


Please check the examination details below before entering your candidate information			
Candidate surname		Other names	
Pearson Edexcel International GCSE		Centre Number	
		<div style="display: flex; justify-content: space-around;"> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> </div>	
		Candidate Number	
		<div style="display: flex; justify-content: space-around;"> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> <div style="border: 1px solid black; width: 20px; height: 20px;"></div> </div>	
<h2 style="margin: 0;">Monday 17 June 2019</h2>			
Afternoon (Time: 2 hours)		Paper Reference 4PM1/01R	
<h2 style="margin: 0;">Further Pure Mathematics</h2> <h3 style="margin: 0;">Paper 1R</h3>			
Calculators may be used.			Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Without sufficient working, correct answers may be awarded no marks.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- You must **NOT** write anything on the formulae page.
Anything you write on the formulae page will gain NO credit.

Information

- The total mark for this paper is 100.
- 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.
- Check your answers if you have time at the end.

Turn over ►

P61882A

©2019 Pearson Education Ltd.

1/1/1/1/




Pearson

International GCSE in Further Pure Mathematics Formulae sheet

Mensuration**Surface area of sphere** $= 4\pi r^2$ **Curved surface area of cone** $= \pi r \times \text{slant height}$ **Volume of sphere** $= \frac{4}{3}\pi r^3$ **Series****Arithmetic series**Sum to n terms, $S_n = \frac{n}{2}[2a + (n-1)d]$ **Geometric series**Sum to n terms, $S_n = \frac{a(1-r^n)}{(1-r)}$ Sum to infinity, $S_\infty = \frac{a}{1-r} \quad |r| < 1$ **Binomial series**

$$(1+x)^n = 1 + nx + \frac{n(n-1)}{2!}x^2 + \dots + \frac{n(n-1)\dots(n-r+1)}{r!}x^r + \dots \quad \text{for } |x| < 1, n \in \mathbb{Q}$$

Calculus**Quotient rule (differentiation)**

$$\frac{d}{dx} \left(\frac{f(x)}{g(x)} \right) = \frac{f'(x)g(x) - f(x)g'(x)}{[g(x)]^2}$$

Trigonometry**Cosine rule**In triangle ABC : $a^2 = b^2 + c^2 - 2bc \cos A$

$$\tan \theta = \frac{\sin \theta}{\cos \theta}$$

$$\sin(A+B) = \sin A \cos B + \cos A \sin B$$

$$\sin(A-B) = \sin A \cos B - \cos A \sin B$$

$$\cos(A+B) = \cos A \cos B - \sin A \sin B$$

$$\cos(A-B) = \cos A \cos B + \sin A \sin B$$

$$\tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$$

$$\tan(A-B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}$$

Logarithms

$$\log_a x = \frac{\log_b x}{\log_b a}$$

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Answer all ELEVEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1

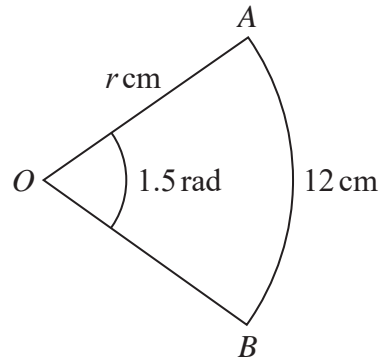


Diagram **NOT**
accurately drawn

Figure 1

Figure 1 shows sector AOB of a circle with centre O and radius r cm. The angle AOB is 1.5 radians and the length of arc AB is 12 cm.

