

Please check the examination details below before entering your candidate information

Candidate surname	Other names
Pearson Edexcel	Centre Number
International GCSE	Candidate Number
Thursday 20 June 2019	
Morning (Time: 2 hours)	Paper Reference 4PM1/02R
Further Pure Mathematics	
Paper 2R	
	
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 ►

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Pearson

International GCSE in Further Pure Mathematics Formulae sheet

MensurationSurface area of sphere = $4\pi r^2$ Curved surface area of cone = $\pi r \times$ slant heightVolume 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, $S_\infty = \frac{a}{1-r}$ $|r| < 1$ **Binomial series** $(1+x)^n = 1 + nx + \frac{n(n-1)}{2!}x^2 + \dots + \frac{n(n-1)\dots(n-r+1)}{r!}x^r + \dots$ 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

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

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Answer all ELEVEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1

$$f(x) = (x - 3)[x^2 + (p - 2)x + q]$$

Given that $f(0) = -12$

(a) find the value of q . (2)

(b) Find the range of values of p for which the cubic equation $f(x) = 0$ has only one real root. (5)

Area with horizontal dotted lines for writing answers.

(Total for Question 1 is 7 marks)



2

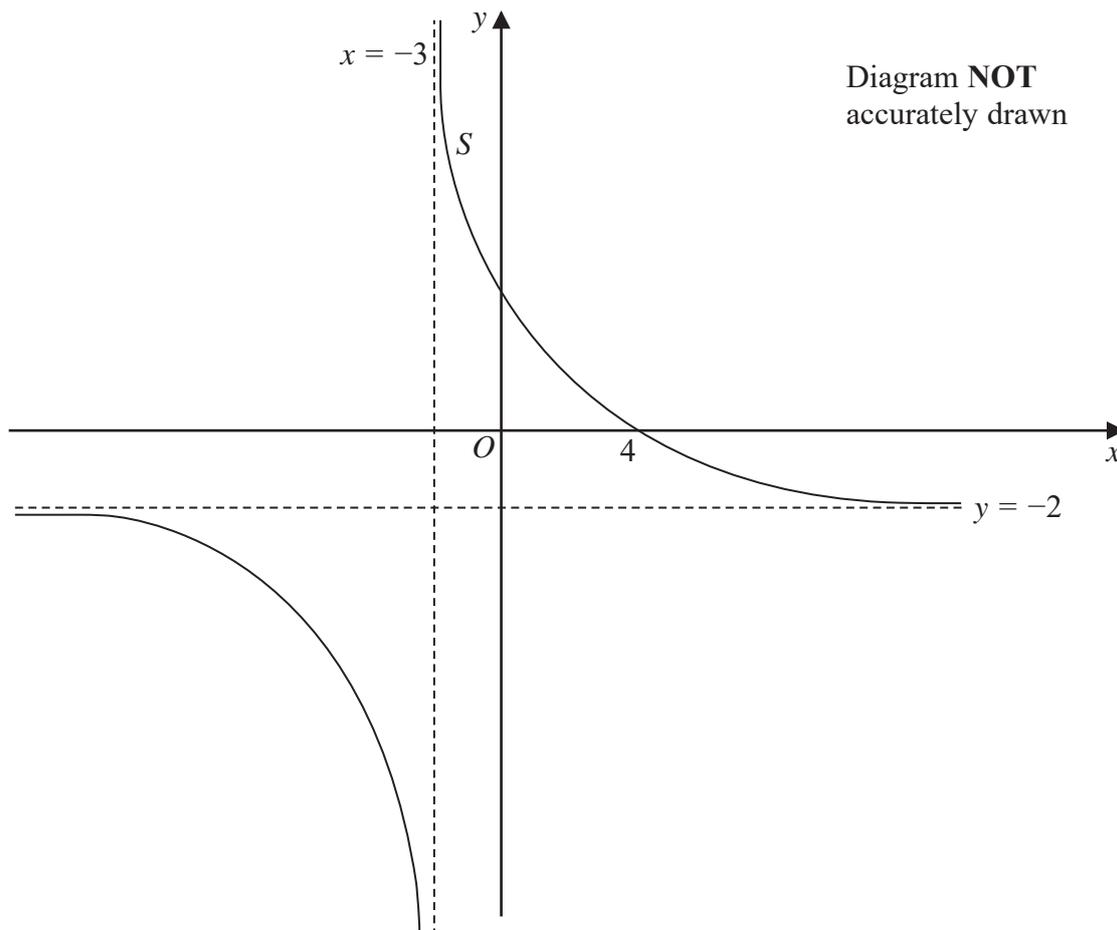


Figure 1

Figure 1 shows part of the curve S with equation $y = \frac{ax + b}{x + c}$ where a , b and c are integers.

The asymptote to S that is parallel to the x -axis has equation $y = -2$

The asymptote to S that is parallel to the y -axis has equation $x = -3$

The curve crosses the x -axis at the point with coordinates $(4, 0)$

The curve crosses the y -axis at the point with coordinates $(0, p)$ where p is a rational number.

Find

- (i) the value of a ,
- (ii) the value of b ,
- (iii) the value of c ,
- (iv) the value of p .

