Pearson Edexcel

AS Mathematics 8MA0

Practice Paper C

Pure Mathematics

Time allowed: 2 **hours**

Centre:

Name:

Teacher:

Question	Points	Score
1	4	
2	4	
3	5	
4	5	
5	6	
6	7	
7	8	
8	9	
9	9	
10	10	
11	10	
12	11	
13	12	
Total:	100	

1. Prove, from first principles, that the derivative of $5x^3$ is $15x^2$. [4]

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

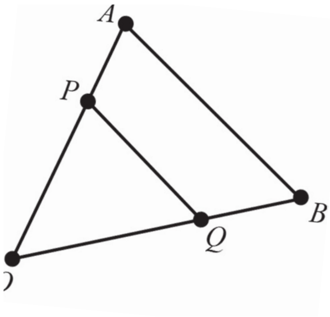
   (b) i. Describe fully the transformation which transforms the graph $y = 8^x$ to the graph $y = 8^{x-1}$. [1]

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

Total: 4

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

   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

4. [5]

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

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

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

5. [6]

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

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

6. (a) Fully expand $(p + q)^5$. [2]

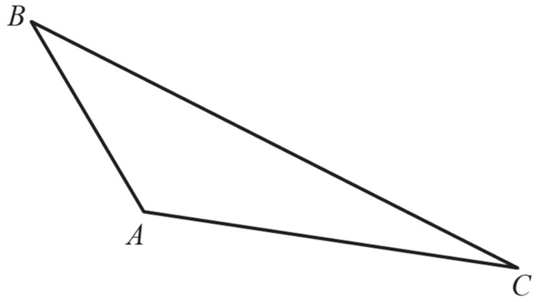
   (b) A fair four-sided die, numbered 1, 2, 3 and 4, is rolled 5 times. [5]

   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.

   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.

Total: 7

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

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. [4]

Leave your answer in the form $ax+by+c=0$ where a, b and c are integers.

Total: 9

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

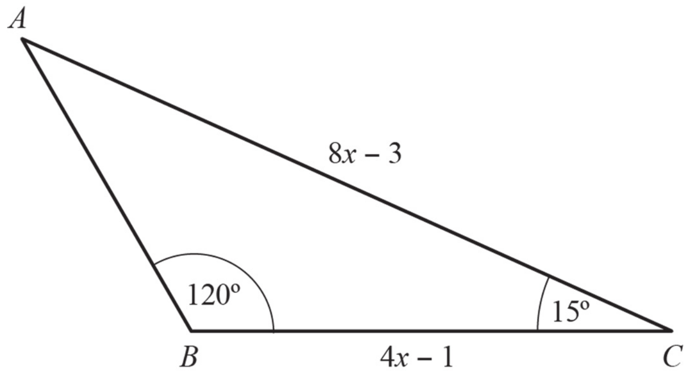
      i. the time taken after the stone is thrown for it to reach ground level, [3]

      ii. the maximum height of the stone above the ground and the time after which this maximum height is reached. [2]

Total: 9

(Q9 continued)

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 $\frac{9+\sqrt{6}}{20}$. [7]

(b) Find the area of $\triangle ABC$, giving your answer to 2 decimal places. [3]

Total: 10

11. (a) Given that [6]

$$\int_a^{2a} 10 - 6x \, \mathrm{d}x = 1,$$

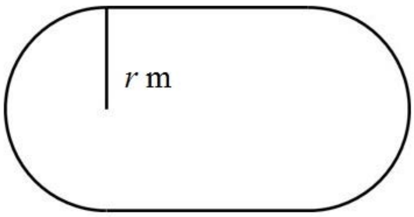
find the two possible values of a.

(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

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 300m and it can be assumed to be very narrow.



(a) Show that the internal area, $A\text{m}^2$, 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. [6]

You do not have to justify that the value is a maximum.

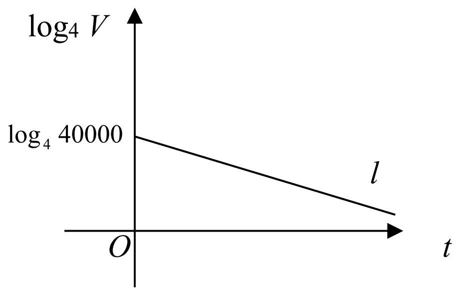
Total: 11

(Q12 continued)

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 $(0, \log_4(40000))$ 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

(Q13 continued)

(Q13 continued)