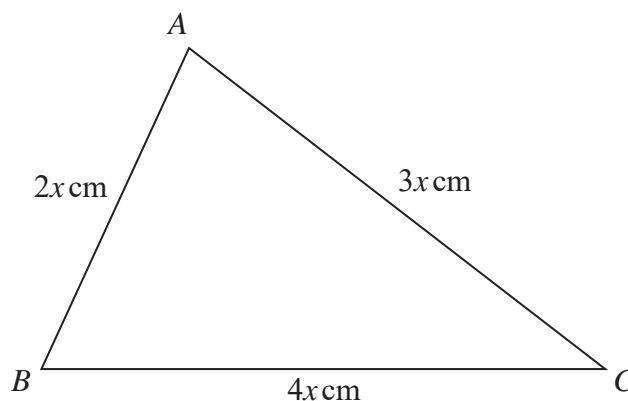
Calculate

- (a) the value of r , (1)
- (b) the area of the sector AOB . (2)

(Total for Question 1 is 3 marks)



2

Diagram **NOT**
accurately drawn**Figure 2**Figure 2 shows triangle ABC in which

$$AB = 2x \text{ cm} \quad AC = 3x \text{ cm} \quad BC = 4x \text{ cm}$$

(a) Show that $\sin ABC = \frac{3\sqrt{15}}{16}$ (4)

Given that the area of triangle ABC is $\frac{75\sqrt{15}}{64} \text{ cm}^2$

(b) find the value of x . (2)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Question 2 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 2 is 6 marks)

3 (a) Write down the value of $\log_3 9$

(1)

(b) Solve the equation $\log_3 9t = \log_9 \left(\frac{12}{t} \right)^2 + 2$ where $t > 0$

Give your answer in the form $a\sqrt{b}$ where a and b are prime numbers.

(6)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Question 3 continued

Handwriting practice area with horizontal dotted lines.

(Total for Question 3 is 7 marks)



4

$$f(x) = e^{3x} \sqrt{1 + 2x}$$

(a) Show that

$$f'(x) = \frac{2e^{3x}(2 + 3x)}{\sqrt{1 + 2x}} \quad (4)$$

(b) Find an equation of the normal to the curve with equation $y = f(x)$ at the point on the curve where $x = 0$

Give your answer in the form $ax + by + c = 0$ where a , b and c are integers. (6)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Question 4 continued

Handwriting practice area with horizontal dotted lines.

(Total for Question 4 is 10 marks)



5 A circle has radius $3r$ cm and area A cm²

Given that the value of r increases by 0.05%

use calculus to find an estimate for the percentage increase in the value of A .

(5)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Question 5 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 5 is 5 marks)

P 6 1 8 8 2 A 0 1 1 3 6

6 (a) Show that $\sum_{r=1}^n (4r - 3) = n(2n - 1)$

(3)

(b) Hence, or otherwise, find the least value of n such that $\sum_{r=1}^n (4r - 3) > 1000$

(3)

Given that $S_n = n(2n - 1)$, $t_n = (4n - 3)$ and that $18 + 3t_{n+7} = S_{n+4}$

(c) find the value of n .

(4)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Question 6 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Question 6 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Question 6 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 6 is 10 marks)

P 6 1 8 8 2 A 0 1 5 3 6

7 O, A, B and C are fixed points such that

$$\vec{OA} = 8\mathbf{i} - 6\mathbf{j} \quad \vec{OB} = 15\mathbf{i} - 6\mathbf{j} \quad \vec{OC} = 8\mathbf{i} + \mathbf{j}$$

(a) Find \vec{BC} as a simplified expression in terms of \mathbf{i} and \mathbf{j} (2)

(b) Find a unit vector parallel to \vec{BC} (2)

The point M is the midpoint of OA and the point N lies on OB such that $ON:NB = 1:2$

(c) Show that the points M, N and C are collinear. (4)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Question 7 continued

Handwriting practice area with 25 horizontal dotted lines.



Question 7 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Question 7 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 7 is 8 marks)

P 6 1 8 8 2 A 0 1 9 3 6

- (2)

DO NOT WRITE IN THIS AREA

- (2)

