

Write your name here

Surname

Other names

Pearson Edexcel
International GCSE

Centre Number

--	--	--	--	--	--

Candidate Number

--	--	--	--	--	--

Further Pure Mathematics

Paper 1

Friday 12 January 2018 – Morning
Time: 2 hours

Paper Reference

4PM0/01

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.*

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 ►

P53291A

©2018 Pearson Education Ltd.

1/1/1/



Pearson

Answer all TEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1

$$f(x) = 6 + 5x - 2x^2$$

Given that $f(x)$ can be written in the form $p(x + q)^2 + r$, where p , q and r are rational numbers,

(a) find the value of p , the value of q and the value of r . (3)

(b) Hence, or otherwise, find

- (i) the maximum value of $f(x)$,
- (ii) the value of x for which this maximum occurs. (2)

$$g(x) = 6 + 5x^3 - 2x^6$$

(c) Write down

- (i) the maximum value of $g(x)$,
- (ii) the exact value of x for which this maximum occurs. (3)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Question 1 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Area with horizontal dotted lines for writing.

(Total for Question 1 is 8 marks)



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

2 (a) On the grid opposite, draw

(i) the line with equation $y = 3x - 3$

(ii) the line with equation $3x + 2y = 12$

(2)

(b) Show, by shading, the region R defined by the inequalities

$$y \leq 3x - 3 \quad 3x + 2y \leq 12 \quad y \geq -1$$

(2)

For all points in R with coordinates (x, y)

$$P = 4x - y$$

(c) Find the greatest value of P .

(4)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

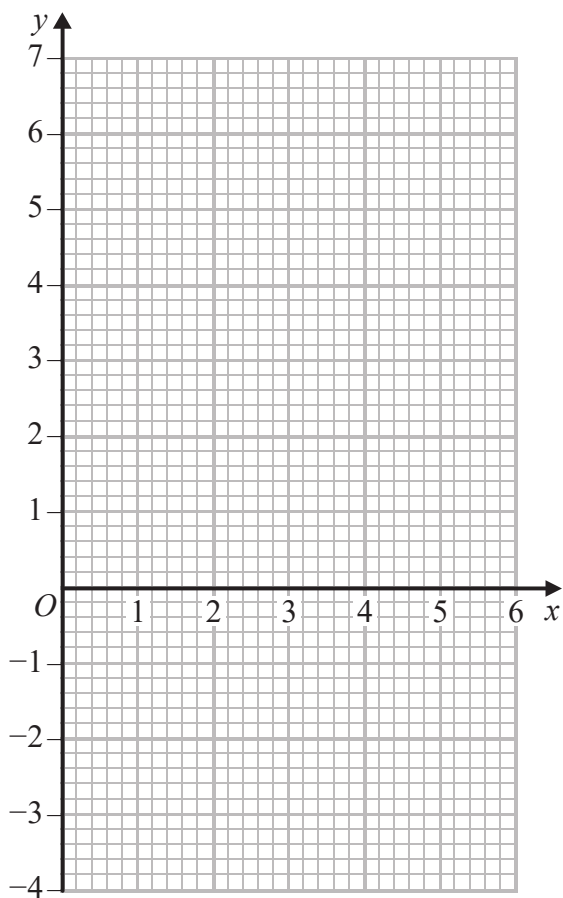


Question 2 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

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



Question 2 continued

Area with horizontal dotted lines for writing.

DO NOT WRITE IN THIS AREA

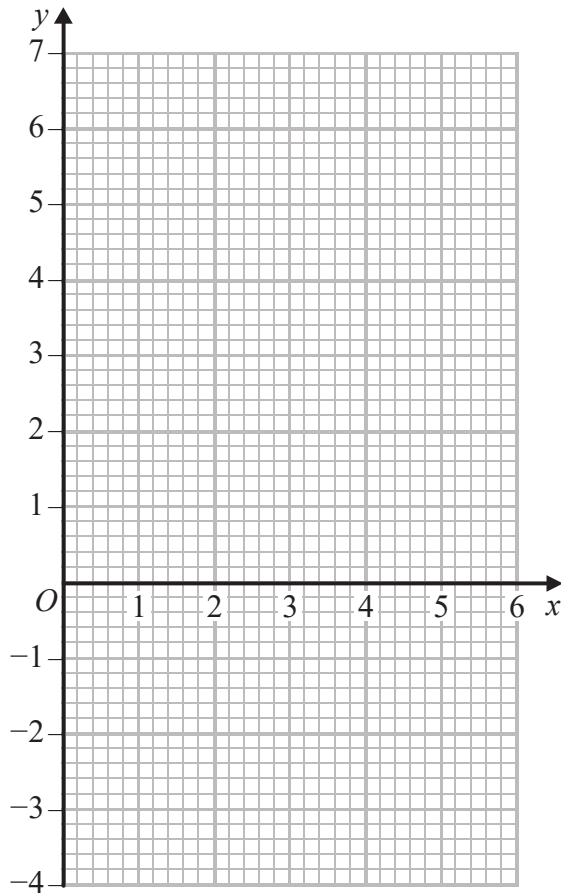
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Question 2 continued

