A LEVEL Cambridge Topical Past Papers

PURE MATHEMATICS 1

2017 — 2023

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PURE MATHEMATICS P1 9709

TOPICAL PAST PAPER WORKSHEETS

2017 - 2023 | Questions + Mark scheme

AVAILABLE PAPERS

P1	P3	P4	P5	P6
490 Questions	432 Questions	299 Questions	287 Questions	257 Questions

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TOPICS	P1
COORDINATES GEOMETRY	39
FUNCTIONS	69
INTERSECTION POINTS	30
DIFFERENTIATION	70
SEQUENCES & SERIES	48
BINOMIAL THEOREM	39
TRIGONOMETRY	61
VECTORS	18
INTEGRATION	75
RADIANS	41

1 - (9709/11_Summer_2017_Q5) - *Trigonometry, Coordinates Geometry*

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]

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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) - *Coordinates Geometry*

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) - *Coordinates Geometry*

$A(-1, 1)$ 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]

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

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4 - (9709/11_Winter_2017_Q6) - *Coordinates Geometry*

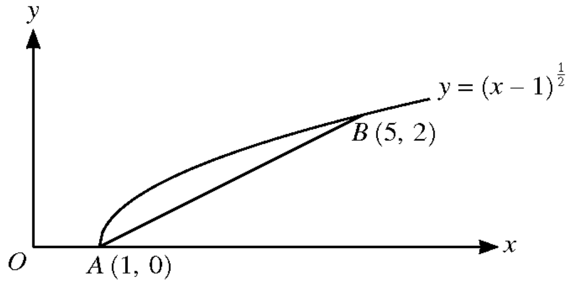
The points $A\,(1,\ 1)$ and $B\,(5,\ 9)$ lie on the curve $6y = 5x^2 - 18x + 19$.

(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]

5 - (9709/13_Winter_2017_Q11) - *Coordinates Geometry, Differentiation*



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]

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

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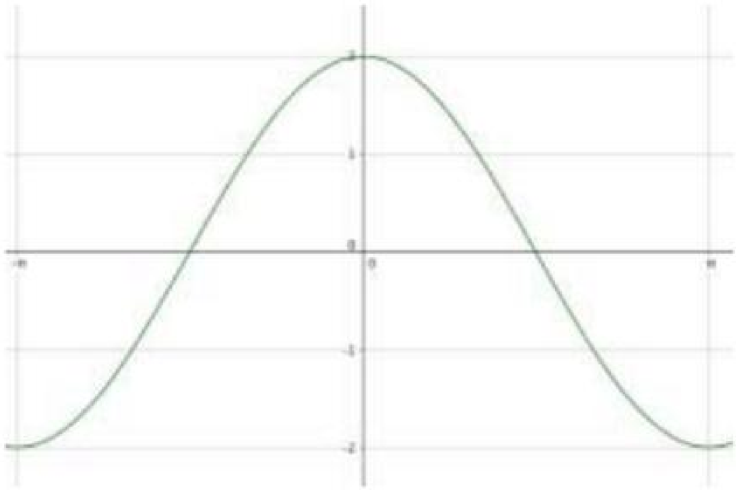
(iii) Find the perpendicular distance between the line AB and the tangent parallel to AB. Give your answer correct to 2 decimal places. [3]

ANSWERS

1 - (9709/11_Summer_2017_Q5) - *Trigonometry, Coordinates Geometry*

(i)		**B1**
		**DB1**
	Total:	**2**
(ii)	$P(\frac{\pi}{3}, 1)\ Q(\pi, -2)$	
	$\rightarrow PQ^2 = \left(\frac{2\pi}{3}\right)^2 + 3^2 \rightarrow PQ = 3.7$	**M1 A1**
	Total:	**2**
(iii)	Eqn of PQ $y-1=-\frac{9}{2\pi}\left(x-\frac{\pi}{3}\right)$	**M1**
	If $y=0 \rightarrow h=\frac{5\pi}{9}$	**A1**
	If $x=0 \rightarrow k=\frac{5}{2}$,	**A1**
	Total:	**3**