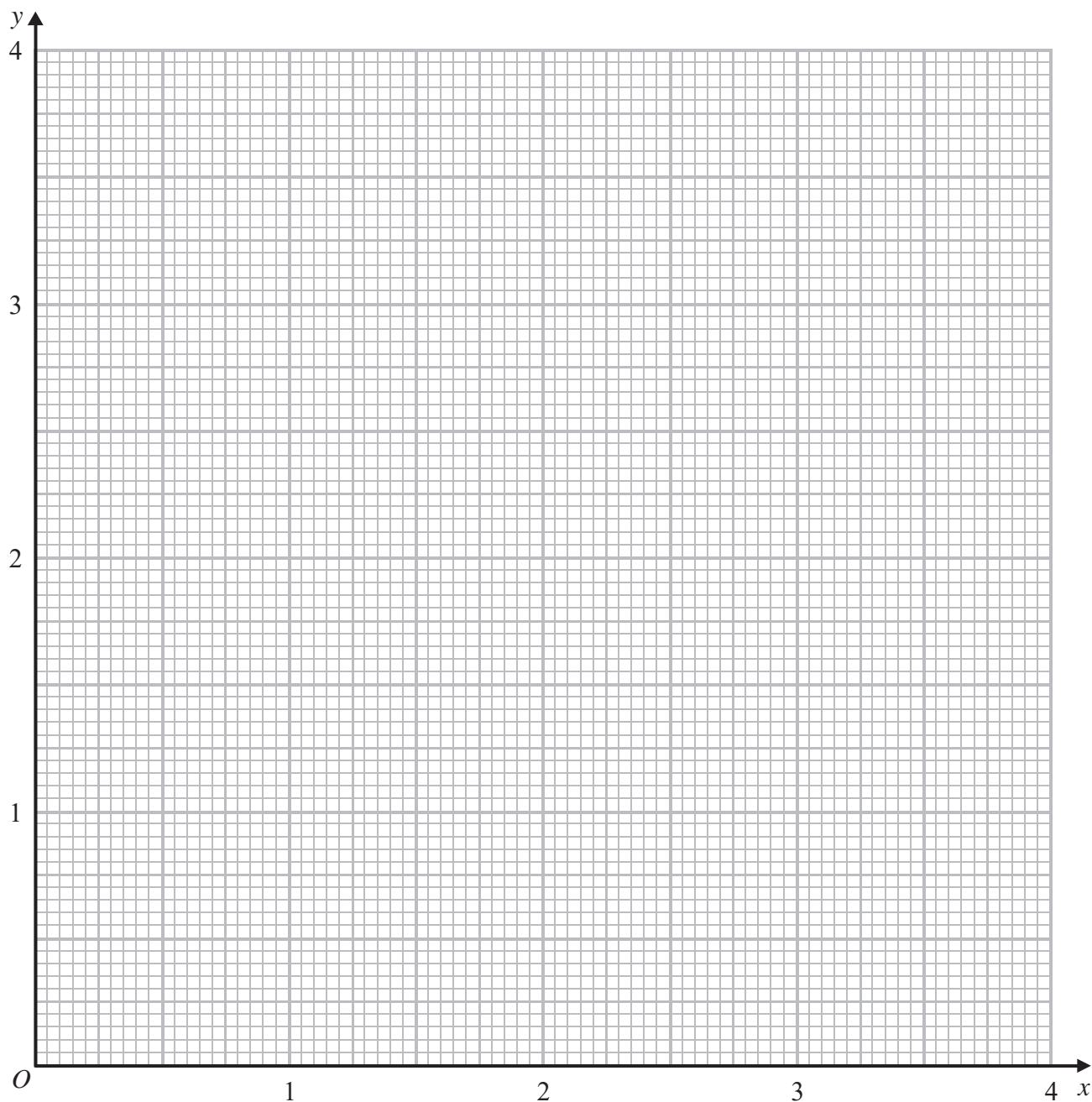
- (3)

- (4)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Question 8 continued



Turn over for a spare grid if you need to redraw your graph.



