

Please check the examination details below before entering your candidate information

Candidate surname	Other names
-------------------	-------------


Centre Number	Candidate Number
<input style="width: 20px; height: 20px; border: 1px solid black;" type="text"/> <input style="width: 20px; height: 20px; border: 1px solid black;" type="text"/> <input style="width: 20px; height: 20px; border: 1px solid black;" type="text"/> <input style="width: 20px; height: 20px; border: 1px solid black;" type="text"/> <input style="width: 20px; height: 20px; border: 1px solid black;" type="text"/>	<input style="width: 20px; height: 20px; border: 1px solid black;" type="text"/> <input style="width: 20px; height: 20px; border: 1px solid black;" type="text"/> <input style="width: 20px; height: 20px; border: 1px solid black;" type="text"/> <input style="width: 20px; height: 20px; border: 1px solid black;" type="text"/>

**Pearson Edexcel International GCSE**

Time 2 hours	Paper reference	4PM1/01
--------------	-----------------	---------

## Further Pure Mathematics

### PAPER 1



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 ►

P66310A

©2022 Pearson Education Ltd.

L:1/1/1/



## 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 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**

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

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 Using calculus find the exact value of  $\int_{\frac{\pi}{4}}^{\frac{\pi}{3}} \cos 4\theta d\theta$

Give your answer in the form  $-\frac{\sqrt{a}}{b}$  where  $a$  is a prime number and  $b$  is an integer.

(4)

(Total for Question 1 is 4 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



2

$$f(x) = 2x^2 - 12x + 5$$

Given that  $f(x)$  can be written in the form  $f(x) = a(x + b)^2 + c$  where  $a$ ,  $b$  and  $c$  are integers,

(a) find the value of  $a$ , the value of  $b$  and the value of  $c$  (3)

(b) Hence find the set of values of  $x$  for which  $f(x) - 37 > 0$  (4)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

4



**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 7 marks)**



3 A geometric series  $G$  has first term  $a$  and common ratio  $r$

The 2nd term of  $G$  is  $\frac{5}{16}$  and the 5th term of  $G$  is  $\frac{135}{1024}$

(a) Find

(i) the value of  $r$

(ii) the value of  $a$

(5)

Given that  $G$  is convergent with sum to infinity  $S$

(b) find the exact value of  $S$

(2)

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 7 marks)**



4 (a) On the grid opposite, draw the line with equation

(i)  $y = 2x - 4$

(ii)  $2x + 3y = 12$

(iii)  $y + 2x + 2 = 0$

(3)

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

$y \geq 2x - 4$

$2x + 3y \leq 12$

$y + 2x + 2 \geq 0$

(1)

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

$$P = x - 2y$$

(c) find the least value of  $P$

(4)

