Question Number	Scheme	Marks
3. (a)	Attempts $f\left(-\frac{3}{2}\right)=6\left(-\frac{3}{2}\right)^3+17\left(-\frac{3}{2}\right)^2+4\left(-\frac{3}{2}\right)-12$	M1
	$=0\Rightarrow(2x+3)$ is a factor *	A1*
		(2)
(b)	$6x^3+17x^2+4x-12=(2x+3)\left(3x^2+4x-4\right)$	M1 A1
	$=(2x+3)(3x-2)(x+2)$	dM1 A1
		(4)
(c)	Solves $\tan\theta=-\frac{3}{2}$ or "–2" or "$\frac{2}{3}$ "	M1
	$\theta=$ awrt 2.03, 2.16	A1
		(2)
		(8 marks)

(a)

M1 Allow for an attempt at finding a value of $f\left(-\frac{3}{2}\right)=6\left(-\frac{3}{2}\right)^3+17\left(-\frac{3}{2}\right)^2+4\left(-\frac{3}{2}\right)-12$

Sight of embedded values is sufficient. Attempted division is M0

A1* Correctly shows $f\left(-\frac{3}{2}\right)=0$ and states "hence factor" (or substantial equivalent conclusion).

They may state "factor if $f\left(-\frac{3}{2}\right)=0$" in a preamble, in which case accept a minimal conclusion such as //

The M must be scored so there needs to be evidence of either embedded $\left(-\frac{3}{2}\right)$'s or calculations.

(b) Allow for work done in part (a) if referred to in part (b).

M1 Attempt to divide or factorise out $(2x+3)$

By factorisation look for $6x^3+17x^2+4x-12=(2x+3)\left(3x^2+kx\pm4\right)$

By division look for $2x+3\overline{)6x^3+17x^2+4x-12}$ with $3x^2\ \pm4x.....$ and $6x^3+9x^2$

By comparing coefficients look for $6x^3+17x^2+4x-12=(2x+3)(ax^2+bx+c)\Rightarrow a=3,c=\pm4,b=...$

A1 Correct quadratic factor $\left(3x^2+4x-4\right)$ found. May be within the long division.

dM1 Attempts to factorise their $\left(3x^2+4x-4\right)$ usual rules.

A1 $(2x+3)(3x-2)(x+2)$ written out as a product of factors (not as a list) and isw.

Allow $3(2x+3)\left(x-\frac{2}{3}\right)(x+2)$ oe as long as there are three linear factors.

Factors given but no working shown scores M0A0dM0A0

(c)

M1 Solves $\tan\theta = k$ where k is any of their roots to their cubic. Allow if $\tan^{-1}$ seen followed by an answer, or it can be implied by awrt -0.98 or -1.1 or 0.59 or 0.58 truncated (or awrt -56.3 or -63.4 or 33.7 (degrees))

A1 $\theta =$ awrt 2.03, 2.16 and no other solutions inside the range.

Accept 0.6476π and 0.687π as these give correct answers to 3s.f. but not 0.648π as this is not correct to 3s.f.

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.