

Please check the examination details below before entering your candidate information

Candidate surname

Other names

**Pearson Edexcel
International GCSE**

Centre Number

--	--	--	--	--

Candidate Number

--	--	--	--	--

Monday 20 January 2020

Morning (Time: 2 hours)

Paper Reference **4PM1/02**

Further Pure Mathematics

Level 2

Paper 2



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 ►

P59939A

©2020 Pearson Education Ltd.

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 = $\pi r \times$ 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



Question 2 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 2 is 6 marks)



Diagram **NOT** accurately drawn

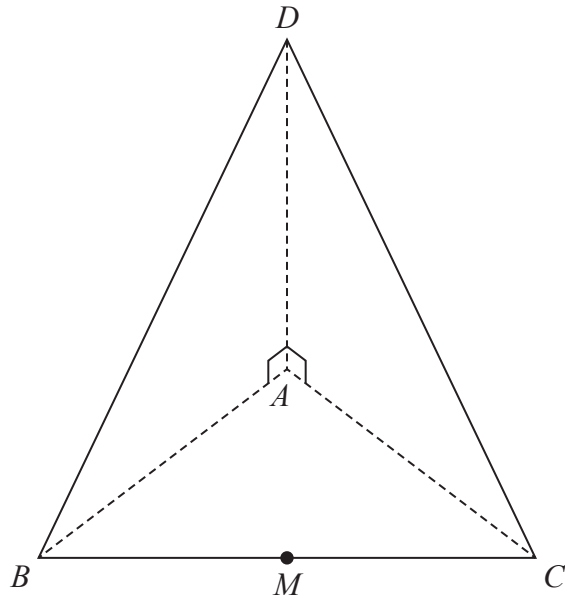


Figure 1

Figure 1 shows a triangular pyramid $ABCD$.

The base, ABC , of the pyramid is a horizontal isosceles triangle with $AB = AC = 10$ cm and $BC = 16$ cm. The midpoint of BC is M .

The face BCD of the pyramid is an isosceles triangle with $BD = CD = 26$ cm and D is vertically above A .

$$\angle BAD = \angle CAD = 90^\circ$$

- (a) Calculate the length, in cm, of AM . (2)

Calculate, in degrees to the nearest degree,

- (b) the size of $\angle BCD$, (3)

- (c) the size of the angle between the planes BCA and BCD . (4)

.....

.....

.....

.....

.....

.....

.....

.....



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.



Question 3 continued

Handwriting practice area consisting of 25 horizontal dotted lines.

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 9 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.



Question 4 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 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 7 marks)



Question 5 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 5 is 8 marks)



6

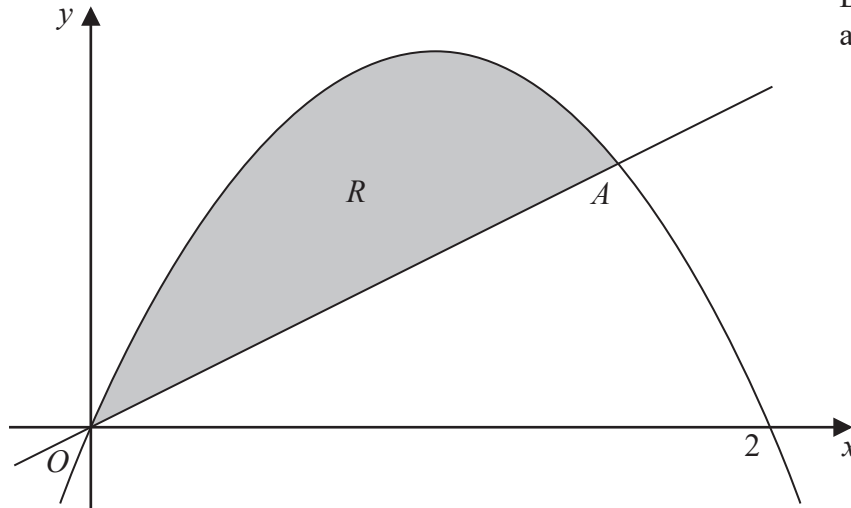


Diagram NOT accurately drawn

Figure 2

The region R , shown shaded in Figure 2, is bounded by the curve with equation $y = 2x - x^2$ and the line with equation $2y - x = 0$

The curve and the line intersect at the origin O and the point A .