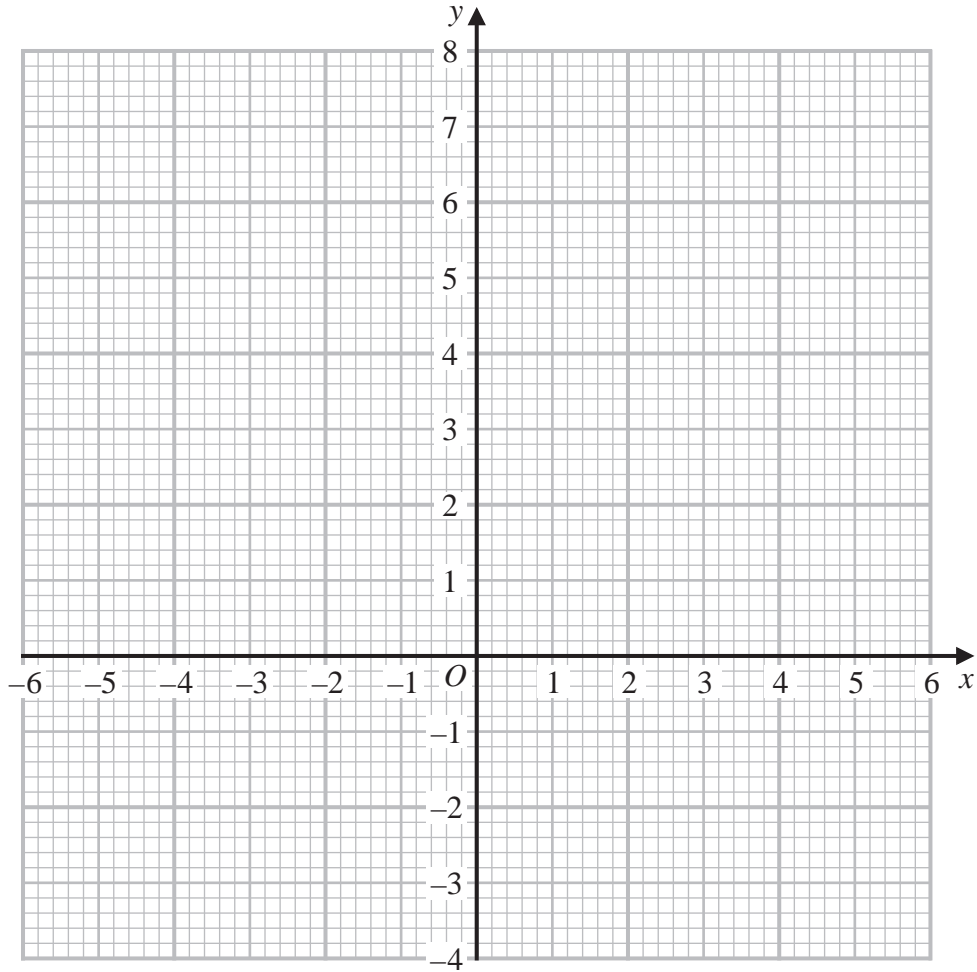
DO NOT WRITE IN THIS AREA

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

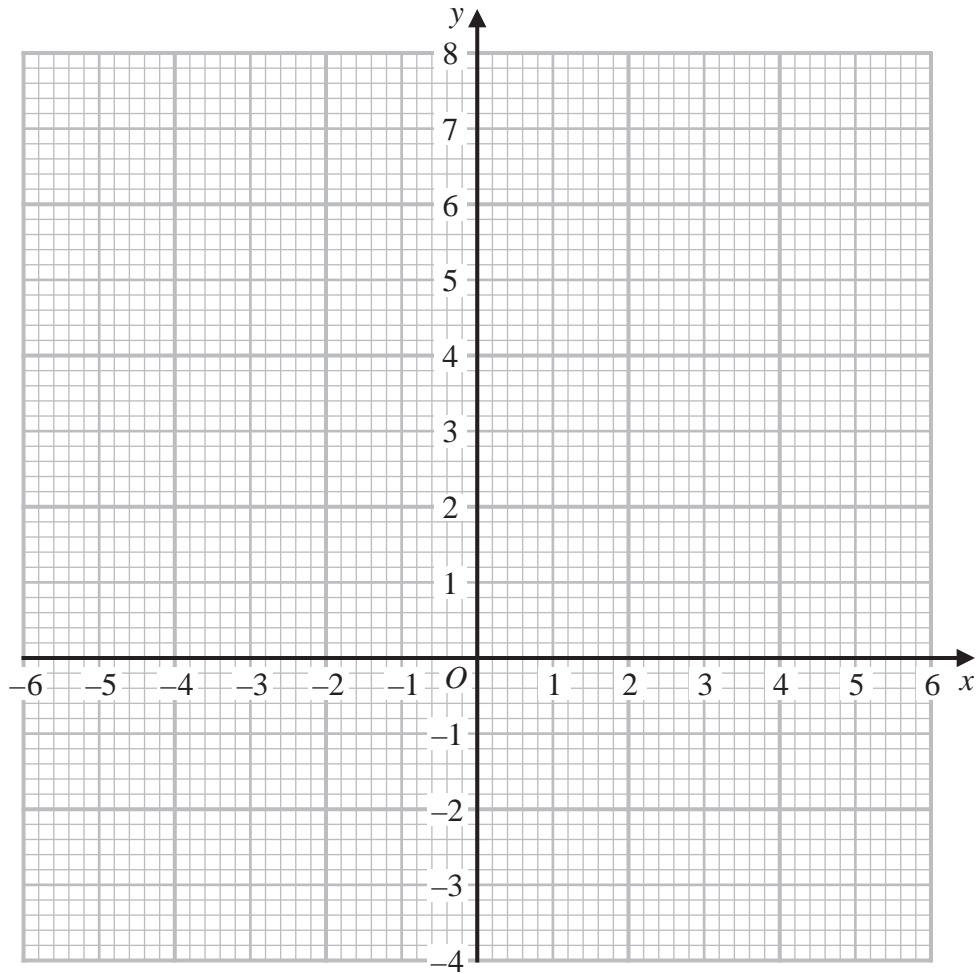
**Turn over for a spare grid if you need to redraw your graph.**





