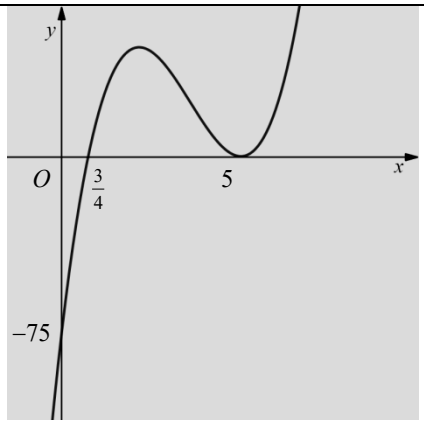
Question Number	Scheme	Marks
10.(a)	 Shape for +ve x^3	B1
	Cuts x-axis at $\left(\frac{3}{4},0\right)$ and meets at $(5,0)$	B1
	Crosses y-axis at $(0,-75)$	B1 **(3)**
(b)(i)	$(x=)$ 3, 20	B1ft
(ii)	$(p=)75$	B1ft **(2)**
(c) (i)	$(g(x)=)\quad (4(x+1)-3)(x+1-5)^2=(4x+1)(x-4)^2$	M1 A1
(ii)	16	B1 **(3)** **(8 marks)**

(a)

For any of the coordinates if there are contradictions between the graph and the text then the graph takes precedence.

B1 Shape for a positive cubic, any position, with one maximum and one minimum. Condone no axes for this mark. Condone cubic curves which have a cusp like appearance at the minimum point.

B1 For a graph crossing at $\left(\frac{3}{4},0\right)$ and meeting at $(5,0)$. The graph should not stop or cross at $(5,0)$.

Allow just the x values instead of the full coordinates marked on the axes or written in the text and condone a slip of x and y the wrong way round as long as the sketch would give the correct coordinates. **Only allow this mark if a graph is drawn.**

B1 For a graph crossing the y-axis at $(0,-75)$

Allow the y value to be marked instead of the full coordinate or written in the text and condone a slip of x and y the wrong way round as long as the sketch would give the correct coordinates. **Only allow this mark if a graph is drawn.** Do not condone 75 marked on the negative y-axis.

Note: in both (b)(i) and (ii) for the follow through the graph takes precedence.
(b)(i)

B1ft $(x=)$ 3, 20 and no others Follow through on 4× their x intercepts.
Allow $(3,0)$ $(20,0)$ ignore $(0,-75)$

(b)(ii)

B1ft $(p=)$ 75 Follow through on their y intercept. Allow if $(y=)\ \mathrm{f}(x)+75$ seen. Do not allow $y=75$

Mark (i) and (ii) together

(c)(i)

M1 Attempts $\mathrm{g}(x)=\big(4\big(x+1\big)-3\big)(x+1-5)^2$ condoning slips. Either award for sight of $x+1$ embedded in the equation or award for sight of an expression of the form $\big(4x+a\big)(x-4)^2$
Alternatively they expand $(4x-3)(x-5)^2=4x^3+Px^2+Qx+R$, where P,Q and $R\neq 0$, and then replace x with $x+1$ to achieve $4(x+1)^3+P(x+1)^2+Q(x+1)+R$ (condoning slips).

A1 $\big(\mathrm{g}(x)=\big)\ \ \big(4x+1\big)(x-4)^2$ or simplified equivalent so accept $4x^3-31x^2+56x+16$

(c)(ii)
B1 16 but accept $\big(0,16\big)$.
Note that they may attempt $\mathrm{f}(1)=\big(4\times1-3\big)(1-5)^2=16$

Question Number	Scheme	Marks
11 (a)	Gradient of normal $= \frac{1}{4}$	B1
	Equation of normal $(y+50) = "\frac{1}{4}"(x-4) \Rightarrow y = \frac{1}{4}x - 51$	M1 A1
		(3)
(b)	$\left(f''(x) =\right) \frac{6}{\sqrt{x^3}} + x = 6x^{-\frac{3}{2}} + x \Rightarrow f'(x) = -12x^{-\frac{1}{2}} + \frac{1}{2}x^2 + k$	M1 A1
	Substitutes $x = 4,\ f'(x) = -4 \Rightarrow k = -6$	dM1 A1
	$\left(f'(x) =\right) -12x^{-\frac{1}{2}} + \frac{1}{2}x^2 - 6 \Rightarrow \left(f(x) =\right) -24x^{\frac{1}{2}} + \frac{1}{6}x^3 - 6x + d$	dM1 A1ft
	Substitutes $x = 4,\ f(x) = -50 \Rightarrow d = \frac{34}{3}$	dddM1
	$\left(f(x) = \right) -24x^{\frac{1}{2}} + \frac{1}{6}x^3 - 6x + \frac{34}{3}$	A1
		(8)
		(11 marks)

Mark (a) and (b) together

(a)

B1 Deduces that the gradient of the normal is $\frac{1}{4}$

M1 Attempts to find the equation of a line passing through $P(4,-50)$ with a **changed** gradient. Allow one sign slip on a coordinate so either $(y+50)$ or $(x-4)$ must be correct. If they use $y = mx + c$ then at least one of the coordinates must be correctly substituted in and they must proceed as far as $c = ...$

A1 $y = \frac{1}{4}x - 51$

(b)

M1 Attempts to integrate $\frac{6}{\sqrt{x^3}} + x$ with one index correct. Either $...x^{-\frac{1}{2}}$ or $...x^2$

A1 $\left(f'(x)\right) = -12x^{-\frac{1}{2}} + \frac{1}{2}x^2 + k$ (unsimplified) with or without the $+k$

dM1 Substitutes $x = 4,\ f'(x) = -4$ into an integrated form (with + *k*) and proceeds to find the value of *k*
This is dependent on the first M1.

A1 $\left(f'(x)=\right) -12x^{-\frac{1}{2}} + \frac{1}{2}x^2 - 6$ (unsimplified) which may be implied

dM1 Dependent upon the first M. It is for integrating 'again' with one index correct. Either $...x^{\frac{1}{2}}$ or $...x^3$

A1ft $\left(f(x)=\right) -24x^{\frac{1}{2}} + \frac{1}{6}x^3 - 6x + d$ (unsimplified) following through ONLY on their *k* (allow k*x*) and with or without *d*