Question	Scheme	Marks	AOs
1 (a)	$(1+8x)^{\frac{1}{2}} = 1 + \frac{1}{2} \times 8x + \frac{\frac{1}{2} \times -\frac{1}{2}}{2!} \times (8x)^2 + \frac{\frac{1}{2} \times -\frac{1}{2} \times -\frac{3}{2}}{3!} \times (8x)^3$	M1 A1	1.1b 1.1b
	$= 1 + 4x - 8x^2 + 32x^3 + ...$	A1	1.1b
		(3)	
(b)	Substitutes $x = \frac{1}{32}$ into $(1+8x)^{\frac{1}{2}}$ to give $\frac{\sqrt{5}}{2}$	M1	1.1b
	Explains that $x = \frac{1}{32}$ is substituted into $1 + 4x - 8x^2 + 32x^3$ and you multiply the result by 2	A1ft	2.4
		(2)	
		(5 marks)	
Notes:			

(a)

M1: Attempts the binomial expansion with $n = \frac{1}{2}$ and obtains the correct structure for term 3 **or** term 4.

Award for the correct coefficient with the correct power of x. Do not accept $^{n}C_{r}$ notation for coefficients.

For example look for term 3 in the form $\frac{\frac{1}{2} \times -\frac{1}{2}}{2!} \times (*x)^2$ or $\frac{\frac{1}{2} \times -\frac{1}{2} \times -\frac{3}{2}}{3!} \times (*x)^3$

A1: Correct (unsimplified) expression. May be implied by correct simplified expression
A1: $1 + 4x - 8x^2 + 32x^3$

Award if there are extra terms (even if incorrect).
Award if the terms are listed $1, 4x, -8x^2, 32x^3$

(b)

M1: Score for substituting $x = \frac{1}{32}$ into $(1+8x)^{\frac{1}{2}}$ to obtain $\frac{\sqrt{5}}{2}$ or equivalent such as $\sqrt{\frac{5}{4}}$

Alternatively award for substituting $x = \frac{1}{32}$ into **both sides** and making a connection between the two sides by use of an = or ≈ .

E.g. $\left(1 + \frac{8}{32}\right)^{\frac{1}{2}} = 1 + 4 \times \frac{1}{32} - 8 \times \left(\frac{1}{32}\right)^2 + 32 \times \left(\frac{1}{32}\right)^3$ following through on their expansion

Also implied by $\frac{\sqrt{5}}{2} = \frac{1145}{1024}$ for a correct expansion

It is not enough to state substitute $x = \frac{1}{32}$ into " the expansion" or just the rhs "$1 + 4x - 8x^2 + 32x^3$"

A1ft: Requires a full (and correct) **explanation** as to how the expansion can be used to estimate $\sqrt{5}$

E.g. Calculates $1 + 4 \times \frac{1}{32} - 8 \times \left(\frac{1}{32}\right)^2 + 32 \times \left(\frac{1}{32}\right)^3$ and multiplies by 2.

This can be scored from an incorrect binomial expansion or a binomial expansion with more terms.

The explanation could be mathematical. So $\frac{\sqrt{5}}{2} = \frac{1145}{1024} \rightarrow \sqrt{5} = \frac{1145}{512}$ is acceptable.

SC: For 1 mark, M1,A0 score for a statement such as "substitute $x = \frac{1}{32}$ into both sides of part (a) and make $\sqrt{5}$ the subject"