Cambridge IGCSE

ADDITIONAL MATHEMATICS

0606 P2

2017 - 2025

QUESTIONS + ANSWERS

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CHAPTER 2

Intersection Points

1 -(0606/21_Summer_2017_Q9) ANSWER

The curve $3x^2 + xy - y^2 + 4y - 3 = 0$ and the line $y = 2(1 - x)$ intersect at the points A and B.

(i) Find the coordinates of A and of B. [5]

(ii) Find the equation of the perpendicular bisector of the line AB, giving your answer in the form $ax + by = c$, where a, b and c are integers. [4]

2 -(0606/21_Winter_2017_Q4) ANSWER

Solve the following simultaneous equations for x and y, giving each answer in its simplest surd form.

$$\sqrt{3}x + y = 4$$

$$x - 2y = 5\sqrt{3}$$ [5]

3 -(0606/22_Summer_2018_Q4) ANSWER

Find the coordinates of the points where the line $2y - 3x = 6$ intersects the curve $\frac{x^2}{4} + \frac{y^2}{9} = 5$. [5]

4 -(0606/21_Winter_2018_Q10) ANSWER

The line $y = 12 - 2x$ is a tangent to two curves. Each curve has an equation of the form $y = k + 6 + kx - x^2$, where k is a constant.

(i) Find the two values of k. [5]

The line $y = 12 - 2x$ is a tangent to one curve at the point A and the other curve at the point B.

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

(iii) Find the equation of the perpendicular bisector of AB. [3]

5 -(0606/22_Winter_2018_Q10) ANSWER

Two lines are tangents to the curve $y = 12 - 4x - x^2$. The equation of each tangent is of the form $y = 2k + 1 - kx$, where k is a constant.

(i) Find the two possible values of k. [5]

(ii) Find the coordinates of the point of intersection of the two tangents. [4]

6 -(0606/23_Winter_2018_Q11) ANSWER

A line with equation $y = -5x + k + 5$ is a tangent to a curve with equation $y = 7 - kx - x^2$.

(i) Find the two possible values of k. [5]

(ii) Find, for **each** of your values of k,

- the equation of the tangent
- the equation of the curve
- the coordinates of the point of contact of the tangent and the curve. [5]

(iii) Find the distance between the two points of contact. [2]

7 -(0606/21_Winter_2019_Q4) ANSWER

Do not use a calculator in this question.

Solve the following simultaneous equations, giving your answers for both x and y in the form $a+b\sqrt{2}$, where a and b are integers.

$$2x+y=5$$

$$3x-\sqrt{2}y=7$$

[5]

8 -(0606/22_Winter_2019_Q4) ANSWER

Find the values of k for which the line $y=kx+3$ does not meet the curve $y=x^2+5x+12$. [5]

9 -(0606/21_Summer_2020_Q6) ANSWER

Find the values of k for which the line $y=kx-7$ and the curve $y=3x^2+8x+5$ do not intersect. [6]

10 -(0606/22_Summer_2020_Q3) ANSWER

Find the values of k for which the line $y=x-3$ intersects the curve $y=k^2x^2+5kx+1$ at two distinct points. [6]

11 -(0606/23_Summer_2020_Q2) ANSWER

Find the set of values of k for which $4x^2-4kx+2k+3=0$ has no real roots. [5]

12 -(0606/21_Winter_2020_Q2) ANSWER

Find the coordinates of the points of intersection of the curve $x^2+xy=9$ and the line $y=\frac{2}{3}x-2$. [5]

13 -(0606/23_Winter_2020_Q2) ANSWER

Solve the simultaneous equations.

$$x^2+3xy=4$$

$$2x+5y=4$$

[5]

1 -(0606/21_Summer_2017_Q9) QUESTION

(i)	Substitution of $y = 2(1-x)$	M1	Must be attempt at full substitution. Condone one sign error in substitution. Condone omission of = 0 or incorrect rhs
	$-3x^2 + 2x + 1 = 0$ oe $\left(3x^2 - 2x - 1 = 0\right)$	A1	Terms collected
	Solving *their* quadratic found from eliminating one variable $(3x+1)(1-x)$ or $(3x+1)(x-1)$	M1	can be implied by a correct pair of x values
	$\left(-\frac{1}{3}, \frac{8}{3}\right)$ oe and $(1, 0)$ oe isw nfww	A2	**A1** for each or **A1** for a correct pair of x-coordinates or a correct pair of y-coordinates
(ii)	$[m =]\frac{1}{2}$ cao	B1	
	$\left(\frac{1}{3}, \frac{4}{3}\right)$	B1	FT
	$y - their\frac{4}{3} = their\frac{1}{2}\left(x - their\frac{1}{3}\right)$	M1	or $y = their\frac{1}{2}x + c$ and substitutes their midpoint and reaches $c = \ldots$
	$6y - 3x = 7$	A1	allow any equivalent form with integer coeffs/constant