2 - (9709/12_Summer_2017_Q2) - *Coordinates Geometry*

(i)	Gradient = 1.5 Gradient of perpendicular = $-\frac{2}{3}$	**B1**
	Equation of AB is $y-6=-\frac{2}{3}(x+2)$ Or $3y+2x=14$ oe	**M1 A1**
	Total:	**3**
(ii)	Simultaneous equations → Midpoint (1, 4)	**M1**
	Use of midpoint or vectors → B (4, 2)	**M1A1**
	Total:	**3**

3 - (9709/13_Summer_2017_Q8) - *Coordinates Geometry*

(i)	$(b-1)/(a+1)=2$	**M1**
	$b=2a+3$ CAO	**A1**
	Total:	**2**
(ii)	$AB^2=11^2+2^2=125$ oe	**B1**
	$(a+1)^2+(b-1)^2=125$	**B1 FT**
	$(a+1)^2+(2a+2)^2=125$	**M1**
	$(5)(a^2+2a-24)=0\rightarrow$ eg$(a-4)(a+6)=0$	**M1**
	$a=4$ or -6	**A1**
	$b=11$ or -9	**A1**
	Total:	**6**

4 - (9709/11_Winter_2017_Q6) - *Coordinates Geometry*

(i)	Mid-point of $AB = (3, 5)$	B1	Answers may be derived from simultaneous equations
	Gradient of $AB = 2$	B1	
	Eqn of perp. bisector is $y - 5 = -\frac{1}{2}(x-3) \to 2y = 13 - x$	M1A1	AG For M1 FT from mid-point and gradient of AB
		4	
(ii)	$-3x + 39 = 5x^2 - 18x + 19 \to (5)(x^2 - 3x - 4)(=0)$	M1	Equate equations and form 3-term quadratic
	$x = 4$ or -1	A1	
	$y = 4\frac{1}{2}$ or 7	A1	
	$CD^2 = 5^2 + 2\frac{1}{2}^2 \to CD = \sqrt{\frac{125}{4}}$	M1A1	Or equivalent integer fractions ISW
		5	

5 - (9709/13_Winter_2017_Q11) - *Coordinates Geometry, Differentiation*

(i)	Gradient of $AB = \frac{1}{2}$	B1	
	Equation of AB is $y = \frac{1}{2}x - \frac{1}{2}$	B1	
		2	
(ii)	$\frac{dy}{dx} = \frac{1}{2}(x-1)^{-\frac{1}{2}}$	B1	
	$\frac{1}{2}(x-1)^{-\frac{1}{2}} = \frac{1}{2}$. Equate *their* $\frac{dy}{dx}$ to *their* $\frac{1}{2}$	*M1	
	$x = 2, \ y = 1$	A1	
	$y - 1 = \frac{1}{2}(x-2)$ (thro' *their*(2,1) & *their* ½) $\to y = \frac{1}{2}x$	DM1 A1	
		5	

(iii)	*EITHER:* $\sin\theta = \frac{d}{1} \ \to \ d = \sin\theta$	(M1	Where θ is angle between AB and the x-axis
	gradient of $AB = \frac{1}{2} \Rightarrow \tan\theta = \frac{1}{2} \Rightarrow \theta = 26.5(7)°$	B1	
	$d = \sin 26.5(7)° = 0.45$ (or $\frac{1}{\sqrt{5}}$)	A1)	
	OR1: Perpendicular through O has equation $y = -2x$	(M1	
	Intersection with AB: $-2x = \frac{1}{2}x - \frac{1}{2} \to \left(\frac{1}{5}, \frac{-2}{5}\right)$	A1	
	$d = \sqrt{\left(\frac{1}{5}\right)^2 + \left(\frac{2}{5}\right)^2} = 0.45$ (or $\frac{1}{\sqrt{5}}$)	A1)	
	OR2: Perpendicular through (2, 1) has equation $y = -2x + 5$	(M1	
	Intersection with AB: $-2x + 5 = \frac{1}{2}x - \frac{1}{2} \to \left(\frac{11}{5}, \frac{3}{5}\right)$	A1	
	$d = \sqrt{\left(\frac{1}{5}\right)^2 + \left(\frac{2}{5}\right)^2} = 0.45$ (or $1/\sqrt{5}$)	A1)	