Question Number	Scheme	Marks
6(a)(i)	$x=4 \Rightarrow \mathrm{f}'(4)=\dfrac{(4+3)^2}{4\sqrt{4}}=\dfrac{49}{8}$ (6.125)	B1
(ii)	$y-20="\dfrac{49}{8}"(x-4)$	M1A1ft
	$49x-8y-36=0$	A1
		(4)
(b)	$\mathrm{f}'(x)=\dfrac{(x+3)^2}{x\sqrt{x}}=\dfrac{x^2+6x+9}{x\sqrt{x}}$ $=\dfrac{x^2}{x\sqrt{x}}+\dfrac{6x}{x\sqrt{x}}+\dfrac{9}{x\sqrt{x}}=\ldots$	M1
	$=x^{\frac{1}{2}}+6x^{-\frac{1}{2}}+9x^{-\frac{3}{2}}$	A1
	$\left(\mathrm{f}(x)=\right)\dfrac{2}{3}x^{\frac{3}{2}}+12x^{\frac{1}{2}}-18x^{-\frac{1}{2}}+c$	dM1 A1A1
	$20=\dfrac{2}{3}(4)^{\frac{3}{2}}+12(4)^{\frac{1}{2}}-18(4)^{-\frac{1}{2}}+c \Rightarrow c=\ldots$	M1
	$\left(\mathrm{f}(x)=\right)\dfrac{2}{3}x^{\frac{3}{2}}+12x^{\frac{1}{2}}-18x^{-\frac{1}{2}}-\dfrac{1}{3}$	A1
		(7)
		Total 11

(a)(i)

B1: Correct value

(ii)

M1: Correct straight line method using $y = 20$ and $x = 4$ with their f'(4) as $(y-20)="\dfrac{49}{8}"(x-4)$

allowing a sign error in one of the brackets.
If they use $y=mx+c$ they must proceed as far as $c=\ldots$
Using a perpendicular gradient is M0.

A1ft: Correct equation in any form following through on their f'(4)

A1: Correct equation in the required form where all terms are on one side of an equation (allow any integer multiple)

(b)

M1: Squares the numerator (condone if only x^2+9 terms are found) and attempts to split the fraction. If this is done in (a) it must be used in (b). Score for one correct index being achieved from correct working: $...x^{\frac{1}{2}}$ or $...x^{-\frac{1}{2}}$ or $...x^{-\frac{3}{2}}$

A1: $x^{\frac{1}{2}}+6x^{-\frac{1}{2}}+9x^{-\frac{3}{2}}$ These terms may appear on different lines.

dM1: $...x^{\frac{1}{2}}\rightarrow...x^{\frac{3}{2}}$ or $...x^{-\frac{1}{2}}\rightarrow...x^{\frac{1}{2}}$ or $...x^{-\frac{3}{2}}\rightarrow...x^{-\frac{1}{2}}$
It is dependent on the previous method mark.

A1: Any 2 correct terms of $\frac{2}{3}x^{\frac{3}{2}}+12x^{\frac{1}{2}}-18x^{-\frac{1}{2}}$ which may be on different lines of their work (unsimplified or simplified)

A1: $\left(\mathrm{f}\left(x\right)=\right)\frac{2}{3}x^{\frac{3}{2}}+12x^{\frac{1}{2}}-18x^{-\frac{1}{2}}\left(+c\right)$ (unsimplified or simplified) which may appear on different lines of their work (condone lack of + *c* for this mark). Condone spurious notation.

M1: Uses *y* = 20 and *x* = 4 in their integrated function to find a value for "*c*". (Not differentiated function or the original function)

A1: $\frac{2}{3}x^{\frac{3}{2}}+12x^{\frac{1}{2}}-18x^{-\frac{1}{2}}-\frac{1}{3}$ (accept equivalent simplified forms with exact coefficients and allow $y=$). Isw after a simplified correct answer, unless they attempt to multiply through by a value. Condone spurious notation.

Question Number	Scheme	Marks
7(a)	$4\times-2\times-9=72$ $p="72"-50$	M1
	$(p=)\ 22$	A1
		(2)
(b)	$(q=)-4,\ 2,\ 4.5$	B1B1
		(2)
(c)	$\mathrm{f}(x)=(x+4)(x-2)(2x-9)$ $\mathrm{f}(x)=(x^2+2x-8)(2x-9)=...x^3\pm...x^2\pm...x\ (\pm...)$	M1
	$=2x^3-5x^2-34x\quad(+72)$	A1
	$(\mathrm{f}'(x)=)\ 6x^2-10x-34$	M1A1
		(4)
(d)	$"6x^2-10x-34"=-18$ $"6x^2-10x-16"=0\Rightarrow x=...\left(-1,\ \frac{8}{3}\right)$	M1
	$-1<x<\frac{8}{3}$	dM1A1
		(3)
		Total 11

(a)

M1: Correct method for *p*. Condone sign slips in finding the product of $4\times-2\times-9$
Alternatively multiplies out to achieve a cubic (eg $.....\pm72$) and subtracts 50 from their constant. $50-72\ (=-22)$ is M0.

A1: 22 cao (22 with no working is M1A1) In the alternative method they must identify *p* as 22.
Check for answer next to question. If there is a contradiction then the answer in the main body of working takes precedence.
Accept $y=\mathrm{f}(x)-22$ but do not accept contradictions such as $\mathrm{f}(x)-22\Rightarrow p=-22$ (M1A0)

(b) Check next to the question (ignore any references to *x*)

B1: Any 1 correct value of $-4,\ 2,\ 4.5$ in their final answer. If they proceed to changing the sign on the value then B0.

B1: $-4,\ 2,\ 4.5$ cao but if they exclude any of these then withhold this mark. If there is a contradiction, then the answer in the main body of working takes precedence and if they state the correct values followed by $4,\ -2,\ -4.5$ then withhold this mark.