

Topic 21 Quadratics 2 (Post-TT) [47] MARKSCHEME

1.

$$(x-1)^2 - 6 = 0$$

M1

Use of formula:

$$x = \frac{2 \pm \sqrt{(4 - 4 \times 1 \times -5)}}{2 \times 1}$$

(allow 1 error in formula from wrong sign for b (-2), b² as -4, 4ac as -4 × 1 × 5 = -20)

Not dividing whole top by 2a is M0 unless recovered.

$$x = 1 \pm \sqrt{6}$$

A1

$$x = \frac{2 \pm \sqrt{24}}{2}$$

$$x = -1.45, 3.45$$

A1 ft.

f.t. their a and b or their formula if one error and root is not negative.

i.e. wrong sign for b (1.45, -3.45)

b² as -4 (3, -1)

If CTS used and 1 + √6 = 3.45 only answer give M1, A1, A0.

[3]

2. Attempt to find gradient of radius = $\frac{4-0}{3-0} = \frac{4}{3}$ [M1]

Perpendicular gradient is $-\frac{3}{4}$

[M1] negative reciprocal of *their* gradient

Attempt to find equation of line e.g. $y - 4 = -\frac{3}{4}(x - 3)$ [M1] oe

$$y = -\frac{3}{4}x + \frac{25}{4}$$

[A1] oe

3.

$$a = 5$$

B1

*from expansion $x^2 - 2ax + a^2$ and comparing coeffs.
or simply spotting that $a = 5$*

$$b = -7$$

B1ft

*ft. from their a using $a^2 + b = 18$
ie. $b = 18 - a^2$
or by inspection*

[2]

4.

(a) $h + 7$ seen

M1

$$\frac{1}{2}h(h + 7) = 32 \text{ oe}$$

M1

$$\text{sorted to } h^2 + 7h - 64 = 0$$

(b) $\{-7 \pm \sqrt{7^2 - 4x - 64}\}/2$

M1

$$\sqrt{305} \text{ or } 17.46 \dots \text{ seen}$$

A1

$$5.23$$

A1

[6]

5.

$$x^2 + (x + 7)^2 = 25$$

$$\text{or } (y - 7)^2 + y^2 = 25$$

M1

For substitution

$$x^2 + 14x + 49$$

$$\text{or } y^2 - 14y + 49$$

M1

*For expansion of $(y - 7)^2$ or $(x + 7)^2$
(at least 3 correct terms)*

$$2x^2 + 14x + 24 = 0$$

$$\text{or } 2y^2 - 14y + 24 = 0$$

M1 dep

*Complete simplification and all on one side of equation
Dependent on both previous marks*

$$(x + 4)(x + 3) = 0$$

$$\text{or } (y - 4)(y - 3) = 0$$

A1

$$\text{Or } (2x + 8)(x + 3) = 0$$

$$\text{Or } (x + 4)(2x + 6) = 0$$

$$\text{Or } (2y - 8)(y - 3) = 0$$

$$\text{Or } (y - 4)(2y - 6) = 0$$

$$\text{Or } y = \frac{7+1}{2}$$

$$\text{Or } x = \frac{-7 \pm 1}{2}$$

oe

$$x = -4 \text{ and } x = -3$$

$$\text{or } y = (+)4 \text{ and } y = (+)3$$

A1

Or 1 correct pair

$$y = (+)3 \text{ and } y = (+)4$$

$$\text{or } x = -4 \text{ and } x = -3$$

A1

Both correct pairings

A1

$$x = -4, y = (+)3 \text{ SC1}$$

$$x = -3, y = (+)4 \text{ SC1}$$

Note: Do not award SC marks from clearly incorrect working

[7]

6.

$$(a) \quad 0 = 4 + 2p + q$$

M1

$$-5 = 9 - 3p + q$$

*for substitution of both sets of coordinates
allow one error*

$$5 = -5 + 5p$$

DM1

oe for correct attempt at elimination of p or q

$$p = 2$$

A1

$$q = -8$$

A1

p = 2 and q = -8 from no obvious working scores 4

$$(b) \quad \text{Solving their } x^2 + px + q = 0$$

M1

if 'formula' used substitution must be completely correct

$$(-4, 0)$$

A1

[6]

7.

(a)	Alternative method 1		
	$a = 2$ or $2(x^2 - 3x + 2.5)$ or $2(x^2 - 3x) + 5$	M1	
	$x^2 - 3x = (x - 1.5)^2 - 1.5^2$	M1dep	oe ft their $x^2 - 3x$
	$a = 2$ and $b = 1.5$ and $c = 0.5$	A1	oe eg $2(x - 1.5)^2 + 0.5$
	Alternative method 2		
	$a = 2$	B1	
$x^2 - bx - bx + b^2$ or $x^2 - 2bx + b^2$ or $-2ab = -6$ or $-ab = -3$ or $b = 1.5$	M1	oe	
$a = 2$ and $b = 1.5$ and $c = 0.5$	A1	oe eg $2(x - 1.5)^2 + 0.5$	

(b)	Alternative method 1		
	their $2(x - 1.5)^2 = 8.5$ - their 0.5	M1	
	their $(x - 1.5) = \pm \sqrt{\frac{8.5 - \text{their } 0.5}{2}}$	M1dep	oe
	3.5 and -0.5	A1	oe
	Alternative method 2		
	$2x^2 - 6x - 3.5 (= 0)$ or $4x^2 - 12x - 7 (= 0)$	M1	oe 3-term quadratic equation or expression
Correct use of quadratic formula eg $\frac{-(-12) \pm \sqrt{(-12)^2 - 4 \times 4 \times -7}}{2 \times 4}$ or correct factorisation eg $(2x - 7)(2x + 1) = 0$	M1dep	oe	
3.5 and -0.5	A1	oe	

8. Attempt to find gradient of radius = $\frac{6-0}{2-0} = 3$ [M1]
 Perpendicular gradient is $-\frac{1}{3}$ [M1] negative reciprocal of *their* gradient
 Attempt to find equation of line e.g. $y - 6 = -\frac{1}{3}(x - 2)$ [M1] oe
 $y = -\frac{1}{3}x + \frac{20}{3}$
 The tangent crosses the x-axis when $y = 0$ i.e. $x = 20$ [M1]
 Either *base* = 20 or *height* = 6 [B1] soi
 Area of triangle = $\frac{1}{2} \times 20 \times 6 = 60$ [A1]

9.

(a) $(2x - 3)^2 = 4x^2 - 6x - 6x + 9$ M1
condone one error $4x^2 + 9$ is two errors

$4x^2 - 12x + 9 = 8x - 16$ M1
 or $4x^2 - 20x + 25 (= 0)$
*for equating expressions and/or simplifying
 this must lead to a quadratic equation*

$(2x - 5)(2x - 5) (= 0)$ M1
*ft from their quadratic equation (if 'formula' used, substitution
 must be completely correct)*

$x = 2.5$ A1

$y = 2$ A1

- (b) Only one solution so straight line must be a tangent to the curve B2ft
 Hence sketch 2
*ft from their solution(s) to (a)
clear solution(s) in (a) \Rightarrow 'correct' sketch in (b) can earn
 B1 (no explanation) or B2 (with explanation)*

[7]