Cambridge A LEVEL
Topical Past Papers

PURE MATHEMATICS 1
9709

2017 — 2025

CHAPTER 1

Coordinates Geometry

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1 - (9709/11_Summer_2017_Q5) ANSWER

The equation of a curve is $y = 2\cos x$.

(i) Sketch the graph of $y = 2\cos x$ for $-\pi \leqslant x \leqslant \pi$, stating the coordinates of the point of intersection with the y-axis. [2]

Points P and Q lie on the curve and have x-coordinates of $\frac{1}{3}\pi$ and π respectively.

(ii) Find the length of PQ correct to 1 decimal place. [2]

The line through P and Q meets the x-axis at $H(h, 0)$ and the y-axis at $K(0, k)$.

(iii) Show that $h = \frac{5}{9}\pi$ and find the value of k. [3]

2 - (9709/12_Summer_2017_Q2) ANSWER

The point A has coordinates $(-2, 6)$. The equation of the perpendicular bisector of the line AB is $2y = 3x + 5$.

(i) Find the equation of AB. [3]

(ii) Find the coordinates of B. [3]

3 - (9709/13_Summer_2017_Q8) ANSWER

$A(-1, 1)$ and $P(a, b)$ are two points, where a and b are constants. The gradient of AP is 2.

(i) Find an expression for b in terms of a. [2]

(ii) $B(10, -1)$ is a third point such that $AP = AB$. Calculate the coordinates of the possible positions of P. [6]

4 - (9709/11_Winter_2017_Q6) ANSWER

The points $A(1, 1)$ and $B(5, 9)$ lie on the curve $6y = 5x^2 - 18x + 19$.

(i) Show that the equation of the perpendicular bisector of AB is $2y = 13 - x$. [4]

The perpendicular bisector of AB meets the curve at C and D.

(ii) Find, by calculation, the distance CD, giving your answer in the form $\sqrt{\left(\frac{p}{q}\right)}$, where p and q are integers. [5]

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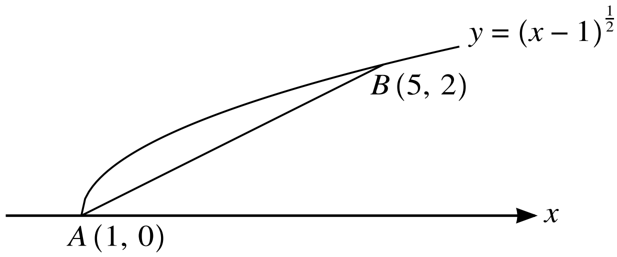
5 - (9709/13_Winter_2017_Q11)



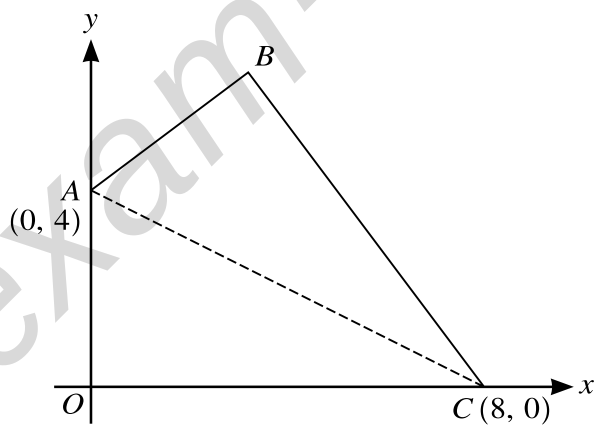
The diagram shows the curve $y = (x - 1)^{\frac{1}{2}}$ and points $A\,(1, 0)$ and $B\,(5, 2)$ lying on the curve.

(i) Find the equation of the line AB, giving your answer in the form $y = mx + c$. [2]

(ii) Find, showing all necessary working, the equation of the tangent to the curve which is parallel to AB. [5]

(iii) Find the perpendicular distance between the line AB and the tangent parallel to AB. Give your answer correct to 2 decimal places. [3]

6 - (9709/11_Summer_2018_Q5)



The diagram shows a kite $OABC$ in which AC is the line of symmetry. The coordinates of A and C are $(0, 4)$ and $(8, 0)$ respectively and O is the origin.

(i) Find the equations of AC and OB. [4]

(ii) Find, by calculation, the coordinates of B. [3]

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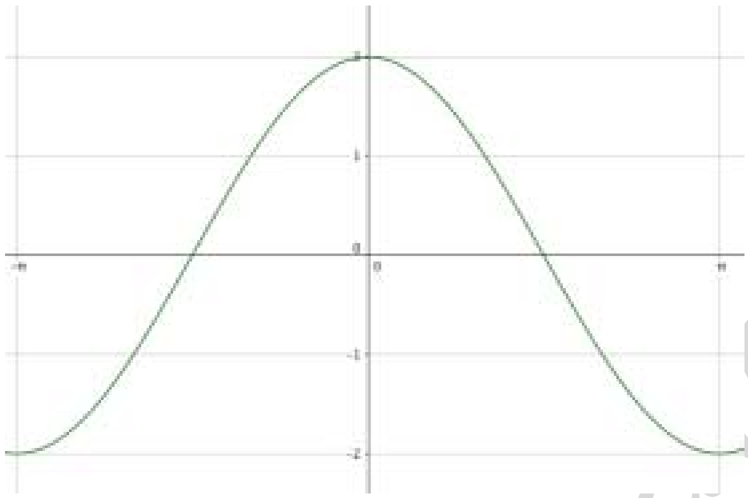
1 - (9709/11_Summer_2017_Q5) QUESTION

