Cambridge IGCSE

ADDITIONAL MATHEMATICS

0606 P1

2017 - 2024

QUESTIONS + ANSWERS

CHAPTER 2

Intersection Points

1 -(0606/11_Summer_2017_Q1) ANSWER

The line $y = kx - 5$, where k is a positive constant, is a tangent to the curve $y = x^2 + 4x$ at the point A.

(i) Find the exact value of k. [3]

(ii) Find the gradient of the normal to the curve at the point A, giving your answer in the form $a + b\sqrt{5}$, where a and b are constants. [2]

2 -(0606/13_Winter_2017_Q3) ANSWER

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

3 -(0606/11_Summer_2018_Q1) ANSWER

Solve the equations

$$y - x = 4,$$

$$x^2 + y^2 - 8x - 4y - 16 = 0.$$

[5]

4 -(0606/12_Summer_2018_Q2) ANSWER

Find the values of k for which the line $y = 1 - 2kx$ does not meet the curve $y = 9x^2 - (3k + 1)x + 5$. [5]

5 -(0606/13_Summer_2018_Q1) ANSWER

Solve the equations

$$y - x = 4,$$

$$x^2 + y^2 - 8x - 4y - 16 = 0.$$

[5]

6 -(0606/12_Winter_2018_Q12) ANSWER

The line $y = 2x + 5$ intersects the curve $y + xy = 5$ at the points A and B. Find the coordinates of the point where the perpendicular bisector of the line AB intersects the line $y = x$. [9]

7 -(0606/12_Summer_2019_Q2) ANSWER

Do not use a calculator in this question.

Find the coordinates of the points of intersection of the curve $y = (2x+3)^2(x-1)$ and the line $y = 3(2x+3)$. [5]

1 -(0606/11_Summer_2017_Q1) QUESTION

(i)	$kx - 5 = x^2 + 4x$ $x^2 + (4-k)x + 5 = 0$
	For a tangent $(4-k)^2 = 20$
	$k = 4 + 2\sqrt{5}$
	Alternative Gradient of line $= k$ Gradient of curve $= \frac{dy}{dx} = 2x + 4$ Equating: $k = 2x + 4$
	substitution of $k = 2x + 4$ or $x = \frac{k-4}{2}$ in $kx - 5 = x^2 + 4$ and simplify to a quadratic equation in k or x
	$k = 4 + 2\sqrt{5}$
(ii)	Normal gradient $= -\frac{1}{4+2\sqrt{5}} \times \frac{4-2\sqrt{5}}{4-2\sqrt{5}}$
	$= -\frac{4-2\sqrt{5}}{-4}$ oe $= 1 - \frac{\sqrt{5}}{2}$

2 -(0606/13_Winter_2017_Q3) QUESTION

$9 < 4k(k-4)$ $4k^2 - 16k - 9$	**M1**
$(2k-9)(2k+1)$	**M1**
Critical values $\frac{9}{2}$, $-\frac{1}{2}$	**A1**
$k < -\frac{1}{2}$, $k > \frac{9}{2}$	**A1**

3 -(0606/11_Summer_2018_Q1) QUESTION

	Substitution and simplification to obtain a 3 term quadratic in one variable	**M1**	substitution of $y = x + 4$ or $x = y - 4$ and simplification to 3 terms.
	$x^2 - 2x - 8 = 0$ or $2x^2 - 4x - 16 = 0$ or $y^2 - 10y + 16 = 0$ or $y^2 - 10y + 16 = 0$	**A1**	correct equation of the form $ax^2 + bx + c = 0$ or $ay^2 + by + c = 0$
	Solution of quadratic equation	**M1**	**M1 dep**
	$x = 4,\ y = 8$ $x = -2,\ y = 2$	**A2**	**A1** for each pair

4 -(0606/12_Summer_2018_Q2) QUESTION

	For an attempt to obtain an equation in x only	**M1**	
	$9x^2 - (k+1)x + 4 = 0$	**A1**	correct 3 term equation
	$(k+1)^2 - (4 \times 9 \times 4)$	**M1**	**M1dep** for correct use of $b^2 - 4ac$ oe
	Critical values $k = 11,\ \ k = -13$	**A1**	
	$-13 < k < 11$	**A1**	For the correct range