Only use this grid if you need to redraw your graph



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(Total for Question 2 is 8 marks)



- 3 The volume of a right circular cone is increasing at a constant rate of $27 \text{ cm}^3/\text{s}$. The radius of the base of the cone is always 1.5 times the height of the cone.

Calculate the rate of change of the height of the cone, in cm/s to 3 significant figures, when the height of the cone is 4 cm.

(6)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Question 3 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Area with horizontal dotted lines for writing.

(Total for Question 3 is 6 marks)



Question 4 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Area with horizontal dotted lines for writing.

(Total for Question 4 is 8 marks)



DO NOT WRITE IN THIS AREA

5 (a) Complete the table of values for $y = \frac{x^3 + 2}{x + 1}$ giving your answers to 2 decimal places where appropriate.

x	0	0.5	1	1.5	2	3	4
y		1.42		2.15		7.25	

(2)

(b) On the grid opposite draw the graph of $y = \frac{x^3 + 2}{x + 1}$ for $0 \leq x \leq 4$

(2)

(c) By drawing a suitable straight line on your graph obtain an estimate, to 1 decimal place, of the root of the equation $x^3 + x^2 - 3x - 2 = 0$ in the interval $0 \leq x \leq 4$

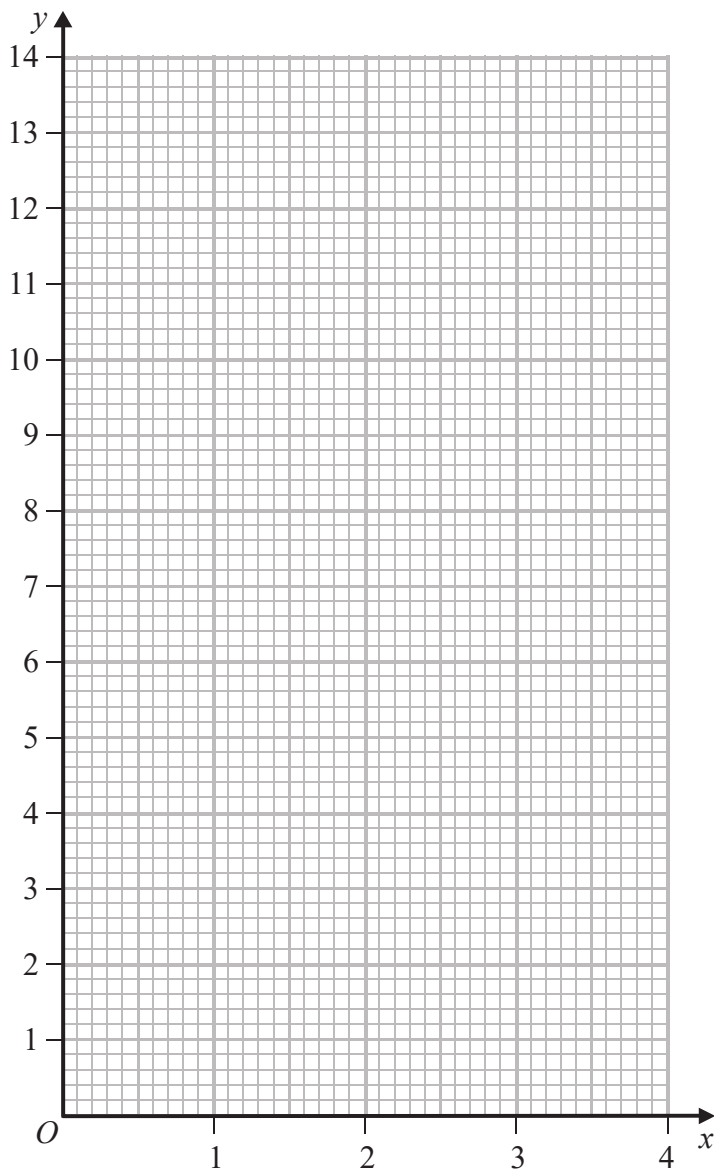
(5)

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

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



Question 5 continued

Area with horizontal dotted lines for writing.

