L6 Ma Mock Teacher Y 21-22 SOLUTIONS [52]

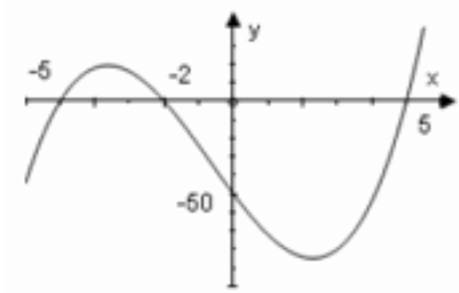
1.

(Quotient =) $x^2 + 2x + 2$ (Remainder =) $0x - 3$ Allow without working	B1 M1 A1 A1 **4**	For correct leading term x^2 in quotient For evidence of division/identity process For correct quotient For correct remainder. The '$0x$' need not be written but must be clearly derived. **4**

2.

$y = 2x - 4$		
$4x^2 + (2x-4)^2 = 10$	**M1***	Attempt to get an equation in 1 variable only
$8x^2 - 16x + 16 = 10$		
$8x^2 - 16x + 6 = 0$	**A1**	Obtain correct 3 term quadratic (aef)
$4x^2 - 8x + 3 = 0$		
$(2x-1)(2x-3) = 0$	**M1dep***	Correct method to solve quadratic of form $ax^2 + bx + c = 0$ $(b \neq 0)$ Correct factorisation oe
$x = \frac{1}{2}$, $x = \frac{3}{2}$	**A1**	Both x values correct
$y = -3$, $y = -1$	**A1** **A1 6**	Both y values correct
	6	or one correct pair of values www B1 second correct pair of values B1

3.



B1	+ve cubic with 3 roots (not 3 line segments)
B1√	(0, -50) labelled or indicated on y-axis
B1	(–5, 0), (–2, 0), (5, 0) labelled or indicated on x-axis and no other x- intercepts
3	

4.

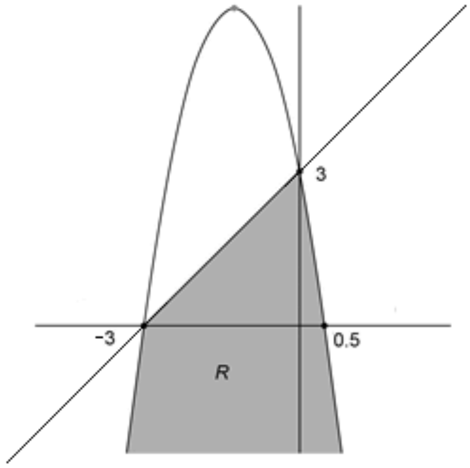
(i)	$\frac{TA}{\sin 107} = \frac{50}{\sin 3}$	M1		Attempt use of correct sine rule to find TA, or equiv
	$TA = 914$ m	A1	2	Obtain 914, or better
(ii)	$TC = \sqrt{914^2 + 150^2 - 2 \times 914 \times 150 \times \cos 70}$	M1		Attempt use of correct cosine rule, or equiv, to find TC
		A1√		Correct unsimplified expression for TC, following their (i)
	$= 874$ m	A1	3	Obtain 874, or better
(iii)	dist from $A = 914 \times \cos 70 = 313$ m	M1		Attempt to locate point of closest approach
	beyond C, hence 874 m is shortest dist	A1	2	Convincing argument that the point is beyond C,
OR				or obtain 859, or better
	perp dist $= 914 \times \sin 70 = 859$ m			SR B1 for 874 stated with no method shown

7

5.

4 (a)	Attempts $H = mt + c$ with both $(3, 2.35)$ and $(6, 3.28)$	M1	3.3
	Method to find both m and c	dM1	3.1a
	$H = 0.31t + 1.42$ oe	A1	1.1b
		(3)	
(b)	Uses the model and states that the initial height is their 'b'	B1ft	3.4
	Compares 140 cm with their 1.42 (m) and makes a valid comment. In the case where $H = 0.31t + 1.42$ it should be this fact supports the use of the linear model as the values are close.	B1ft	3.5a
		(2)	
			(5 marks)

6.

