NAME:

Date to be handed in:

MARK (out of 100):

PAPER C

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

Mathematics

Advanced Subsidiary
Paper 1: Pure Mathematics

Practice Paper C:
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, from first principles, that the derivative of $5x^3$ is $15x^2$.

(Total 4 marks)

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2. (*a*) Sketch the graph of $y = 8^x$ stating the coordinates of any points where the graph crosses the coordinate axes.

(2)

(*b*) (i) Describe fully the transformation which transforms the graph $y = 8^x$ to the graph $y = 8^{x-1}$.

(1)

(ii) Describe the transformation which transforms the graph $y = 8^{x-1}$ to the graph $y = 8^{x-1} + 5$.

(1)

(Total 4 marks)

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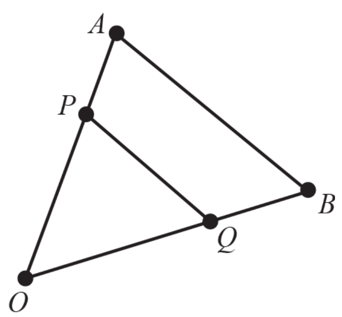
3. In $\triangle OAB$, $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.

P divides OA in the ratio 3 : 2 and Q divides OB in the ratio 3 : 2.



(*a*) Show that PQ is parallel to AB.

(4)

(*b*) Given that the length of AB is 10 cm, find the length of PQ.

(1)

(Total 5 marks)

4.
$$g(x) = \frac{4}{x-6} + 5, \quad x \in \mathbb{R}.$$

Sketch the graph $y = g(x)$.

Label any asymptotes and any points of intersection with the coordinate axes.

(Total 5 marks)

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5. $$f(x) = 2x^3 - x^2 - 13x - 6.$$

Use the factor theorem and division to factorise f(x) completely.

(Total 6 marks)

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6. (a) Fully expand $(p + q)^5$.

(2)

A fair four-sided die, numbered 1, 2, 3 and 4, is rolled 5 times.

Let p represent the probability that the number 4 is rolled on a given roll and let q represent the probability that the number 4 is not rolled on a given roll.

(b) Using the first three terms of the binomial expansion from part (a), or otherwise, find the probability that the number 4 is rolled at least 3 times.

(5)

(Total 7 marks)

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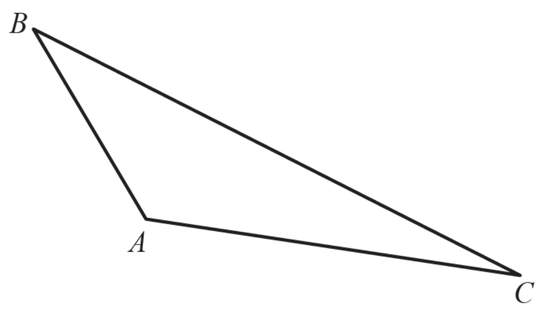
7. In $\triangle ABC$, $\overrightarrow{AB} = -3\mathbf{i} + 6\mathbf{j}$ and $\overrightarrow{AC} = 10\mathbf{i} - 2\mathbf{j}$.



(a) Find the size of $\angle BAC$, in degrees, to 1 decimal place.

(5)

(b) Find the exact value of the area of $\triangle ABC$.

(3)

(Total 8 marks)

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8. The points A and B have coordinates $(3k - 4, -2)$ and $(1, k + 1)$ respectively, where k is a constant.

Given that the gradient of AB is $-\frac{3}{2}$,

(a) show that $k = 3$,

(2)

(b) find an equation of the line through A and B,

(3)

(c) find an equation of the perpendicular bisector of A and B. Leave your answer in the form $ax + by + c = 0$ where a, b and c are integers.

(4)

(Total 9 marks)

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9. A stone is thrown from the top of a cliff.

The height h, in metres, of the stone above the ground level after t seconds is modelled by the function

$$\mathrm{h}(t) = 115 + 12.25t - 4.9t^2.$$

(a) Give a physical interpretation of the meaning of the constant term 115 in the model.

(1)

(b) Write $h(t)$ in the form $A - B(t - C)^2$, where A, B and C are constants to be found.

