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Tangents to curves

Mark schemes for the Tangents to curves question pack

WJEC Level 2 Additional Mathematics (9550) · Calculus

Official WJEC mark schemes for the 9 questions in the matching revise.wales question pack (54 marks total), from the 2011–2024 papers. Pack layout © revise.wales.

18	When $x = 1$, finding $y = -3$	B1	
	$dy/dx = 4x - 10$	M1	Ignore notation, e.g. $y = 4x - 10$, provided clear not from any wrong method.
	(when $x = 1$) gradient is -6	A1	Must be from sight of $dy/dx = 4x - 10$
	Use of $\frac{y - y_1}{x - x_1} = m$ or $y = mx + c$	M1	Method to form equation with appropriate substitution for at least two of x, y and m. FT 'their derived y value' and 'their derived gradient'. Needs to be $x = 1$, do not FT 'their x'
	$y + 3 = -6(x - 1)$ or $-3 = -6 \times 1 + c$, $c = 3$	A1	FT for $x = 1$, 'their y' and 'their derived m'
	$y = -6x + 3$	A1	CAO. Must be in this form
		6	

17	When $x = 2$, finding $y = 16$	B1	
	$dy/dx = 10x - 3$	M1	
	when $x = 2$ gradient is 17	A1	Must be from sight of $dy/dx = 10x - 3$
	Use of $y - y_1 = m(x - x_1)$ or $y = mx + c$ or $m = \frac{y - y_1}{x - x_1}$	M1	Method to form equation with appropriate substitution for at least two of x, y and m. FT 'their y value' (but not y=2) and 'their derived gradient'. Needs to be $x = 2$, do not FT 'their x'
	$y - 16 = 17(x - 2)$ or $16 = 17\times2 + c$, $c = -18$ or $y = 17x - 18$	A1	FT for $x = 2$, 'their y' and 'their derived m'
	$17x - y - 18 = 0$ or $-17x + y + 18 = 0$	A1	CAO. Allow terms in other orders provided '= 0' Mark final answer
		6	

		3	
17	When x = 1, finding y = -1 dy/dx = 8x - 6 (when x = 1) gradient is 2 Use of $y - y_1 = m(x - x_1)$ or $y = mx + c$ or $m = \frac{y - y_1}{x - x_1}$ $y - -1 = 2(x-1)$ or $-1 = 2\times1 + c$, $c = -3$ or $y = 2x - 3$ $2x - y - 3 = 0$ or $-2x + y + 3 = 0$	B1 M1 A1 M1 A1 A1 6	 Must be from sight of dy/dx = 8x - 6 Method to form equation with appropriate substitution for at least two of x, y and m. FT 'their y value' (but not y=2) and 'their derived gradient'. Needs to be x = 1, do not FT 'their x' FT for x = 1, 'their y' and 'their derived m' CAO. Allow terms in other orders provided '= 0' Mark final answer

Differentiating from first principles. Marking guide.
Q14.

11	(a) Correct shaped graph with (0°,) 180° & 360° labelled on the x-axis AND 2, 7 & 12 labelled on the y-axis	B3	Ignore outside the required range *Intention for approximately (0°, 7), (90°, 2), (180°, 7), (270°, 12) and (360°, 7)* B2 awarded a for correct shape graph with conditions: • sinx reflected • with one complete period, labelled 0° to 360° • with difference in y values between maximum and minimum of 10, for their labels OR B1 for a correct shape graph with any 2 of the 3 bullet points above met, OR B1 for a graph with all 3 bullet points above met but joined by straight lines (even if turning points curved), OR B1 for a curved graph through intended points: (0°, 7), (90°, 2), (180°, 7), (270°, 12) and (360°, 7)
	(b) Maximum value 12 AND Minimum value 2	B1	Accept Maximum (270(°), 12) and Minimum (90(°), 2) Allow unsupported correct responses
		4	FT provided at least B2 previously awarded in (a)
12	(a) $(dy/dx=)\ 16x^7+8x$ $(d^2y/dx^2=)\ 112x^6+8$	B1 B1	 FT to 2nd B1 from $dy/dx = kx^n (+\ldots)$
	(b) $(5/5)\ x^5+(3/-1)\ x^{-1}+(-2/-2)x^{-2}$ $(=x^5-3x^{-1}+x^{-2})$	B3	B1 for each term. Accept unsimplified. ISW
	$+c$ (constant)	B1	Award if at least B1 given for integration
	(c) $6x^2/2+10x$ $[6x^2/2+10x]^3_2$ and with intention to substitute and subtract	B2 M1	B1 for $6x^2/2$ or $10x$ Intention to use 3, 2 (in either order) **and** subtract FT their integration, not the same terms as given or differentiated, this includes if there is only1 term seen.
	$=(6\times3^2/2+10\times3)-(6\times2^2/2+10\times2)$ $(=\ 57-32)$	A1	FT for correct use of limits provided working with 2 terms from 'their integration'
	$=\ 25$	A1 11	CAO, not FT. *Answer only, no working shown, M0A0A0*
13	(When x = 2) y = 27 (Gradient when x = 2, dy/dx =) $5\times2x$ 20	B1 M1 A1	 For differentiation, before substitution of x = 2
	Equation $\frac{y-27}{x-2}=20$ or $27=20\times2+c$	M1	FT values for 'their 27' and 'their 20' provided at least one of these is correct.
	$y-27=20(x-2)$ or $c=-13$	m1	Implies previous M1
	$y=20x-13$	A1 6	CAO. Mark final answer
14	Method to solve simultaneously, e.g. use of $y=2x+1$ or $x=(y-1)/2$ into the first equation	M1	$2x+1=x^2-5x+13$ or $y=\frac{(y-1)^2}{2^2}-\frac{5(y-1)}{2}+13$
	$x^2-7x+12=0$ or $y^2-16y+63=0$	A1	Or equivalent but must '=0' or implied in further working
	$(x-3)(x-4)\ (=0)$ or $(y-9)(y-7)\ (=0)$	m1	OR $x=(7\pm\sqrt{1})/2$ or $y=(16\pm\sqrt{4})/2$
	(3, 7) and (4, 9)	A1	FT from their quadratic CAO Need not be in this form, accept x=3, y=7 with x=4, y=9 x & y values must be given
		4	Do not accept unsupported responses Do not accept trial & improvement