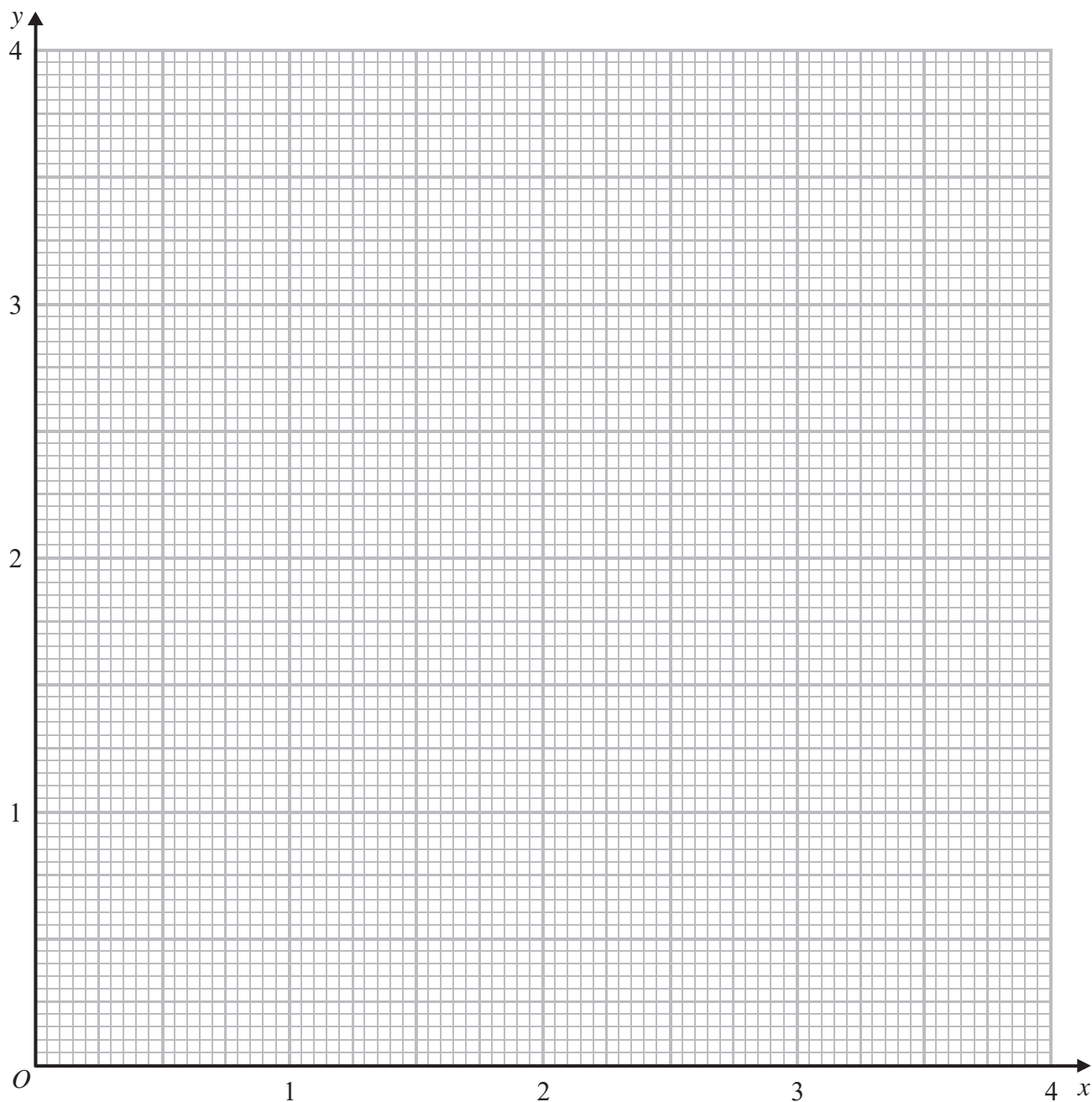
Question 8 continued

DO NOT WRITE IN THIS AREA

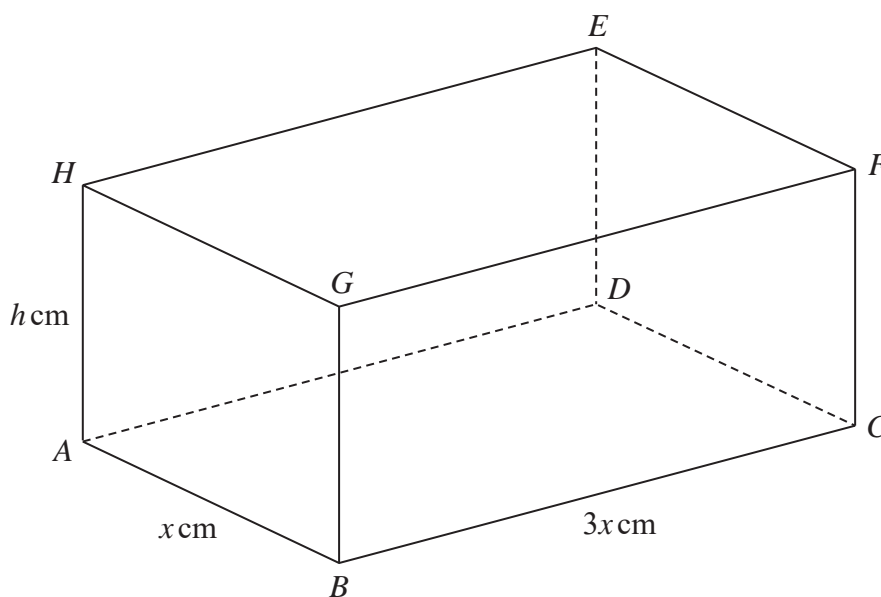
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Question 8 continued**Only use this grid if you need to redraw your graph.****(Total for Question 8 is 11 marks)**

9

Diagram **NOT**
accurately drawn**Figure 3**Figure 3 shows a solid cuboid $ABCDEFGH$

$$AB = x \text{ cm} \quad BC = 3x \text{ cm} \quad AH = h \text{ cm}$$

The volume of the cuboid is 540 cm^3 The total surface area of the cuboid is $S \text{ cm}^2$

- (a) Show that $S = 6x^2 + \frac{1440}{x}$ (4)

Given that x can vary,

- (b) use calculus to find, to 3 significant figures, the value of x for which S is a minimum.
Justify that this value of x gives a minimum value of S . (5)
- (c) Find, to 3 significant figures, the minimum value of S . (1)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Question 9 continued

Handwriting practice area with horizontal dotted lines.



Question 9 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Question 9 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 9 is 10 marks)

P 6 1 8 8 2 A 0 2 7 3 6

10

$$f(x) = 6x - x^2 \quad x \in \mathbb{R}$$

Given that $f(x)$ can be written in the form $D(x + E)^2 + F$ where D , E and F are integers,

(a) find the value of D , the value of E and the value of F .

(3)

(b) Find

(i) the maximum value of $f(x)$,

(ii) the value of x for which the maximum occurs.

(2)

The curve C has equation $y = f(x)$

The curve S has equation $y = x^2 - 4x + 8$

The curve S intersects the curve C at two points.

(c) Find the coordinates of each of these two points.