(4)

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Question 2 continued

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(Total for Question 2 is 4 marks)



Question 3 continued

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(Total for Question 3 is 6 marks)



Question 4 continued

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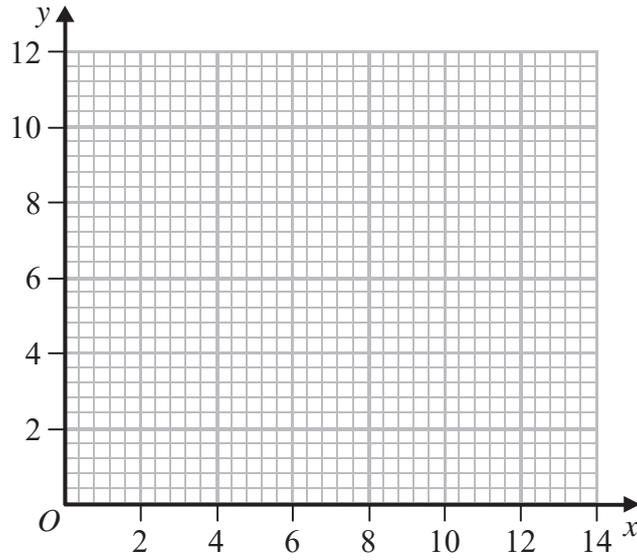
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(Total for Question 4 is 8 marks)



Question 5 continued



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



Question 5 continued

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Question 6 continued

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Question 7 continued

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Area with horizontal dotted lines for writing.



Question 7 continued

Area for writing answers, consisting of multiple horizontal dotted lines.

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Question 7 continued

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(Total for Question 7 is 11 marks)



8

Diagram **NOT** accurately drawn

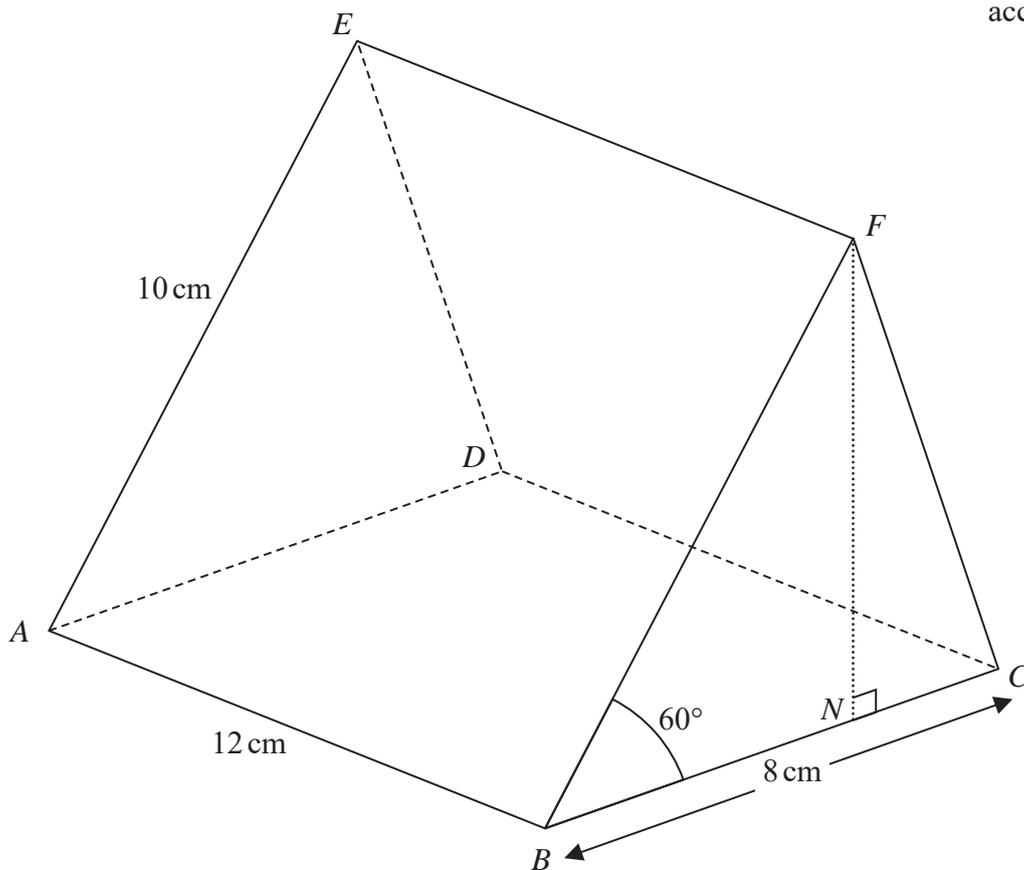


Figure 3

Figure 3 shows a right prism $ABCDEF$. The cross section BCF of the prism is a triangle.

$$AB = DC = 12 \text{ cm} \quad BC = AD = 8 \text{ cm} \quad BF = AE = 10 \text{ cm} \quad \angle FBC = \angle EAD = 60^\circ$$

The point N lies on BC such that FN is perpendicular to BC .

(a) Show that $BN = 5 \text{ cm}$. (2)

(b) Find, in cm to 3 significant figures, the length of EN . (3)

The midpoint of BF is X and the midpoint of FC is Y .

(c) Find, in degrees to one decimal place, the size of the angle between the plane $ABCD$ and the plane $AXYD$. (2)

(d) Find, in degrees to one decimal place, the size of the angle AYE . (6)

Question 8 continued

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Question 8 continued

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(Total for Question 8 is 13 marks)



Question 9 continued

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Question 9 continued

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(Total for Question 9 is 9 marks)



Question 10 continued

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Question 10 continued

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(Total for Question 10 is 15 marks)



Question 11 continued

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