DO NOT WRITE IN THIS AREA

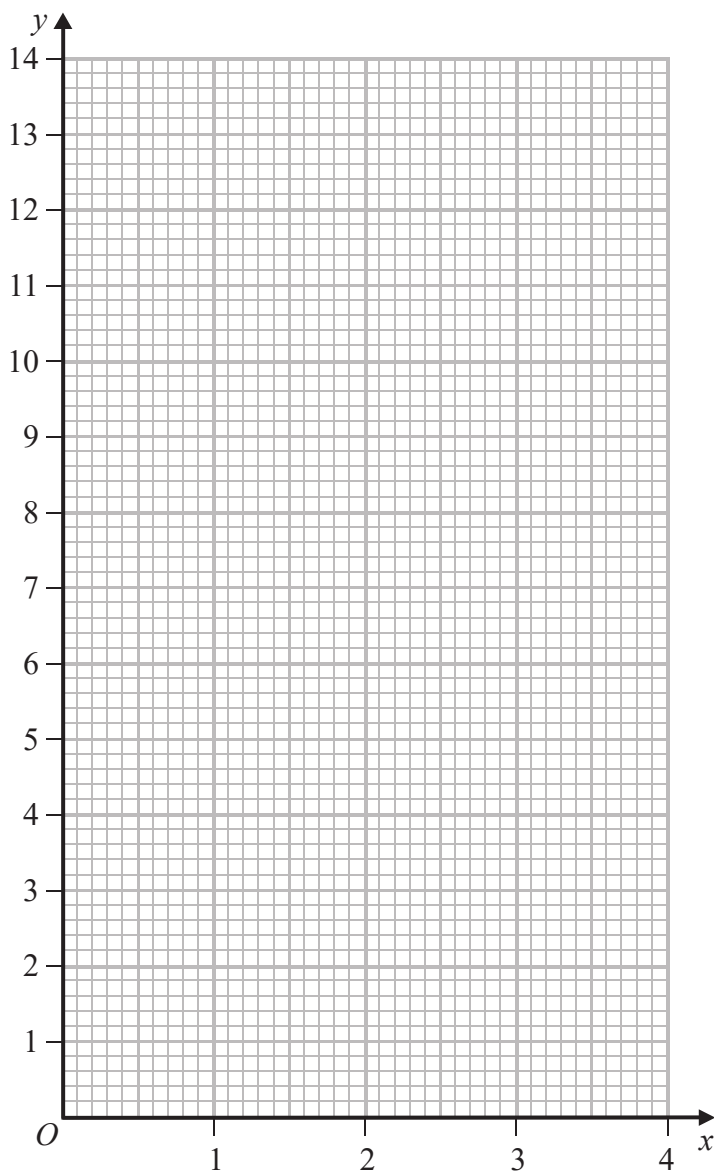
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Question 5 continued

Only use this grid if you need to redraw your graph



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

.....

.....

.....

.....

.....

.....

.....

.....

(Total for Question 5 is 9 marks)



6

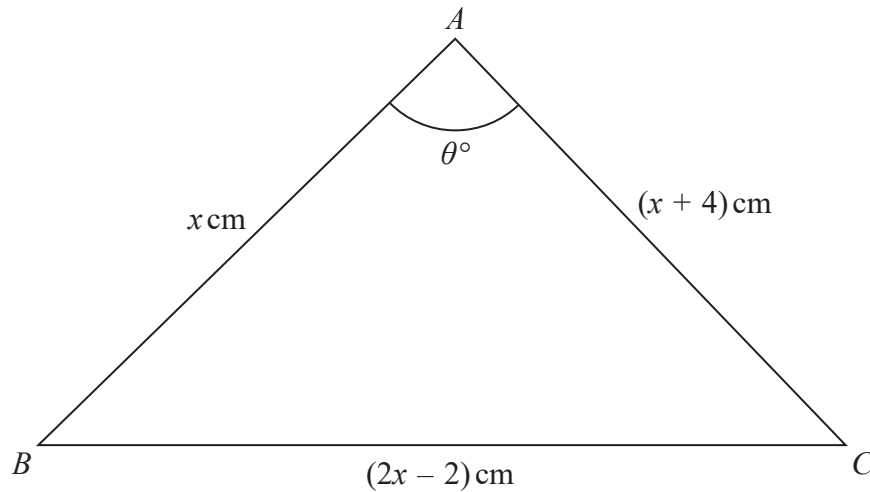


Diagram NOT accurately drawn

Figure 1

Figure 1 shows the triangle ABC with $AB = x \text{ cm}$, $BC = (2x - 2) \text{ cm}$, $AC = (x + 4) \text{ cm}$ and $\angle BAC = \theta^\circ$