2 -(0606/21_Winter_2017_Q4) QUESTION

	$x-2\left(4-\sqrt{3}x\right)=5\sqrt{3}$	**M1**	Eliminate y
	$x=\dfrac{5\sqrt{3}+8}{2\sqrt{3}+1}$	**A1**	
	$x=\dfrac{\left(5\sqrt{3}+8\right)\left(2\sqrt{3}-1\right)}{\left(2\sqrt{3}+1\right)\left(2\sqrt{3}-1\right)}$	**M1**	Multiply by $\left(a\sqrt{b}+c\right)$ as appropriate
	$x=2+\sqrt{3}$	**A1**	
	$y=1-2\sqrt{3}$	**A1**	
	<u>Alternative method</u> $\sqrt{3}\left(5\sqrt{3}+2y\right)+y=4$	**M1**	Eliminate x
	$y=\dfrac{-11}{\left(2\sqrt{3}+1\right)}$	**A1**	
	$y=\dfrac{-11\left(2\sqrt{3}-1\right)}{\left(2\sqrt{3}+1\right)\left(2\sqrt{3}-1\right)}$	**M1**	Multiply by $\left(a\sqrt{b}+c\right)$ as appropriate
	$y=1-2\sqrt{3}$	**A1**	
	$x=2+\sqrt{3}$	**A1**	

3 -(0606/22_Summer_2018_Q4) QUESTION

	Eliminates one of the unknowns	**M1**	
	Simplifies to a correct 3-term quadratic: $2x^2+4x-16$ [= 0] oe or $2y^2-6y-36$ [= 0] oe	**A1**	
	Factorises or solves $(x+4)(x-2)=0$ oe or $(y+3)(y-6)=0$ oe	**M1**	**FT** *their* 3-term quadratic in x or y;
	(2, 6) and (–4, –3) oe	**A2**	Not from wrong working **A1** for either (2, 6) or (–4, –3) or **A1** for $x=2$ and $x=-4$ or $y=6$ and $y=-3$

4 -(0606/21_Winter_2018_Q10) QUESTION

(i)	$12-2x=k+6+kx-x^2$ $\rightarrow x^2-(2+k)x+6-k=0$	M1	* Equate and collect terms
	$b^2-4ac=0$ $\rightarrow (2+k)^2=4(6-k)$	M1	**Dep***
	$k^2+8k-20=0$	A1	
	$(k+10)(k-2)=0$	M1	
	$k=-10$ or 2	A1	
(ii)	$(-4,\ 20)$ and $(2,\ 8)$	3	**M1** Insert values of k in equations and solve for x **A1** $x^2+8x+16=0 \rightarrow x=-4$ $\rightarrow y=20$ **A1** $x^2-4x+4=0$ $\rightarrow x=2 \rightarrow y=8$
(iii)	Grad of perpendicular $=\frac{1}{2}$	B1	
	Midpoint $(-1\ ,14)$	B1	**FT**
	Eqn $\frac{y-14}{x+1}=\frac{1}{2} \rightarrow y=\frac{1}{2}x+14.5$	B1	**FT**

5 -(0606/22_Winter_2018_Q10)

(i)	$2k+1-kx=12-4x-x^2$ $x^2+4x-kx+2k-12+1$	**M1**	*
	b^2-4ac $\rightarrow(4-k)^2-4(2k-11)$	**M1**	**Dep***
	$k^2-16k+60$	**A1**	
	$(k-6)(k-10)$	**M1**	
	$k=6$ or 10	**A1**	
	OR		
	$k=4+2x$	**M1**	*
	$-4x-2x^2+8+4x+1=12-4x-x^2$ or $2k+1-k\left(\frac{k-4}{2}\right)=12-2(k-4)-\left(\frac{k-4}{2}\right)^2$	**M1**	**Dep***
	x^2-4x+3 or $k^2-16k+60$	**A1**	
	$(x-1)(x-3)$ or $(k-6)(k-10)$	**M1**	
	$x=1$ or $x=3\rightarrow k=$ 6 or 10	**A1**	
(ii)	$k=6\rightarrow[y]=13-6x$	**B1**	**FT**
	$k=10\rightarrow[y]=21-10x$	**B1**	**FT**
		M1	solve
	$x=2$, $y=1$.	**2**	cao

6 -(0606/23_Winter_2018_Q11) QUESTION

(i)	$-5x+k+5=7-kx-x^2$	**M1**	*
	$b^2-4ac\ (=0) \quad \rightarrow \quad (k-5)^2-4(k-2)\ (=0)$	**M1**	**Dep***
	$k^2-14k+33 \quad (=0)$	**A1**	
	$(k-11)(k-3)\ \ (=0)$	**M1**	**Dep dep** * solve quadratic in k
	$k=11$ and $k=3$	**A1**	
(ii)	$y=-5x+16$ and $y=7-11x-x^2$ $y=-5x+8$ and $y=7-3x-x^2$	**B2**	**FT** *their* k **B1** for any two correct
	solve one tangent/curve pair for one variable from quadratic equation with repeated root	**M1**	
	$(-3, 31)$ and $(1, 3)$	**A2**	**A1** for one correct point or two correct x values
(iii)	find distance between any two points found in **(ii)**	**M1**	
	$\sqrt{800}$ oe	**A1**	

7 -(0606/21_Winter_2019_Q4) QUESTION

	Eliminate x or y	**M1**	
	$x=\dfrac{7+5\sqrt{2}}{3+2\sqrt{2}}$ or $y=\dfrac{1}{3+2\sqrt{2}}$	**A1**	
	Multiply numerator and denominator by $3-2\sqrt{2}$	**M1**	
	$x=1+\sqrt{2}$	**A1**	
	$y=3-2\sqrt{2}$	**A1**	