Question Number	Scheme	Marks
8. (a)	$-5 < x < \frac{2}{3}$	M1, A1 **(2)**
(b)	$(2x-7)$	B1 **(1)**
(c)	$f'(x) = 2(3x-2)(x+5) = 6x^2+26x-20$	
	$f(x) = 2x^3+13x^2-20x+c$	M1, A1
	$x = \frac{7}{2}, \quad y / f(x) = 0 \Rightarrow c = (-175)$	dM1, A1
	$f(x) = 2x^3+13x^2-20x-175 = (2x-7)(x^2+10x+25)$	ddM1
	$= (2x-7)(x+5)^2$	A1 **(6)** **(9 marks)**

(a)

M1: Achieves the correct critical values. Condone for this mark -5 and awrt 0.67

They may be seen as part of an incorrect inequality

A1: $-5 < x < \frac{2}{3}$ or $-5 \text{,, } x \text{,, } \frac{2}{3}$. Either of these on their own (with consistent inequality use) scores both marks

Accept other valid alternatives such as $x \in \left(-5, \frac{2}{3}\right)$ and $\{x : x > -5\} \cap \left\{x : x < \frac{2}{3}\right\}$ but not $x < \frac{2}{3}$ or $x > -5$

(b)

B1: States $(2x-7)$ or $A = 2, B = -7$ which must be seen in (b).

Condone candidates who write $\left(x - \frac{7}{2}\right) = (2x-7)$ Note that stating $\left(x - \frac{7}{2}\right)$ on its own is B0

(c) Some candidates integrate in part (b). Allow these candidates to score the marks in (c) as long as they re-write $f(x)$ in (c) or do some extra work involving $f(x)$ in (c)

M1: Multiplies out $f'(x)$ to form a quadratic expression and attempts to integrate.

Look for $f'(x) = 2(3x-2)(x+5) = ax^2+bx+c \rightarrow f(x) = px^3+qx^2+rx....(+c)$ with or without the + c

A1: $f(x) = 2x^3+13x^2-20x+c$ with or without the + c

dM1: Substitutes $x = \frac{7}{2}, \quad y / f(x) = 0 \Rightarrow c = ...$

Alternatives exist via division using the fact that $(2x-7)$ is a factor of $2x^3+13x^2-20x+c$

A1: $f(x) = 2x^3+13x^2-20x-175$ but allow $f(x) = 2x^3+13x^2-20x+c$ followed by $c = -175$

ddM1: Attempts to divide or factorise out a factor of $(2x-7)$ or $\left(x-\frac{7}{2}\right)$ from their

$f(x)=2x^3+13x^2-20x-175$

Awarded for 'correct' first and last terms or correct first two terms for their $f(x)$ condoning sign slips

E.g. $2x^3+13x^2-20x-175=(2x-7)(x^2+...x\pm 25)$ or

$2x^3+13x^2-20x-175=\left(x-\frac{7}{2}\right)(2x^2+...x\pm 50)$

It is dependent upon both previous M's so cannot be awarded if they don't have a value for *c*
Mark their final response here as there may be working before the final answer

A1: CSO Requires working to be seen (see bold sentences in question) so look for

- $f(x)=(2x-7)(x+5)^2$ or $f(x)=(2x-7)(x+5)(x+5)$ following correct $f(x)$
- AND correct intermediate factorisation $(2x-7)(x^2+10x+25)$

Going directly from $2x^3+13x^2-20x-175$ to $(2x-7)(x+5)^2$ without sight of working would result in the loss of the last two marks

Note that the last 4 marks can be scored without finding the value of *c* BUT the constant *c* must be present.

We know that $f(x)=2x^3+13x^2-20x+c$ and that $(2x-7)$ is a factor

So $2x^3+13x^2-20x+c=(2x-7)(Ax^2+Bx+C)$ which may be attempted via division

$2x^3+13x^2-20x+c=(2x-7)(1x^2+10x+25)=(2x-7)(x+5)^2$ o.e

The 6 marks in part (c) are awarded as follows

M1, A1: For $f(x)=2x^3+13x^2-20x+c$ with or without the + *c*

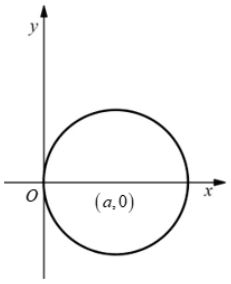
dM1: For setting their $f(x)='2'x^3+'13'x^2-'20'x+c=(2x-7)(Ax^2+Bx+C)$ and correctly deduces the value for *A* for their $f(x)$. You may see a division attempted here which is equivalent work

A1: Correctly deduces $2x^3+13x^2-20x+c=(2x-7)(x^2+10x+C)$

Via division, the $(x^2+10x+...)$ can be awarded implied from within the calculation

ddM1: Correctly deduces $2x^3+13x^2-20x+c=(2x-7)(x^2+10x+25)$

A1: $f(x)=(2x-7)(x+5)^2$ o.e.

Question Number	Scheme	Marks
9(a)		B1 **(1)**
(b)	$(x \pm a)^2 + y^2 = ...$	M1
	$(x \pm a)^2 + y^2 = a^2$	A1
	Uses $(5, 6)$ in $(x \pm a)^2 + y^2 = a^2$ to form and solve an equation in a	dM1
	E.g. $(5-a)^2 + 36 = a^2 \Rightarrow 10a = 61 \Rightarrow a = 6.1$	
	$(x-6.1)^2 + y^2 = 6.1^2$	A1
		(4) **(5 marks)**

(a)

B1: A circle lying in quadrants 1 and 4 only which

- passes through (0, 0)
- is symmetrical about the *x*-axis

Condone slips of the pen. Mark this positively.
Ignore any reference to the point $(5,6)$
Ignore any reference to the coordinates of the centre

(b) Way One: Candidates start from an appropriate equation involving x^2 and y^2 then use (5, 6)

The following equations are mostly written with a constant *a*. Any suitable constant may be used.
The sign of the constant is also not important so accept $(x+a)^2 + y^2 = ...$ or $(x-a)^2 + y^2 = ...$ as well as $(a-x)^2 + y^2 = ...$

M1: Allowable left-hand side for the equation of *C* For example $(x \pm a)^2 + y^2 = ...$ or $(a-x)^2 + y^2 = ...$
This must involve a constant and not be $(x-5)^2 + y^2 = ...$ for example

A1: Correct form for the equation involving a **single** constant.
Examples of correct equations are $(x-a)^2 + y^2 = a^2$, $(x+k)^2 + y^2 = k^2$ and $x^2 + y^2 = \pm 2px$
If they write $(x-a)^2 + y^2 = r^2$ and $r^2 = a^2$ this can be implied

dM1: Uses $(5, 6)$ in $(x \pm a)^2 + y^2 = a^2$ o.e. to form and solve an equation in *a*.
E.g. $(5-a)^2 + 36 = a^2 \Rightarrow \pm 10a = 61 \Rightarrow a = ...$
$5^2 + 6^2 = \pm 10p \Rightarrow p = ...$

A1: $(x-6.1)^2 + y^2 = 6.1^2$ o.e. such as $x^2 + y^2 = 12.2x$

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