17	When x = 2, finding y = 1	B1	
	dy/dx = 12x - 18	M1	
	when x = 2 gradient is 6	A1	
	Use of $y - y_1 = m(x - x_1)$ or $y = mx + c$	M1	Method to form equation
	or $m = \frac{y - y_1}{x - x_1}$		FT their y value (but not y=6) and their derived gradient
	$y - 1 = 6(x-2)$ or $1 = 6\times2 + c$, $c = -11$	A1	
	$6x - y - 11 = 0$	A1	CAO. Must be in this form with '=0' written, with different order or all operations reversed
			Mark final answer
		6	

13	When x = 4, finding y = 0	B1	
	dy/dx = 10x – 20	M1	Ignore notation, e.g. y = 10x - 20, provided clear not from any wrong method.
	(when x = 4) gradient is 20	A1	
	Use of $\frac{y - y_1}{x - x_1} = m$ or $y = mx + c$	M1	Method to form equation FT their y value but not y=4, and their derived gradient
	y – 0 = 20 (x-4) or 0 = 20×4 + c, c = -80	A1	
	20x – y – 80 = 0	A1	CAO. Must be in this form, accept equivalents written as 3 terms with whole number coefficients with '=0' or '0='
		6	

	Additional Mathematics Summer 2017		Final Version

	Summer 2016		
13	(When x = 3) y = 33	B1	
	(Gradient when x = 3, dy/dx =) 3×2x 18	M1 A1	For differentiation, before substitution of x = 3
	Equation $\frac{y-33}{x-3}$ = 18 or 33 = 18×3 + c	M1	FT values for 'their 33' and 'their 18' provided at least one of these is correct.
	y – 33 = 18(x – 3) or c = -21	m1	Implies previous M1
	y = 18x – 21 or equivalent	A1	CAO. Mark final answer
		6	

		3	*possible maximum is only 4 marks, final A0*
13	When x = 3, finding y = -6 dy/dx = 4x - 8 when x = 3 gradient is 4 Use of $y - y_1 = m(x - x_1)$ or $y = mx + c$ $y - -6 = 4(x-3)$ or $-6 = 4\times3 + c$, $c = -18$ $4x - y - 18 = 0$	B1 M1 A1 M1 A1 A1 6	 Method to form equation FT their y value, but not y=3 and their derived gradient CAO. Must be in this form, accept equivalents written as 3 terms with whole number coefficients with '=0' or '0='

		Additional Mathematics Summer 2015			Final	

13	When $x = 2$, finding $y = 20$	B1	
	$dy/dx = 6x + 4$	M1	
	when $x = 2$ gradient is 16	A1	
	Use of $y - y_1 = m(x - x_1)$ or $y = mx + c$	M1	Method to form equation FT their y value, but not y=16 and their derived gradient
	$y - 20 = 16(x-2)$ or $20 = 16\times2 + c$, $c = -12$	A1	
	$16x - y - 12 = 0$ or $-16x + y + 12 = 0$	A1	CAO. Must be in this form, accept equivalents written as 3 terms not with whole number coefficients
		6	

End of solutions