Question Number	Scheme	Marks
6 (a)	(i) -6 and 15	B1
	(ii) 1 and 8	B1
		(2)
(b)	$(f(x)) = k(x+2)(x-5)^2$	M1
	$(0,10) \Rightarrow 10 = k(0+2)(-5)^2 \Rightarrow k = ...$	dM1
	$(f(x)) = \frac{1}{5}(x+2)(x-5)^2$	A1
		(3)
(c)	Correctly deduces that $x = -2$	B1
	$\frac{1}{5}\cancel{(x+2)}(x-5)^2 = 10\cancel{(x+2)} \Rightarrow (x-5)^2 = 50$	M1
	$\Rightarrow x-5 = \pm\sqrt{50} \Rightarrow x = 5 \pm 5\sqrt{2}$	dM1, A1
		(4)
		(9 marks)

(a)(i)

B1: Requires both -6 and 15. May be seen within the question. Condone repetitions, e.g $-6, 15$ and 15

Condone roots being expressed as $(-6,0)$ and $(15,0)$ only if there are no other coordinates, e.g (0, 10)

(a)(ii)

B1: Requires both 1 and 8 May be seen within the question. Condone repetitions, e.g 1, 8 and 8

Condone roots being expressed as $(1,0)$ and $(8,0)$ only if there are no other coordinates, e.g (3, 10)

SC: If a candidate writes down three coordinates for (i) including $(-6,0)$ and $(15,0)$

and three coordinates for (ii) including $(1,0)$ and $(8,0)$

they should be awarded SC: B1, B0. This may be also awarded from the result of two sketches

(b)

M1: States or implies that $f(x)$ or $y = k(x \pm 2)(x \pm 5)^2$. Allow with $k = 1$

dM1: Substitutes (0, 10) in $f(x) = k(x \pm 2)(x \pm 5)^2$ and finds a value for k

A1: States or implies that $f(x)$ or y is $\frac{1}{5}(x+2)(x-5)^2$ o.e. ISW after a correct answer

Some candidates may be able to write this down with little or no working which is fine for 3 marks

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Alt (b) Note that the demand is that they should (**but not must**) leave $f(x)$ in a factorised form

So, if a candidate attempts to use the form $f(x) = ax^3 + bx^2 + cx + d$ and

- substitutes $(-2,0)$, $(5,0)$ and $(0,10)$ in $f(x) = ax^3 + bx^2 + cx + d$
- substitutes $(5,0)$ in $f'(x) = 3ax^2 + 2bx + c$

they can score M1, dM1 for an attempt at values for a, b, c and d and A1 for $f(x) = \frac{1}{5}x^3 - \frac{8}{5}x^2 + x + 10$

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(c) M1, dM1, A1 can only be scored if they have a valid answer to part (b). That is $f(x) = k(x+2)(x-5)^2$

B1: Correctly deduces that $x = -2$ is one of the solutions.

This may be scored at any point in the solution but must be from a non- calculator method

Examples of ways this may be deduced are

- sight of $x = -2$ being substituted into $y = 10(x+2)$ showing $y = 0$
- $(x+2)$ being divided or factored out of an equation
- sketching $y = 10(x+2)$ on the Figure and showing an intersection at (-2, 0)

M1: $k\cancel{(x+2)}(x-5)^2 = 10\cancel{(x+2)} \Rightarrow (x-5)^2 = \beta, \quad \beta > 0$

Factorises or cancels out the $(x+2)$ term leading to a quadratic factor/equation.

Allow with $k = 1$. Note that many will expand and form a 3TQ

dM1: Proceeds to at least one value for x using a correct NON- CALCULATOR method.

A1: $x = 5 \pm 5\sqrt{2}$ o.e such as $x = 5 \pm \sqrt{50}$

We may have candidates who attempt part (c) via WMA12 methods.

