Write your name here Surname	Other n	ames
Edexcel International GCSE	Centre Number	Candidate Number
<b>Further Pu</b>	ire Math	ematics
Paper 2	are matri	ciliatics
		Paper Reference 4PM0/02

### **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 ▶

**PEARSON** 

# Answer all ELEVEN questions.

# Write your answers in the spaces provided.

### You must write down all stages in your working.

	Tou must write down an stages in your working.			
1	Solve the equation			
	$5^{x+1} = 120$			
	giving your answer to 3 significant figures.	(4)		
		(4)		
	(Total for Question 1 is 4 m	arks)		

2	Given that $x = t^3 + 4$ and $y = 1 - t + 5t^2$	
	(a) find (i) $\frac{dx}{dt}$	
	(ii) $\frac{\mathrm{d}y}{\mathrm{d}t}$	(2)
	(b) Find $\frac{dy}{dx}$ in terms of $t$ .	
	dx	(2)
•••••		
	(Total for Question 2 is 4 ma	rks)



3	Solve the equations	
	$2x^2 + xy - y^2 = 36$	
	x + 2y = 1	
		(6)
•••••		
•••••		

Question 3 continued	
	(Total for Question 3 is 6 marks)



4	Differentiate with respect to $x$	
	(a) $\frac{1}{x^2}$	(2)
	(b) $\frac{1}{(2x+1)^2}$	(2)
	$(c) \frac{1}{1-\cos^2 x}$	(3)
•••••		

Question 4 continued	
	(Total for Question 4 is 7 marks)



5	The curve R has equation $y = x^2 - 7x + 10$	
	The curve S has equation $y = -x^2 + 7x - 2$	
	(a) Find the coordinates of each of the two points where the curves $R$ and $S$ intersect.	(4)
	(b) Find the area of the finite region bounded by the curve <i>R</i> and the curve <i>S</i> .	(4)

Question 5 continued	



Question 5 continued	

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



6	The first term of a geometric series S is $\sqrt{2}$	
	The second term of S is $\sqrt{2} - 2$	
	(a) (i) Find the exact value of the common ratio of S.	
	(ii) Find the third term of S, giving your answer in the form $a\sqrt{2} + b$ , where a and	b
	are integers.	(5)
	(b) (i) Explain why the series is convergent.	
	(ii) Find the sum to infinity of <i>S</i> .	
	(ii) I ma the sam to mining of S.	(3)

Question 6 continued	
	(Total for Question 6 is 8 marks)



7 The curve G has equation $y = 3 - \frac{1}{x - 1}$	$\frac{1}{1}$ , $x \neq 1$
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- (a) Find an equation of the asymptote to G which is parallel to
  - (i) the x-axis,
  - (ii) the y-axis.

**(2)** 

- (b) Find the coordinates of the point where G crosses
  - (i) the x-axis,
  - (ii) the y-axis.

**(2)** 

(c) Sketch *G*, showing clearly the asymptotes and the coordinates of the points where the curve crosses the coordinate axes.

(3)

A straight line l intersects G at the points P and Q. The x-coordinate of P and the

x-coordinate of Q are roots of the equation  $2x - 3 = \frac{1}{x - 1}$ 

(d) Find an equation of *l*.

(2)





8	The curve C has equation $y = 4x + 8 + \frac{25}{x - 2}, x \neq 2$	
	(a) Find the coordinates of the stationary points on <i>C</i> .	(6)
	(b) Determine the nature of each of these stationary points.	(3)

Question 8 continued		



Question 8 continued	

Question 8 continued	
	(Total for Question 8 is 9 marks)



9	The particle $M$ is moving along the straight line $PQ$ with a constant acceleration of 2 m/s	s <sup>2</sup> .
	At time $t = 0$ , $M$ is at the point $P$ moving with velocity 6 m/s towards $Q$ .	
	(a) Find an expression for the velocity of $M$ at time $t$ seconds.	(2)
	(b) Show that the displacement of M from P at time t seconds is $(t^2 + 6t)$ metres.	(2)
	A second particle $N$ is moving along $PQ$ . The acceleration of $N$ at time $t$ seconds is $6t$ m. At time $t = 0$ , $N$ is stationary at the point $P$ .	$/\mathrm{s}^2$ .
	(c) Find an expression for the velocity of $N$ at time $t$ seconds.	(2)
	(d) Find an expression for the displacement of $N$ from $P$ at time $t$ seconds.	(2)
	(e) Find the distance between $M$ and $N$ at time $t = 5$ seconds.	(2)
	(f) Find the value of $t$ , $t > 0$ , when the two particles meet.	(3)

Question 9 continued	



Question 9 continued	



Question 9 continued	
	(Total for Question 9 is 13 marks)



10 The points A, B, C and D are the vertices of a quadrilateral and

$$\overrightarrow{AB} = 3\mathbf{i} + 5\mathbf{j}$$
,  $\overrightarrow{AC} = 6\mathbf{i} + 6\mathbf{j}$  and  $\overrightarrow{AD} = 9\mathbf{i} + 3\mathbf{j}$ 

- (a) (i) Find  $\overrightarrow{BC}$ 
  - (ii) Hence show that ABCD is a trapezium.

(3)

- (b) (i) Find the exact value of  $|\overrightarrow{BD}|$ 
  - (ii) Find a unit vector parallel to  $\overrightarrow{BD}$

(4)

The point F is on the line BD and BF : FD = 1 : 2

(c) Find  $\overrightarrow{AF}$ 

(2)

The point E is on the line AD such that ABCE is a parallelogram.

- (d) (i) Show that F lies on the line CE
  - (ii) Find the ratio EF: FC

(6)


Question 10 continued



Question 10 continued		



Question 10 continued	
	(Total for Question 10 is 15 marks)



11

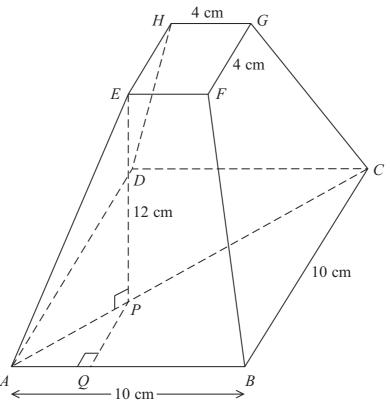


Diagram **NOT** accurately drawn

Figure 1

Figure 1 shows a truncated right pyramid. The base ABCD is a square with sides of length 10 cm. The top EFGH is a square with sides of length 4 cm. The base is parallel to the top and AE = BF = CG = DH.

The point P is on the line AC such that angle APE is a right-angle and EP = 12 cm.

(a) Find, in centimetres, the exact length of

(i) AC (ii) EG (iii) AP

(b) Find, in centimetres to 3 significant figures, the length of AE. (2)

(c) Find, in degrees to 1 decimal place, the angle between the line AE and the plane ABCD.

The point Q is on the line AB. Angle AQP is a right-angle.

- (d) (i) Show that PQ = 3 cm.
  - (ii) Write down, in centimetres, the length of AQ.

(e) Find, in degrees to 1 decimal place, the angle between the line AE and the line AB.

(f) Find, in degrees to 1 decimal place, the angle between the plane *ABFE* and the plane *ABCD*.

(3)

**(2)** 

**(2)** 

**(6)** 

28

Question 11 continued		



Question 11 continued		



Question 11 continued		



estion 11 continued	
	(Total for Question 11 is 17 marks)