5 -(0606/13_Summer_2018_Q1) QUESTION

	Substitution and simplification to obtain a 3 term quadratic in one variable	**M1**	substitution of $y = x + 4$ or $x = y - 4$ and simplification to 3 terms.
	$x^2 - 2x - 8 = 0$ or $2x^2 - 4x - 16 = 0$ or $y^2 - 10y + 16 = 0$ or $y^2 - 10y + 16 = 0$	**A1**	correct equation of the form $ax^2 + bx + c = 0$ or $ay^2 + by + c = 0$
	Solution of quadratic equation	**M1**	**M1 dep**
	$x = 4,\ y = 8$ $x = -2,\ y = 2$	**A2**	**A1** for each pair

6 - (0606/12_Winter_2018_Q12) QUESTION

	$2x^2 + 7x = 0$ or $y^2 - 3y - 10 = 0$	**M1**	For attempt to obtain a simplified quadratic equation in one variable equated to 0
		M1	**Dep** For solution of quadratic
	$(0, 5)$	**A1**	
	$\left(-\frac{7}{2}, -2\right)$	**A1**	
	Midpoint $\left(-\frac{7}{4}, \frac{3}{2}\right)$	**B1**	
	Gradient of $AB = 2$ $\therefore \perp$ gradient $= -\frac{1}{2}$	**M1**	For attempt to obtain gradient of line perpendicular to *AB* using *their* coordinates
	$\perp$ bisector: $y - \frac{3}{2} = -\frac{1}{2}\left(x + \frac{7}{4}\right)$	**M1**	For a correct attempt to obtain equation of perpendicular bisector using their midpoint and *their* perpendicular gradient
	Consideration of when $y = x$	**M1**	**Dep** on previous **M1** For attempt to find intersection with the line $y = x$
	$x = y = \frac{5}{12}$	**A1**	For both

7 -(0606/12_Summer_2019_Q2) QUESTION

	Either: $(2x+3)^2(x-1)=3(2x+3)$ $(2x+3)(2x^2+x-6)(=0)$	**M1**	For attempt to equate line and curve and attempt to simplify to $2x+3$ × a quadratic factor or cancelling $2x+3$ and obtaining a quadratic factor
	$(2x+3)(2x^2+x-6)=0$ $(2x+3)(2x-3)(x+2)=0$	**M1**	**Dep** for attempt at 3 linear factors from a linear term and a quadratic term
	$\left(-\frac{3}{2}, 0\right)$	**B1**	
	$\left(\frac{3}{2}, 18\right)$	**A1**	**Dep** on first M mark only
	$(-2, -3)$	**A1**	**Dep** on first M mark only
	Or: $(2x+3)^2(x-1)=3(2x+3)$ $4x^3+8x^2-9x-18(=0)$	**M1**	For attempt to equate line and curve and attempt to simplify to a cubic equation, by collecting like terms
	$(x+2)(4x^2-9)$ $(2x-3)(2x^2+7x+6)$ $(2x+3)(2x^2+x-6)$ $(2x+3)(2x-3)(x+2)(=0)$	**M1**	**Dep** For attempt to find a factor from a 4 term cubic equation (usually $x+2$), do long division oe to obtain a quadratic factor and factorise this quadratic factor
	$\left(-\frac{3}{2}, 0\right)$	**A1**	
	$\left(\frac{3}{2}, 18\right)$	**A1**	
	$(-2, -3)$	**A1**	

8 -(0606/13_Summer_2019_Q3) QUESTION

	$x^2+(3-m)x+m-4=0$	**M1**	For equating line and curve and attempting to obtain a quadratic equation equated to zero
	Discriminant: $(3-m)^2-4(m-4)$	**M1**	**Dep** For use of b^2-4ac, could be implied by use of quadratic formula
	$(m-5)^2$	**A1**	
	Always positive or zero for any *m*, so line and curve will always touch or intersect	**A1**	For a suitable comment/conclusion