These can be scored in an identical way. They must start with an f(x) in a suitable form which must be

- either $f(x) = k(x+2)(x-5)^2$
- or $f(x) = \frac{1}{5}x^3 - \frac{8}{5}x^2 + x + 10$ or multiple thereof

Example of a correct solution

$x^3 - 8x^2 - 45x - 50 = 0$

$(x+2)\left(x^2 - 10x - 25\right) = 0$

$\Rightarrow x = -2, \; x = \frac{10 \pm \sqrt{100+100}}{2}$

$\Rightarrow x = -2, \; x = 5 \pm \sqrt{50}$

B1: Correctly deduces that $x = -2$ is one of the solutions.

This may be scored at any point in the solution but must be from a non- calculator method

M1: After reaching a cubic form, attempts to factorise out (or divide by) the $(x+2)$ term leading to a 3TQ equation. They cannot just write down the solutions of their cubic from the calculator

dM1: Proceeds to at least one value for x using a correct NON-CALCULATOR method.

A1: $x = 5 \pm 5\sqrt{2}$ o.e such as $x = 5 \pm \sqrt{50}$

Example of a solution that scores no marks

$x^3 - 8x^2 - 45x - 50 = 0$

$\Rightarrow x = -2, \; x = 5 \pm \sqrt{50}$

B1 (for $x = -2$) would only be awarded if they gave some additional evidence.

For example, they state $x = -2$ ($y = 0$) lies on both graphs.

It cannot be just awarded from their calculator solution to the cubic equation

Question Number	Scheme	Marks
7 (a)	$\left(\frac{dy}{dx}\right) = 2x^2 - 16x + 43$	M1, A1
	$= 2x^2 - 16x + 43 \equiv 2\left(x^2 - 8x\right) + ... \equiv 2(x-4)^2 ...$	B1ft, dM1
	$\equiv 2(x-4)^2 + 11$	A1
		(5)
(b)(i)	States minimum value of $\frac{dy}{dx}$ is 11.	B1 ft
(ii)	States that the x coordinate is 4	B1 ft
		(2)
(c)	Attempts $\frac{2}{3}\times"4"^3 - 8\times"4"^2 + 43\times"4" - \frac{20}{3}\left(=80\right)$	M1
	Attempts equation of tangent $y - 80 = 11(x-4)$	dM1
	$y = 11x + 36$	A1
		(3)
		(10 marks)

(a)

M1: Reduces the index on any term including $\frac{20}{3} \to 0$. The index must be processed for this award

A1: $\left(\frac{dy}{dx}\right) = 2x^2 - 16x + 43$ or exact equivalent. There should not be any extra terms such as + c

B1ft: Takes out a correct factor of '2' from their $'2'x^2 - 16x + 43$

This will be implied by the correct value of p for their $2x^2 - 16x + 43$

dM1: Achieves a correct value for q for their $2x^2 - 16x + 43$. Look for $"\frac{-16}{2p}"$

It is dependent upon having differentiated (i.e scoring the first M1)

A1: CAO $2(x-4)^2 + 11$

(b) The question states hence so ideally, answers in (b) should follow their part (a).
A method must be seen so don't allow answers in (b) following no working in (a).

Condone solutions in (b) arising from the second derivative. E.g. $\frac{d^2y}{dx^2} = 4x - 16 = 0 \Rightarrow x = 4$

(b)(i) Do not award marks in (b) for just writing down (4, 11)

B1ft: States 11 but follow through on their r from part (a) as long as $\frac{dy}{dx} = p(x+q)^2 + r$

Also allow candidates to substitute $x =$ 4 in $\frac{dy}{dx}$ to reach 11. Ignore incorrect labelling such as y = 11

(b)(ii)

B1ft: States that the x coordinate is 4 but follow through on their $-q$ from part (a)

(c)

M1: Attempts to find the y coordinate of C using their $x = "4"$.

dM1: Correct attempt at equation of tangent using their 11 and a correctly found y coordinate

It is dependent upon the previous M1

A1: $y = 11x + 36$