**Question 4 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 4 is 8 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 answers.

**(Total for Question 5 is 9 marks)**



6 In triangle  $ABC$ ,  $AC = x$  cm,  $AB = (x + 3)$  cm and  $\angle ABC = 30^\circ$

Given that  $\angle ACB = \theta^\circ$  where  $0 < \theta < 90$

(a) show that

$$(i) \sin \theta^\circ = \frac{x + 3}{2x}$$

$$(ii) \cos \theta^\circ = \frac{\sqrt{3x^2 - 6x - 9}}{2x}$$

(5)

Given that the size of  $\angle BAC$ : the size of  $\angle ABC = 7:2$

(b) find the exact value of  $x$

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

(5)

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**

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 answers.

**(Total for Question 6 is 10 marks)**



7 (a) Write down the value of  $\log_2 16$  (1)

Given that  $4 + 2\log_4 x = \log_2 y$

(b) show that  $y = 16x$  (4)

(c) Hence solve the equation  $4 + 2\log_4 x = \log_2(4x + 5)$  (3)

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 8 marks)**





**Question 8 continued**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

A large rectangular area with a rounded border, containing numerous horizontal dotted lines for writing.





**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 (a) Expand  $\frac{1}{\sqrt{1-2x}}$  in ascending powers of  $x$  up to and including the term in  $x^3$

Simplify each term as far as possible.

(3)

- (b) Show that  $\frac{1}{\sqrt{0.96}} = \frac{5\sqrt{6}}{12}$

Show all your working clearly.

(2)

- (c) Express  $\frac{1}{5\sqrt{6}-12}$  in the form  $\frac{a\sqrt{6}}{c} + b$  where  $a$ ,  $b$  and  $c$  are integers.

Show all your working clearly.

(2)

Using the expansion you found in part (a) with a suitable value of  $x$

- (d) find an estimate, to 5 decimal places, of  $\frac{9}{5\sqrt{6}-12}$

(4)

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 for writing answers, consisting of multiple horizontal dotted lines.





**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 11 marks)**



10 The equation of the line  $L_1$  is  $y - 2x - 6 = 0$

The point  $P$  with coordinates  $(2, a)$  lies on  $L_1$

(a) Find the value of  $a$

(1)

The line  $L_2$  is perpendicular to  $L_1$  and passes through  $P$

(b) Show that an equation of  $L_2$  is  $x + 2y - 22 = 0$

(4)

Line  $L_1$  crosses the  $x$ -axis at the point  $A$  and line  $L_2$  crosses the  $x$ -axis at the point  $B$

The point  $C$  has coordinates  $(m, n)$  such that  $m > 0$  and  $n < 0$

The length of  $AC$  is  $5\sqrt{2}$  and the gradient of  $BC$  is  $\frac{1}{4}$

(c) Find the value of  $m$  and the value of  $n$

(9)

(d) Find the area of quadrilateral  $ACBP$

(3)

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 for writing answers, consisting of multiple horizontal dotted lines.





**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 answers.

**(Total for Question 10 is 17 marks)**





**Question 11 continued**

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

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





DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

**BLANK PAGE**



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

**BLANK PAGE**

