


Please check the examination details below before entering your candidate information

Candidate surname	Other names
<b>Pearson Edexcel</b>	Centre Number
<b>International GCSE</b>	Candidate Number
<b>Monday 15 June 2020</b>	
Afternoon (Time: 2 hours)	Paper Reference <b>4PM1/01R</b>
<b>Further Pure Mathematics</b>	
<b>Paper 1R</b>	
	
<b>Calculators may be used.</b>	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

**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**

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

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**Question 1 continued**

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**Question 1 continued**

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**(Total for Question 1 is 7 marks)**





**Question 2 continued**

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**Question 2 continued**

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**(Total for Question 2 is 11 marks)**



3 The  $n$ th term of an arithmetic series is  $u_n$  such that

$$u_n = \ln a + (n - 1) \ln b$$

where  $a$  and  $b$  are positive integers.

Given that  $u_2 = \ln 12$  and that  $u_5 = \ln 768$

find the value of  $a$  and the value of  $b$ .

(7)

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**Question 3 continued**

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**(Total for Question 3 is 7 marks)**





**Question 4 continued**

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**(Total for Question 4 is 6 marks)**



- 5 (a) Expand  $\sqrt{1-x}$  in ascending powers of  $x$  up to and including the term in  $x^3$   
Give each coefficient as an exact fraction in its lowest terms. (3)
- (b) Using your expansion with a suitable value of  $x$ , obtain an approximation,  
to 6 decimal places, of  $\sqrt{0.92}$  (3)
- (c) Hence find an approximation, to 5 decimal places, of  $\sqrt{23}$  (2)

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**Question 5 continued**

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**(Total for Question 5 is 8 marks)**



6 (a) Show that

$$\sin(A + B) + \sin(A - B) = 2\sin A \cos B \quad (2)$$

(b) Hence express  $2\sin 7x \cos x$  in the form  $\sin mx + \sin nx$  where  $m$  and  $n$  are integers, giving the value of  $m$  and the value of  $n$ . (1)

(c) Use calculus to evaluate

$$\int_0^{\frac{\pi}{4}} (6\sin 7x \cos x) dx \quad (4)$$

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**Question 6 continued**

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**Question 6 continued**

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**(Total for Question 6 is 7 marks)**





**Question 7 continued**

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**Question 7 continued**

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**(Total for Question 7 is 9 marks)**



8

$$f(x) = 3x^2 - x + 4$$

$$g(x) = x^2 - px + q$$

The roots of the quadratic equation  $f(x) = 0$  are  $\alpha$  and  $\beta$

The roots of the quadratic equation  $g(x) = 0$  are  $\left(\alpha + \frac{1}{\alpha}\right)$  and  $\left(\beta + \frac{1}{\beta}\right)$

Without solving the equation  $f(x) = 0$

(a) show that  $p = \frac{7}{12}$  (3)

(b) Find the value of  $q$  (4)

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**Question 8 continued**

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**Question 8 continued**

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**(Total for Question 8 is 7 marks)**



9 Showing your working clearly, use algebra to solve the equations

$$\frac{16^x}{8^y} = \frac{1}{4}$$

$$4^x 2^y = 16$$

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**Question 9 continued**

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**(Total for Question 9 is 7 marks)**



10 (a) Solve the equation

$$\sin\left(x + \frac{\pi}{3}\right) = \frac{\sqrt{3}}{2} \quad \text{for } 0 \leq x \leq 2\pi$$

Give your solutions in terms of  $\pi$ , where appropriate.

(3)

(b) Solve the equation

$$3 \sin \theta + 5 \cos \theta = 0 \quad \text{for } -360^\circ \leq \theta \leq 360^\circ$$

Give your solutions to the nearest degree.

(3)

(c) Solve the equation

$$1 + \sin 2y = 2 \cos^2 2y \quad \text{for } -180^\circ \leq y \leq 0^\circ$$

(5)

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**Question 10 continued**

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**Question 10 continued**

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**(Total for Question 10 is 11 marks)**



11

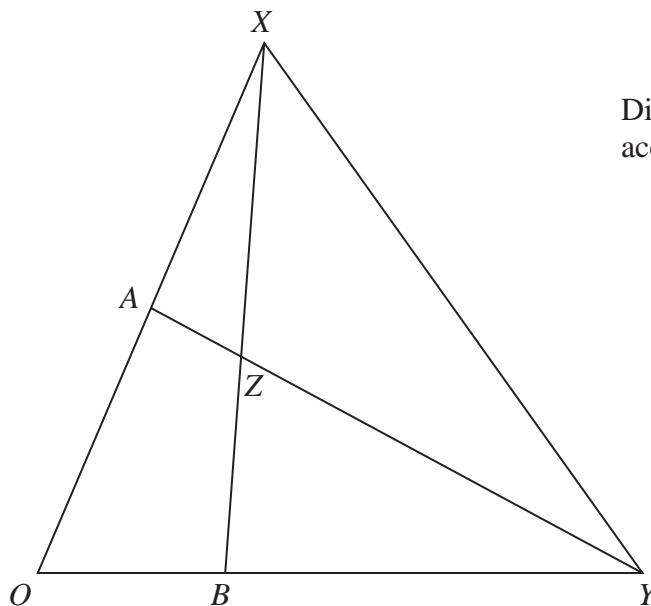


Diagram **NOT** accurately drawn

**Figure 1**

Figure 1 shows a triangle  $OXY$

$$\vec{OX} = 2\mathbf{a} \text{ and } \vec{OY} = 3\mathbf{b}$$

$A$  is the midpoint of  $OX$  and  $B$  is the point on  $OY$  such that  $OB : BY = 1 : 2$   
The lines  $XB$  and  $AY$  intersect at  $Z$ .

