

(b) Find the 3 figure bearing of boat R from boat Q.

(5)

(10 marks)

---

11. A fish tank in the shape of a cuboid is to be made from 1600 cm² of glass.
The fish tank will have a square base of side length x cm, and no lid. No glass is wasted.
The glass can be assumed to be very thin.

(a) Show that the volume, V cm³, of the fish tank is given by $V = 400x - \dfrac{x^3}{4}$.

(5)

(b) Given that x can vary, use differentiation to find the maximum or minimum value of V.

(4)

(c) Justify that the value of V you found in part **b** is a maximum.

(2)

(Total 11 marks)

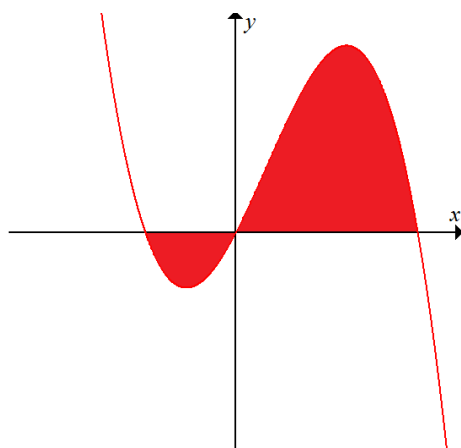**12.** The graph shows part of the curve C with equation $y = -x^3 + 2x^2 + 8x$.

Figure 1

The curve C crosses the x-axis at the origin O and at points A and B.

(a) Using an appropriate algebraic method, find the coordinates of A and B.

(3)

(b) The finite region shown shaded is bounded by the curve C and the x-axis.
   Use calculus to find the total area of the shaded region.

(8)

(Total 11 marks)

13.
$$p(x) = 3 - \frac{1}{2}x, \qquad q(x) = x^2 - 10x - 20.$$

(a) Solve the equation $q(x) = 0$. Write your answer in the form $a \pm 3\sqrt{b}$, where a and b are integers to be found.

(2)

(b) Sketch the graphs of $y = p(x)$ and $y = q(x)$ on the same set of axes.
   Label all points where the curves intersect the coordinate axes.

(4)

(c) Use an algebraic method to find the coordinates of any point of intersection of the graphs $y = p(x)$ and $y = q(x)$.

(4)

(d) Write down, using set notation, the set of values of x for which $p(x) < q(x)$.

(2)

(Total 12 marks)

END OF PAPER (TOTAL: 100 MARKS)

BLANK PAGE