Given that $\tan \theta^\circ = \sqrt{255}$ and without finding the value of θ ,

(a) show that $\cos \theta^\circ = \frac{1}{16}$ (2)

Hence find

(b) the value of x , (5)

(c) the size, in degrees to 1 decimal place, of $\angle ABC$, (2)

(d) the area, in cm^2 to 3 significant figures, of triangle ABC . (2)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

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

Area with horizontal dotted lines for writing.



Question 6 continued

Area with horizontal dotted lines for writing.

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

Area with horizontal dotted lines for writing.

(Total for Question 6 is 11 marks)



- 7 (a) Expand $(1 - 4x^2)^{-\frac{1}{2}}$ in ascending powers of x , up to and including the term in x^6 , giving each coefficient as an integer. (3)
- (b) Write down the range of values of x for which your expansion is valid. (1)
- (c) Expand $\frac{3 + x}{\sqrt{1 - 4x^2}}$ in ascending powers of x up to and including the term in x^4 , giving each coefficient as an integer. (3)
- (d) Hence, use algebraic integration to obtain an estimate, to 3 significant figures, of $\int_0^{0.3} \frac{3 + x}{\sqrt{1 - 4x^2}} dx$ (4)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



Question 7 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Area with horizontal dotted lines for writing.



Question 7 continued

Area with horizontal dotted lines for writing.

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

Area with horizontal dotted lines for writing.

(Total for Question 7 is 11 marks)



8 The sixth term of a geometric series G , with common ratio r ($r \neq 0$), is four times the second term.

- (a) Find the two possible exact values of r . (2)

The sum of the third and seventh terms of G is 30

- (b) Find the first term of the series. (3)

Given that $r > 0$

- (c) find the sum of the first 10 terms of G . (2)

Given that t_n is the n th term of G ,

- (d) find the least value of n for which $t_n > 2400$ (3)

Dotted lines for writing answers.



Question 8 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Area with horizontal dotted lines for writing.



Question 8 continued

Area with horizontal dotted lines for writing.

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Question 8 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Area with horizontal dotted lines for writing.

(Total for Question 8 is 10 marks)



9 It is given that α and β are such that $\alpha + \beta = -\frac{5}{2}$ and $\alpha\beta = -5$

(a) Form a quadratic equation with integer coefficients that has roots α and β (2)

Without solving the equation found in part (a)

(b) find the value of

(i) $\alpha^2 + \beta^2$ (5)

(ii) $\alpha^3 + \beta^3$ (5)

(c) Hence form a quadratic equation with integer coefficients that has roots

$\left(\alpha - \frac{1}{\alpha^2}\right)$ and $\left(\beta - \frac{1}{\beta^2}\right)$ (6)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



Question 9 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Handwriting practice area with 25 horizontal dotted lines.



Question 9 continued

Area with horizontal dotted lines for writing.

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

Area with horizontal dotted lines for writing.

(Total for Question 9 is 13 marks)



10

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

(a) Show that $\cos^2 \theta = \frac{1}{2}(\cos 2\theta + 1)$ (3)

Given that $f(\theta) = 8\cos^4 \theta + 8\sin^2 \theta - 7$

(b) show that $f(\theta) = \cos 4\theta$ (5)

(c) Solve, for $0 \leq \theta \leq \frac{\pi}{2}$, the equation

$$16\cos^4\left(\theta - \frac{\pi}{6}\right) + 16\sin^2\left(\theta - \frac{\pi}{6}\right) - 15 = 0$$
 (4)

(d) Using calculus, find the exact value of

$$\int_0^{\frac{\pi}{2}} (8\cos^4 \theta + 8\sin^2 \theta + 2\sin 2\theta) d\theta$$
 (4)



Question 10 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Area with horizontal dotted lines for writing.



Question 10 continued

Area with horizontal dotted lines for writing.

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

Area with horizontal dotted lines for writing.



Question 10 continued

Dotted lines for writing.

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(Total for Question 10 is 16 marks)

TOTAL FOR PAPER IS 100 MARKS



P 5 3 2 9 1 A 0 3 6 3 6