(4)

The finite region R is bounded by the curve C and the curve S .

(d) Use algebraic integration to find the area of R .

(4)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Question 10 continued

Handwriting practice area with 20 horizontal dotted lines for the answer to Question 10.



P 6 1 8 8 2 A 0 2 9 3 6

Question 10 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Question 10 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 10 is 13 marks)

P 6 1 8 8 2 A 0 3 1 3 6

11 The points A and B have coordinates $(-1, 3)$ and $(5, 6)$ respectively.

(a) Find an equation for the line AB .

(2)

The point P divides AB in the ratio $2:1$

(b) Show that the coordinates of P are $(3, 5)$

(2)

The point C with coordinates (m, n) , where $m > 0$, is such that CP is perpendicular to the line AB .

Given that the radius of the circle which passes through A , P and C is 5

(c) find the value of m and the value of n .

(6)

The point D with coordinates (p, q) is such that the line AD is perpendicular to the line AB and the line DC is parallel to the line AB .

(d) Find the value of p and the value of q .

(3)

(e) Find the area of trapezium $ABCD$.

(4)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Question 11 continued

Handwriting practice area with horizontal dotted lines.



P 6 1 8 8 2 A 0 3 3 3 6

Question 11 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Question 11 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



P 6 1 8 8 2 A 0 3 5 3 6

Question 11 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 11 is 17 marks)**TOTAL FOR PAPER IS 100 MARKS**