Question Number	Scheme	Marks
7(a)	$\dfrac{12x^3(x-7)+14x(13x-15)}{21\sqrt{x}}=\dfrac{12x^4-84x^3+182x^2-210x}{21\sqrt{x}}$	M1
	$\dfrac{4}{7}x^{\frac{7}{2}}, -4x^{\frac{5}{2}}, +\dfrac{26}{3}x^{\frac{3}{2}}, -10x^{\frac{1}{2}}$	A1
	$\left(y=\right)\dfrac{4}{7}x^{\frac{7}{2}}-4x^{\frac{5}{2}}+\dfrac{26}{3}x^{\frac{3}{2}}-10x^{\frac{1}{2}}$	A1
		(3)
(b)	$y=\dfrac{4}{7}x^{\frac{7}{2}}-4x^{\frac{5}{2}}+\dfrac{26}{3}x^{\frac{3}{2}}-10x^{\frac{1}{2}}$ $\left(\dfrac{\mathrm{d}y}{\mathrm{d}x}=\right)2x^{\frac{5}{2}}-10x^{\frac{3}{2}}+13x^{\frac{1}{2}}-5x^{-\frac{1}{2}}$	M1A1ft
	$2x^3-10x^2+13x-5=0$ *	A1*
		(3)
(c)	$\left(2x^3-10x^2+13x-5\right)\div(x-1)=(2x^2\pm...x\pm...)$	M1
	$2x^2-8x+5$	A1
	$x=\dfrac{4\pm\sqrt{6}}{2}$	A1
		(3)
		(9 marks)

(a)

M1: Attempts to multiply out numerator (at least 2 correct terms obtained).
May be done by e.g. 2 separate fractions.

A1: Two of $\dfrac{4}{7}x^{\frac{7}{2}}, -4x^{\frac{5}{2}}, +\dfrac{26}{3}x^{\frac{3}{2}}, -10x^{\frac{1}{2}}$ where the coefficient may be unsimplified but the index must be processed so allow for any 2 of e.g. $\dfrac{12}{21}x^{\frac{7}{2}}, -\dfrac{84}{21}x^{\frac{5}{2}}, +\dfrac{182}{21}x^{\frac{3}{2}}, -\dfrac{210}{21}x^{\frac{1}{2}}$

A1: $y=\dfrac{4}{7}x^{\frac{7}{2}}-4x^{\frac{5}{2}}+\dfrac{26}{3}x^{\frac{3}{2}}-10x^{\frac{1}{2}}$ or exact simplified equivalent. Allow as a list.

(b)

M1: Differentiates to achieve an expression of the form $\left(\dfrac{\mathrm{d}y}{\mathrm{d}x}=\right)...x^{\frac{5}{2}}\pm...x^{\frac{3}{2}}\pm...x^{\frac{1}{2}}\pm...x^{-\frac{1}{2}}$

A1ft: Correct differentiation $2x^{\frac{5}{2}}-10x^{\frac{3}{2}}+13x^{\frac{1}{2}}-5x^{-\frac{1}{2}}$ Follow through their *a*, *b*, *c* and *d* with simplified coefficients. "$\dfrac{\mathrm{d}y}{\mathrm{d}x}=$" is not required.

A1*: $2x^3-10x^2+13x-5=0$
Reaches this printed answer from a correct derivative where the "= 0" has appeared at least once before the final answer. Must be as shown and not just e.g. $x^{-\frac{1}{2}}\left(2x^3-10x^2+13x-5\right)=0$ but allow e.g. $x^{-\frac{1}{2}}\left(2x^3-10x^2+13x-5\right)=0$ followed by a minimal conclusion e.g. hence proven.

(c)

M1: Uses $x-1$ is a factor to establish the quadratic factor. May be by inspection or long division leading to an expression of the form $2x^2+\alpha x+\beta$

A1: Obtains the correct quadratic factor $2x^2-8x+5$

A1: $x=\frac{4\pm\sqrt{6}}{2}$ or exact simplified equivalents e.g. $x=2+\frac{1}{2}\sqrt{6},\ 2-\frac{1}{2}\sqrt{6}$ or $\frac{8\pm\sqrt{24}}{4}$.

(The roots may have been found using a calculator but the **M1A1** must have been awarded)

Some candidates are doing the work for part (c) in part (b) so allow the marks for (c) to score in (b) i.e. mark parts (b) and (c) together.

Question Number	Scheme	Marks
8(a)	$3a = \frac{a}{1-r} \Rightarrow r = ...$	M1
	$r = \frac{2}{3}$ *	A1*
		(2)
(b)	$ar - ar^3 = 16$	B1
	$\frac{10}{27}a = 16 \Rightarrow a = ...$	M1
	$a = 43.2$	A1
	$S_{10} = \frac{43.2(1-\left(\frac{2}{3}\right)^{10})}{1-\frac{2}{3}} = 127.4$	dM1A1
		(5)
		(7 marks)

(a)

M1: Sets $3a = \frac{a}{1-r}$, cancels all the *a*'s and attempts to rearrange to find a numerical value for *r*

A1*: $r = \frac{2}{3}$ with no errors and at least one intermediate step after $3a = \frac{a}{1-r}$

Alternative by verification:

$$r = \frac{2}{3}, \Rightarrow \frac{a}{1-r} = \frac{a}{1-\frac{2}{3}} = 3a \qquad \text{Hence } r = \frac{2}{3}$$

Score **M1** for substituting $r = \frac{2}{3}$ into a correct sum to infinity formula and obtaining $3a$

Score **A1** for correct work followed by a (minimal) conclusion e.g. QED, proven, etc.

(b)

B1: $ar - ar^3 = 16$ seen or implied.

M1: Proceeds to a value for *a* from a linear equation in *a* using $r = \frac{2}{3}$ and $ar - ar^3 = 16$

But condone use of $r = \frac{2}{3}$ and $ar^2 - ar^4 = 16$

A1: $a = 43.2$ or any equivalent correct numerical expression e.g. $\frac{16 \times 27}{10}, \frac{216}{5}$

dM1: Substitutes their *a*, $r = \frac{2}{3}$ and *n* = 10 into the correct sum formula.

(Also allow a correct and full attempt to calculate the sum of all 10 terms separately)

It is dependent on the previous method mark.

A1: awrt 127.4 For reference the exact answer is $\frac{92840}{729}$

If candidates use $ar + ar^3 = 16$ rather than $ar - ar^3 = 16$ we will treat this as a copying slip and allow B0M1A0dM1A0 if the subsequent work merits it.