Draws quadratic curve in the correct orientation eg vertex above x-axis and two intersections on the x-axis	1.1a	M1	
Labels all correct points of intersection for the correct quadratic curve with vertex clearly in the 2nd quadrant Must see −3, 0.5 and 3	1.1b	A1	
Draws **correct straight line** passing through (−3, 0) and (0, 3) or straight line which intersects their quadratic curve on the negative x-axis and positive y-axis **and shades** corresponding region for their quadratic curve **FT** their quadratic All lines must be **solid** Condone missing label R	2.2a	A1F	
Total		**3**	

7.

11(a)	$\left(2-\frac{x}{16}\right)^9 = 2^9 + \binom{9}{1}2^8.\left(-\frac{x}{16}\right) + \binom{9}{2}2^7.\left(-\frac{x}{16}\right)^2 + ...$	M1	1.1b
	$\left(2-\frac{x}{16}\right)^9 = 512 + ...$	B1	1.1b
	$\left(2-\frac{x}{16}\right)^9 = ... -144x + ...$	A1	1.1b
	$\left(2-\frac{x}{16}\right)^9 = ... + ... + 18x^2 (+ ...)$	A1	1.1b
		(4)	
(b)	Sets $'512'a = 128 \Rightarrow a = ...$	M1	1.1b
	$(a =)\frac{1}{4}$ oe	A1 ft	1.1b
		(2)	
(c)	Sets $'512'b + '-144'a = 36 \Rightarrow b = ...$	M1	2.2a
	$(b =)\frac{9}{64}$ oe	A1	1.1b
		(2)	
			(8 marks)

8.

7(a)	Uses a technique which could lead to showing two lines are perpendicular. Obtains at least one correct distance (or distance^2) or gradient.	AO3.1a	M1	$AB^2 = (8-15)^2 + (17-10)^2$ $= 98$ $AC^2 = (8--2)^2 + (17--7)^2$ $= 676$ $CB^2 = (15--2)^2 + (10--7)^2$ $= 578$ $AB^2 + BC^2 = 98 + 578$ $= 676$ $= AC^2$ Angle ABC is a right angle.
	Obtains three correct distances (or distance^2) or two gradients. Lengths: $7\sqrt{2}, 17\sqrt{2}, 26$ Gradients: $AB = -\frac{7}{7}, BC = \frac{17}{17}$	AO1.1b	A1	
	Completes correct rigorous argument to show required result Uses Pythagoras OR Multiplies gradients to show product is -1 AND Writes a concluding statement.	AO2.1	R1	
(b)(i)	Explains why AC is a diameter Must reference angle subtended by diameter (condone "angle in a semi-circle") or give full explanation.	AO2.4	E1	The angle subtended by a diameter is 90° $\therefore AC$ must be a diameter of the circle
(b)(ii)	Deduces correct radius (or radius^2)	AO2.2a	B1	Radius $\frac{\sqrt{676}}{2} = 13$ Centre $\left(\frac{8-2}{2}, \frac{17-7}{2}\right) = (3, 5)$ Distance from centre to D $(3--8)^2 + (5--2)^2 = 11^2 + 7^2$ $= 170 > 169$ So D lies outside the circle.
	Obtains mid-point of diameter	AO1.1b	B1	
	Uses $D(-8, -2)$ to find the distance or (distance^2) from *their* centre OE	AO1.1a	M1	
	Completes rigorous argument by comparing $\sqrt{170} > 13$ (or $170 > 169$) to show that D lies outside the circle	AO2.1	R1	
	Total		**8**	

9.

11 (a)	Attempts $f(4) = 2\times 4^3 - 13\times 4^2 + 8\times 4 + 48$	M1	1.1b
	$f(4) = 0 \Rightarrow (x-4)$ is a factor	A1	1.1b
		(2)	
(b)	$2x^3 - 13x^2 + 8x + 48 = (x-4)(2x^2 ... x - 12)$	M1	2.1
	$= (x-4)(2x^2 - 5x - 12)$	A1	1.1b
	Attempts to factorise quadratic factor or solve quadratic eqn	dM1	1.1b
	$f(x) = (x-4)^2(2x+3) \Rightarrow f(x) = 0$ has only two roots, 4 and -1.5	A1	2.4
		(4)	

(c)	Deduces either three roots or deduces that $f(x)$ is moved down two units	M1	2.2a
	States three roots, as when $f(x)$ is moved down two units there will be three points of intersection (with the x - axis)	A1	2.4
		(2)	
(d)	For sight of $k = \pm 4, \pm \frac{3}{2}$	M1	1.1b
	$k = 4, -\frac{3}{2}$	A1ft	1.1b
		(2)	
			(10 marks)