(a) Find  $\vec{AB}$  as a simplified expression in terms of  $\mathbf{a}$  and  $\mathbf{b}$  (1)

(b) Using a vector method, find  $\vec{OZ}$  as a simplified expression in terms of  $\mathbf{a}$  and  $\mathbf{b}$  (9)

The point  $M$  on  $XY$  is such that  $O, Z$  and  $M$  are collinear.

(c) Find  $\vec{OM}$  as a simplified expression in terms of  $\mathbf{a}$  and  $\mathbf{b}$  (3)

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**Question 11 continued**

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**Question 11 continued**

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**(Total for Question 11 is 13 marks)**



12

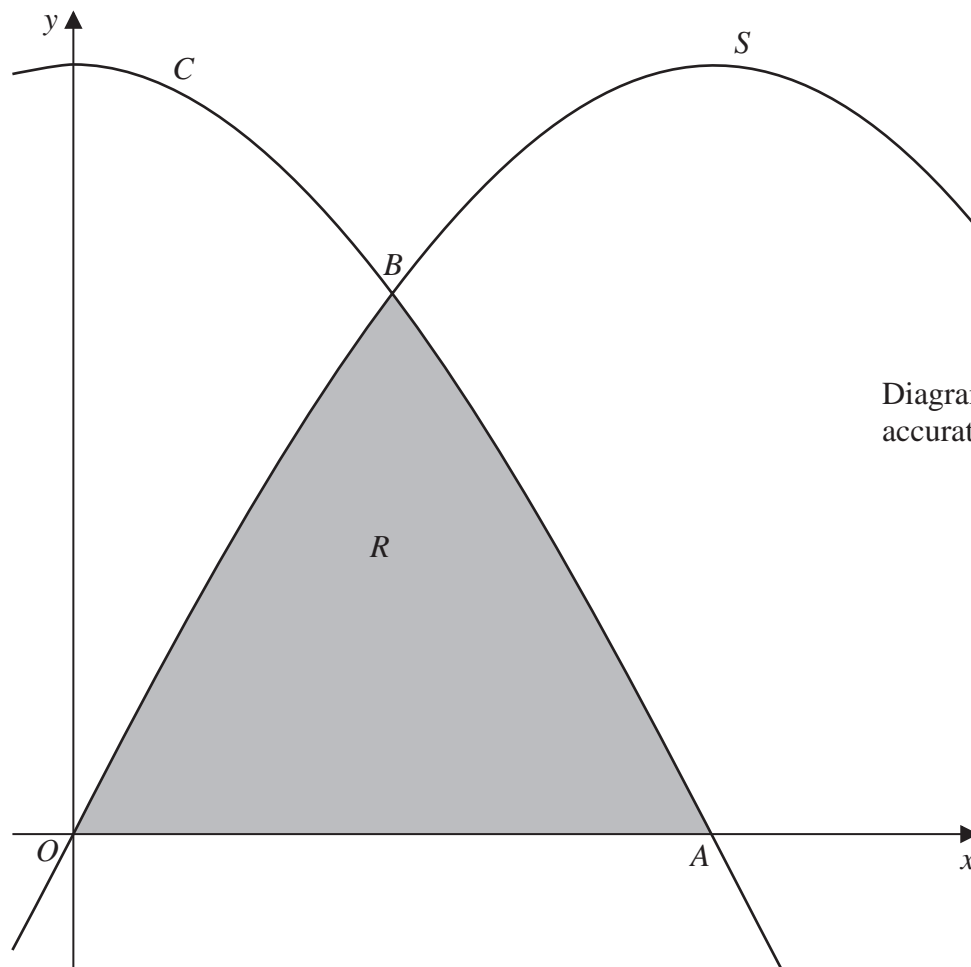


Figure 2

The region  $R$ , shown shaded in Figure 2, is bounded by the  $x$ -axis, the curve  $S$  with equation  $y = 2\sin x$  and the curve  $C$  with equation  $y = 2\cos x$ . As shown in Figure 2,  $C$  crosses the  $x$ -axis at the point  $A$ .

(a) Write down the  $x$  coordinate of  $A$ . (1)

As shown in Figure 2,  $C$  and  $S$  intersect at the point  $B$ .

(b) Find the  $x$  coordinate of  $B$ . (2)

(c) Using calculus, find the area of the shaded region  $R$ .  
Give your answer in the form  $a - \sqrt{b}$  where  $a$  and  $b$  are integers. (4)

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**Question 12 continued**

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