(3)

(c) Using your answer to part (b), or otherwise, find, with justification

(i) the time taken after the stone is thrown for it to reach ground level,

(3)

(ii) the maximum height of the stone above the ground and the time after which this maximum height is reached.

(2)

(Total 9 marks)

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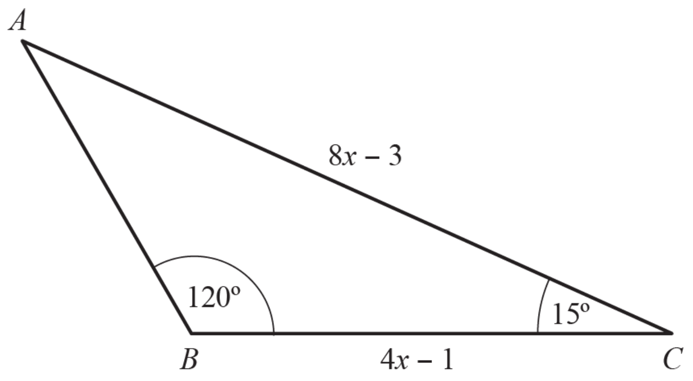
10. The diagram shows $\triangle ABC$ with $AC = 8x - 3$, $BC = 4x - 1$, $\angle ABC = 120°$ and $\angle ACB = 15°$.



(a) Show that the exact value of x is $\dfrac{9+\sqrt{6}}{20}$.

(7)

(b) Find the area of $\triangle ABC$, giving your answer to 2 decimal places.

(3)

(Total 10 marks)

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11. (a) Given that $\int_a^{2a}(10-6x)\mathrm{d}x = 1$, find the two possible values of a.

(6)

(b) Labelling all axes intercepts, sketch the graph of $y = 10 - 6x$ for $0 \leq x \leq 2$.

(2)

(c) With reference to the integral in part a and the sketch in part (b), explain why the larger value of a found in part (a) produces a solution for which the actual area under the graph between a and $2a$ is not equal to 1. State whether the area is greater than 1 or smaller than 1.

(2)

(Total 10 marks)

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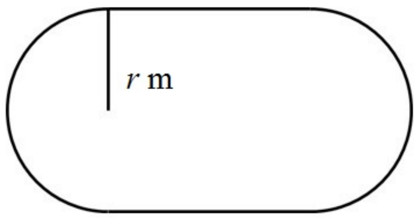
12. The diagram shows the plan of a school running track. It consists of two straight sections, which are the opposite sides of a rectangle, and two semicircular sections, each of radius r m. The length of the track is 300 m and it can be assumed to be very narrow.



(*a*) Show that the internal area, A m^2, is given by the formula $A = 300r - \pi r^2$.

(5)

(*b*) Hence find in terms of π the maximum value of the internal area.
You do not have to justify that the value is a maximum.

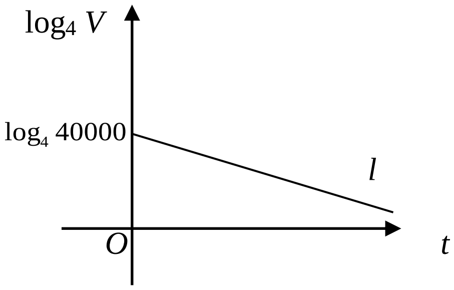
(6)

(Total 11 marks)

13. The value of a car, V in £, is modelled by the equation $V = ab^t$, where a and b are constants and t is the number of years since the car was purchased.

The line l shown in the diagram illustrates the linear relationship between t and $\log_4 V$ for $t \geq 0$.

The line l meets the vertical axis at $(0, \log_4 40\,000)$ as shown. The gradient of l is $-\frac{1}{10}$.



(*a*) Write down an equation for l.

(2)

(*b*) Find, in exact form, the values of a and b.

(4)

(*c*) With reference to the model, interpret the values of the constant a and b.

(2)

(*d*) Find the value of the car after 7 years.

(1)

(*e*) After how many years is the value of the car less than £10 000?

(2)

(*f*) State a limitation of the model.

(1)

(Total 12 marks)

END OF PAPER (TOTAL: 100 MARKS)

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