	$y = 2\cos x$	
(i)		
		
	Total:	**2**
(ii)	$P(\frac{\pi}{3}, 1)\ Q(\pi, -2)$	
	$\rightarrow PQ^2 = \left(\frac{2\pi}{3}\right)^2 + 3^2 \rightarrow PQ = 3.7$	
	Total:	**2**
(iii)	Eqn of PQ $y - 1 = -\frac{9}{2\pi}\left(x - \frac{\pi}{3}\right)$	
	If $y = 0 \rightarrow h = \frac{5\pi}{9}$	
	If $x = 0 \rightarrow k = \frac{5}{2}$,	
	Total:	**3**

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2 - (9709/12_Summer_2017_Q2) QUESTION

(i)	Gradient = 1.5 Gradient of perpendicular = −⅔	
	Equation of AB is $y-6=-\tfrac{2}{3}(x+2)$ Or $3y+2x=14$ oe	
	Total:	**3**
(ii)	Simultaneous eq → Midpoint (1, 4)	
	Use of midpoint or vectors → B (4, 2)	
	Total:	**3**

3 - (9709/13_Summer_2017_Q8) QUESTION

(i)	$(b-1)/(a+1)=2$	
	$b=2a+3$ CAO	
	Total:	**2**
(ii)	$AB^2=11^2+2^2=125$ oe	
	$(a+1)^2+(b-1)^2=125$	
	$(a+1)^2+(2a+2)^2=125$	
	$(5)(a^2+2a-24)=0 \rightarrow$ eg $(a-4)(a+6)=0$	
	a = 4 or −6	
	b = 11 or −9	
	Total:	**6**

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4 - (9709/11_Winter_2017_Q6)

(i)	Mid-point of $AB = (3, 5)$	
	Gradient of $AB = 2$	
	Eqn of perp. bisector is $y-5=-½(x-3) \rightarrow 2y=13-x$	
		4
(ii)	$-3x+39=5x^2-18x+19 \rightarrow (5)(x^2-3x-4)(=0)$	
	$x=4$ or -1	
	$y=4½$ or 7	
	$CD^2=5^2+2½^2 \rightarrow CD=\sqrt{\dfrac{125}{4}}$	
		5

5 - (9709/13_Winter_2017_Q11)

(i)	Gradient of $AB = \dfrac{1}{2}$	
	Equation of AB is $y=\dfrac{1}{2}x-\dfrac{1}{2}$	
		2
(ii)	$\dfrac{dy}{dx}=½(x-1)^{-\frac{1}{2}}$	
	$½(x-1)^{-\frac{1}{2}}=½$. Equate *their* $\dfrac{dy}{dx}$ to *their* ½	
	$x=2,\ \ y=1$	
	$y-1=½(x-2)$ (thro' *their*(2,1) & *their* ½) $\rightarrow\ y=½x$	
		5

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(iii)	*EITHER:* $\sin\theta = \frac{d}{1} \quad \to \quad d = \sin\theta$	
	gradient of $AB = ½ \Rightarrow \tan\theta = ½ \Rightarrow \theta = 26.5(7)°$	
	$d = \sin 26.5(7)° = 0.45 \quad (\text{or } \frac{1}{\sqrt{5}})$	
	OR1: Perpendicular through O has equation $y = -2x$	
	Intersection with AB: $-2x = ½x - ½ \to \left(\frac{1}{5}, \frac{-2}{5}\right)$	
	$d = \sqrt{\left(\frac{1}{5}\right)^2 + \left(\frac{2}{5}\right)^2} = 0.45 \ (\text{or } \frac{1}{\sqrt{5}})$	
	OR2: Perpendicular through (2, 1) has equation $y = -2x + 5$	
	Intersection with AB: $-2x + 5 = ½x - ½ \to \left(\frac{11}{5}, \frac{3}{5}\right)$	
	$d = \sqrt{\left(\frac{1}{5}\right)^2 + \left(\frac{2}{5}\right)^2} = 0.45$ (or $1/\sqrt{5}$)	
(iii)	*OR3:* ΔOAC has area $\frac{1}{4}$ [where $C = (0, -\frac{1}{2})$]	
	$\frac{1}{2} \times \frac{\sqrt{5}}{2} \times d = \frac{1}{4} \to d = \frac{1}{\sqrt{5}}$	
		3

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6 - (9709/11_Summer_2018_Q5)

5(i)	Eqn of AC $y = -\frac{1}{2}x + 4$ (gradient must be $\Delta y / \Delta x$)	
	Gradient of $OB = 2$ $\rightarrow$ $y = 2x$ (If y missing only penalise once)	
		4
5(ii)	Simultaneous equations $\rightarrow$ ((1.6, 3.2))	
	This is mid-point of OB. $\rightarrow$ B (3.2, 6.4)	
	or	
	Let coordinates of B (h, k) $OA = AB \rightarrow h^2 = 8k - k^2$ $OC = BC \rightarrow k^2 = 16h - h^2 \rightarrow$ (3.2, 6.4)	
	or	
	gradients ($\frac{k-4}{h} \times \frac{k}{h-8} = -1$)	
	or	
	Pythagoras: $h^2 + (k-4)^2 + (h-8)^2 + k^2 = 4^2 + 8^2$	
		3

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