Question Number	Scheme	Marks
4(a)	$x^2(2x+1)-15x \Rightarrow 2x^3+x^2-15x = x(2x^2+x-15)$	M1
	$x(2x-5)(x+3)=0 \Rightarrow x=...$	dM1
	Two of $x=0,\ \frac{5}{2},\ -3$	B1
	$x=0,\ \frac{5}{2},\ -3$	A1
		(4)
(b)	$y^{\frac{2}{3}} = \frac{5}{2} \Rightarrow y = \left(\frac{5}{2}\right)^{\frac{3}{2}}$	M1
	$\frac{5}{4}\sqrt{10}$	A1cso
		(2)
		(6 marks)

The question says "In this question you must show detailed reasoning. Solutions relying on calculator technology are not acceptable". Correct answers do not imply full marks.

(a)

M1 Multiplies out the bracket to achieve a cubic, takes out a linear factor or cancels the x leading to a quadratic factor (usually $2x^2+x-15$). Award for $...x(...x^2 \pm ...x \pm ...)$ or $...x(...x \pm ...)(...x \pm ...)$ May be implied by eg $x(2x-5)(x+3)$ May see = 0 or may be implied.

dM1 Attempts to solve their quadratic either by factorising or using the quadratic formula or completing the square. They cannot just state the roots and the fully factorised version or values of *a*, *b* and *c* must match their quadratic. It is dependent on the previous method mark. The = 0 can be implied and the factorised quadratic may appear under their solutions.

B1 Two of $x=0,\ \frac{5}{2},\ -3$

A1 $x=0,\ \frac{5}{2},\ -3$ provided all previous marks have been scored. Check for $x=0$ in earlier work

Eg1 $2x^3+x^2-15x = x(2x-5)(x+3) \Rightarrow 0,\ \frac{5}{2},\ -3$ M1dM1B1A1

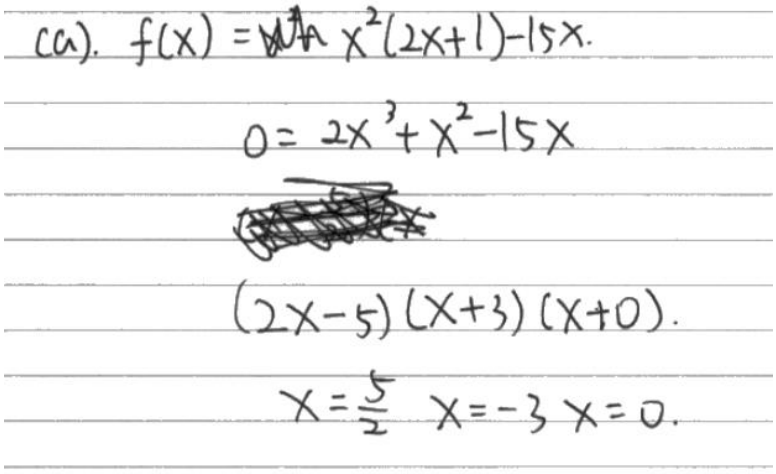
Eg2 $2x^3+x^2-15x=0 \Rightarrow x^3+\frac{1}{2}x^2-\frac{15}{2}x=0 \Rightarrow x\left(x-\frac{5}{2}\right)(x+3)=0 \Rightarrow 0,\ \frac{5}{2},\ -3$ M1dM1B1A1

Eg3 $2x^3+x^2-15x = x\left(x-\frac{5}{2}\right)(x+3) \Rightarrow 0,\ \frac{5}{2},\ -3$ M1dM0B1A0 (the cubic and factorised version are not equal to each other)

Eg4 $2x^3+x^2-15x = x(2x^2+x-15) \Rightarrow 0,\ \frac{5}{2},\ -3$ M1dM0B1A0 (no method seen to solve the quadratic)

Eg5 $0,\ \frac{5}{2},\ -3$ M0dM0B1A0 (no method seen at all)

This response below can score full marks.



(b)

M1 $y^{\frac{2}{3}} = "\frac{5}{2}" \Rightarrow y = \left("\frac{5}{2}"\right)^{\frac{3}{2}}$ (or one of their positive solutions from part (a)). The question states a calculator cannot be used so do not award for an implied method if they have decimal solutions or the exact answer without the method to deal with the fractional power seen. No marks can be scored without a positive solution from (a) or they restart in (b).

Allow notation such as $y = \sqrt[\frac{2}{3}]{\frac{5}{2}}$ and you do not need to see $y = ...$

A1 $\frac{5}{4}\sqrt{10}$ or $1.25\sqrt{10}$ or $1\frac{1}{4}\sqrt{10}$ **only and no other solutions** cso

Eg1 $y^{\frac{2}{3}} = "\frac{5}{2}" \Rightarrow y = 3.95...$ is M0A0

Eg2 $y^{\frac{2}{3}} = "\frac{5}{2}" \Rightarrow y = \frac{5}{4}\sqrt{10}$ is M0A0

Eg3 $y^{\frac{2}{3}} = "\frac{5}{2}" \Rightarrow y^2 = \frac{125}{8} \Rightarrow y = \frac{5}{4}\sqrt{10}$ can score M1A1 as they have shown a method to deal with the factional power.

Question Number	Scheme	Marks
5(a)	$f'(x) = 12x^{-\frac{1}{2}} + \frac{x}{3} - 4$	
	One of $x^{-\frac{1}{2}} \to x^{\frac{1}{2}}$, $-4 \to -4x$, $x \to x^2$	M1
	$f(x) = \int 12x^{-\frac{1}{2}} + \frac{x}{3} - 4\,dx = 24x^{\frac{1}{2}} + \frac{x^2}{6} - 4x + c$	A1A1
	$8 = 24(9)^{\frac{1}{2}} + \frac{(9)^2}{6} - 4(9) + c \Rightarrow c = ...$	dM1
	$\left(f(x) =\right)\ 24x^{\frac{1}{2}} + \frac{x^2}{6} - 4x - \frac{83}{2}$	A1
		(5)
(b)	$f'(9) = \frac{12}{\sqrt{9}} + \frac{9}{3} - 4 \quad (=3)$	M1
	$3 \to -\frac{1}{3}$	dM1
	$y - 8 = "-\frac{1}{3}"(0-9)$	M1
	$(0, 11)$	A1
		(4)
		(9 marks)

(a)

M1 Integrates by raising the power on one of the terms (ie $x^{-\frac{1}{2}} \to x^{\frac{1}{2}}$, $-4 \to -4x^1$, $x \to x^2$). The index does not need to be processed.

A1 Two terms correct of $24x^{\frac{1}{2}} + \frac{x^2}{6} - 4x$ or unsimplified equivalent which may appear as a list. The indices must be processed. Allow x^1

A1 $24x^{\frac{1}{2}} + \frac{x^2}{6} - 4x\ (+c)$ or unsimplified equivalent. Condone the lack of +*c* for this mark. Allow x^1 and ignore any spurious notation including = 0

dM1 Attempts to substitute $x = 9, y = 8$ into their f(*x*) and proceeds to find *c*. It is dependent on the previous method mark. If they have no + *c* then this mark cannot be scored.

A1 $\left(f(x) =\right)\ 24x^{\frac{1}{2}} + \frac{x^2}{6} - 4x - \frac{83}{2}$ or simplified equivalent. Withhold this mark if they attempt to make the coefficients integers. Do not accept rounded decimals such as $0.166x^2$. Also withhold this mark if spurious notation around the answer is seen such as the integral and d*x* or an = 0