Question Number	Scheme	Marks
4	$\int\left(2x^2+7\right)\mathrm{d}x=\frac{2}{3}x^3+7x$ or $\int\left(10-2x^2\right)\mathrm{d}x=10x-\frac{2}{3}x^3$	M1 A1
	Achieves/uses a limit of $\sqrt{5}$	B1
	Area = $17\sqrt{5}-\int_0^{\sqrt{5}}\left(2x^2+7\right)\mathrm{d}x$ | Area = $\int_0^{\sqrt{5}}\left(10-2x^2\right)\mathrm{d}x$	M1
	$=17\sqrt{5}-\frac{2}{3}\times5\sqrt{5}-7\sqrt{5}$ | $=10\sqrt{5}-\frac{2}{3}\times5\sqrt{5}$	M1
	$=\frac{20}{3}\sqrt{5}$	A1
		(6) **(6 marks)**

Line and curve separate

M1 Correct attempt at integration on $2x^2+7$ ie raises a power by one

A1 $\frac{2}{3}x^3+7x$ (need not be simplified)

B1 Achieves a limit of $\sqrt{5}$ either attached to an integral or used to find the area of the rectangle.

M1 For applying Area of R = ±(area of rectangle - area under curve) = $\pm\left("17\sqrt{5}"-\int\left(2x^2+7\right)\mathrm{d}x\right)$

M1 Area under curve = $\left[\frac{2}{3}x^3+7x\right]_0^{\sqrt{5}}=\frac{2}{3}\sqrt{5}^3+7\sqrt{5}$. This is for applying the limits of 0 and their √5 (must be an x value) to the integral which must be a changed function. The application of the 0 may be implied. Can be scored if the rectangle is not considered. May be awarded on decimals correct to 1d.p. (allow if found by calculator (23.1)).

A1 $\frac{20}{3}\sqrt{5}$ or exact (single term) equivalent and can be recovered from a negative made positive

Line and curve together

M1 Attempts ± (line – curve) with correct attempt at integration on their $\pm10\pm2x^2$ (raises a power by one)

A1 $\pm\left(10x-\frac{2}{3}x^3\right)$ (may be either way round)

B1 Achieves a limit of $\sqrt{5}$

M1 For Area = $\pm\int_0^{\sqrt{5}}$ their "line – curve" $\mathrm{d}x$ with limits 0 and their √5 which must be an x value.

M1 $\left[10x-\frac{2}{3}x^3\right]_0^{\sqrt{5}}=10\sqrt{5}-\frac{2}{3}\sqrt{5}^3$ This is for applying the limits of 0 (may be implied) and their √5 (must be an x value) to the integral. May be awarded on decimals (1d.p., calculator use ie 14.9 if correct intergral).

A1 $\frac{20}{3}\sqrt{5}$ or exact (single term) equivalent and can be recovered from a negative made positive

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Note that Area of $R=\int_7^{17}\frac{(y-7)^{\frac{1}{2}}}{\sqrt{2}}\mathrm{d}y=\left[\frac{2(y-7)^{\frac{3}{2}}}{3\sqrt{2}}\right]_7^{17}$ is not on specification but allowable and the above scheme can be applied having made x the subject . M1A1 correct integration B1 uses limit 7 M1 attempts integral w.r.t. y with limits their 7 and 17 (need not be correct integration) M1 applies limits A1 answer.

Question Number	Scheme	Marks
5 (a)	Attempts $30\,000\times r^3 = 34\,000$	M1
	$r^3 = \dfrac{17}{15} \Rightarrow r = 1.0426$ Hence $p = 4.26$	A1 A1ft
		[3]
(b)	Attempts $30\,000\times(1.0426)^{"N"} = 75\,000$ or with > or < etc throughout.	M1
	$(1.0426)^{"N"} = \dfrac{5}{2}$	A1
	Takes logs $"N" = \dfrac{\log\left(\frac{5}{2}\right)}{\log 1.0426}$ (= awrt 21.96)	M1 A1
	$N = 22$	B1
		[5]
		(8 marks)

(a)

M1 Attempts to find the common ratio by use of $30\,000\times r^3 = 34\,000$ or $30\,000\times r^2 = 34\,000$. Must involve taking a root. It may be called *p.* Condone slips on the 30000 or 34000.

A1 For awrt 1.04. It may be called *p*

A1ft $p = 4.26$ or follow through on a correct percentage to 2 d.p. for their *r* if the method has been earned (usually 6.46). Note it must be 2d.p. for this mark.

(b)

M1 States/uses $30\,000\times("r")^{"N"} = 75\,000$ or $30\,000\times("r")^{"N-1"} = 75\,000$ with their ratio *r,* but not if their percentage is used. E.g. follow through on their 1.0426 but not 4.26

A1 "Correct" intermediate statement $("r")^{"N"} = \dfrac{5}{2}$ or $("r")^{"N-1"} = \dfrac{5}{2}$

Accept $r =$ awrt 1.04 or $r =$ awrt 1.06 if r^2 was used in (a)

M1 Uses logs correctly $"N" = \dfrac{\log\left(\frac{5}{2}\right)}{\log"1.0426"}$ or $"N-1" = \dfrac{\log\left(\frac{5}{2}\right)}{\log"1.0426"} =$ or $"N" = \log_{"1.0426"}\left(\dfrac{5}{2}\right) =$

Award for the correct solution of any index equation using logs (correctly). The equation may be from incorrect work, e.g having used S_n but must be a solvable equation (ie positive base and operand)

A1 Correct expression for *N* or $N =$ awrt 21.96 following correct work

B1 Depends on $r =$ awrt 1.04 and ar^N used. It is for 22 or f.t. their "*N*" rounded up to nearest integer providing the only errors have been due to rounding. E.g. For $r = 1.04$ this will be for $N = 24$

Note: Accept answers in (b) using inequalities and don't be concerned about the inequalities.

S.C. If power $N - 1$ is used then $N = 22.962$ will be reached if all is correct. If they then round down to 22 then the final A and B can be recovered (it is correct work).

SC For trial and improvement M1 Tries $30\,000\times("r")^N$ with *N* either side of 22 or appropriate value for their *r* (eg 15 for 1.0646) with A1 correct values found either side of 75000 for $r =$ awrt 1.04 or 1.06

M1 Values for *N* directly either side of 75000 found for their *r*. A1 Must be using $r = 1.0426$. Finds $30\,000\times(1.0426)^{21} = 72043$ and $30\,000\times(1.0426)^{22} = 75112$.

B1 Deduces 22 or f.t. $N = 24$ for $r = 1.04$.