- (a) Show that the point A has coordinates $\left(\frac{3}{2}, \frac{3}{4}\right)$. (2)

The region R is rotated through 360° about the x -axis.

- (b) Use algebraic integration to find, in terms of π , the volume of the solid formed. (6)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



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 8 marks)



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

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

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 12 marks)



8 Given that $y = e^{3x} \sin 2x$

show that $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 13y = 0$

(8)

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.



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

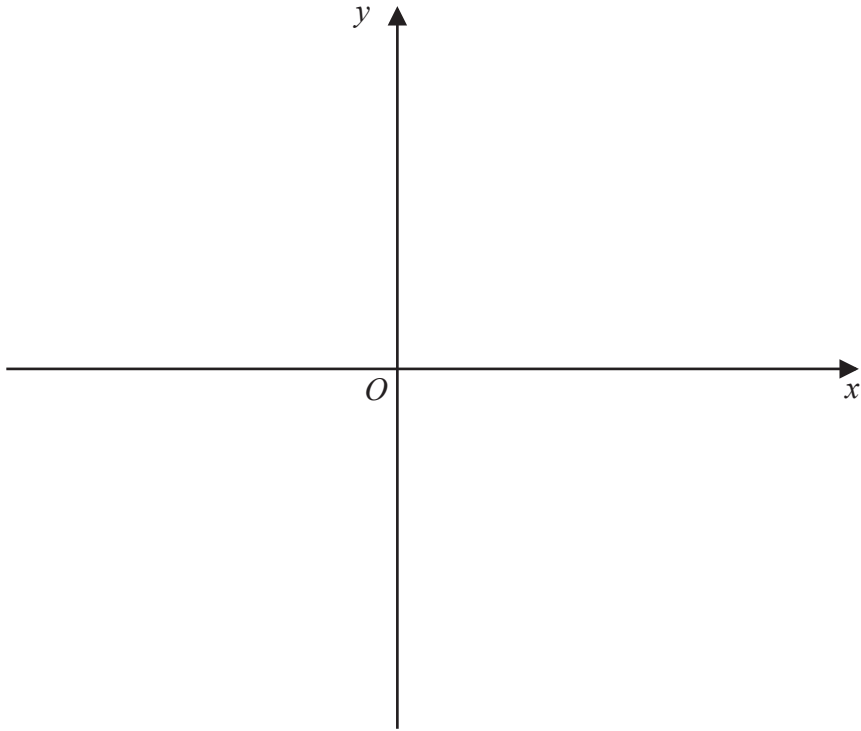
DO NOT WRITE IN THIS AREA

Area with horizontal dotted lines for writing.

(Total for Question 8 is 8 marks)



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.



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 16 marks)



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.

(Total for Question 10 is 9 marks)



11 (a) Express the equation

$$3 \sin(A - B) = \sin(A + B)$$

in the form $\tan A = k \tan B$, giving the value of the integer k .

(4)

(b) Given that $\theta \neq \frac{(2n+1)\pi}{2}$ where $n \in \mathbb{Z}$,

show that $\frac{\cos^4 \theta - \sin^4 \theta}{\cos^2 \theta} = 1 - \tan^2 \theta$

(3)

(c) Using the exact values of $\sin x^\circ$, $\cos x^\circ$ and $\tan x^\circ$ for $x = 30, 45, 60$

show that

(i) $\cos 15^\circ = \frac{\sqrt{6} + \sqrt{2}}{4}$

(2)

(ii) $\tan 255^\circ = \frac{3 + \sqrt{3}}{3 - \sqrt{3}}$

(4)



Question 11 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.



