Question Number	Scheme	Marks
4 (a)	-35	B1 **(1)**
(b)	Attempts $f\left(\pm\frac{2}{3}\right)=0 \rightarrow \left(\frac{2}{3}-3\right)\left(3\left(\frac{2}{3}\right)^2+\left(\frac{2}{3}\right)+a\right)-35=0$	M1
	$-\frac{7}{3}(2+a)=35 \Rightarrow a=-17$ *	A1* **(2)**
(c)	$f(x)=(x-3)(3x^2+x-17)-35=3x^3-8x^2-20x+16$	B1
	$=(3x-2)(x^2-2x-8)$	M1 A1
	$=(3x-2)(x+2)(x-4)$	M1 A1 **(5)** **(8 marks)**

(a)

B1 -35 stated

(b)

M1 Attempts to set $f\left(\pm\frac{2}{3}\right)=0$. Must see $\pm\frac{2}{3}$ substituted into the expression and set equal to zero.
Condone bracket errors for this mark. They may multiply out the expression before substituting so allow errors in the manipulation for this mark. (FYI $3x^3+x^2+ax-9x^2-3x-3a$)
"=0" may be implied by their working.

A1* Achieves the given answer with no incorrect work (including brackets) and at least one correct intermediate line before proceeding to $a=-17$. "=0" must be seen somewhere for this mark.
Eg. $-\frac{7}{3}(2+a)=35 \Rightarrow a=-17$

……

Alt (b)

M1 Assumes $a=-17$ and attempts $f\left(\pm\frac{2}{3}\right)=0$ where $f(x)=(x-3)(3x^2+x-17)-35$

A1* Achieves $f\left(\frac{2}{3}\right)=0$ with no incorrect work, at least one correct intermediate line and states hence proven or some other acknowledgement of the "proof".

……..

(c)

B1 Multiplies out to achieve $f(x)=3x^3-8x^2-20x+16$. This may be implied by eg $(3x-2)(x^2-2x-8)$

M1 Attempts to divide or factorise out $(3x-2)$ from their cubic.

By factorisation look for $3x^3\pm...x^2\pm...x\pm 2\alpha=(3x-2)(x^2+kx\pm\alpha)$ $k\neq 0$ or they may equate coefficients correctly to find *k*.

By division look for $3x-2\overline{)\ 3x^3\pm\beta x^2.....}$ $\quad x^2\pm\frac{(\beta+2)}{3}x.....$ $\quad \underline{3x^3-2x^2}$ (Usually $x^2\pm 6x....$)

There are various other methods but we should be seeing a correct method to find at least two of the coefficients (allow ±) of their quadratic for the method mark. Send to review if unsure how to mark a response.

A1 Correct factors $(3x-2)(x^2-2x-8)$ The two factors do not need to be written together eg this mark can be awarded if the quadratic factor is seen at the top of their algebraic division.

M1 Factorises their quadratic factor of the form Ax^2+Bx+C with *A*, *B*, $C\neq 0$. Score for $(Ax^2+Bx+C)=(dx+e)(fx+g)$ where $|A|=|d\times f|$ or $|C|=|e\times g|$

A1 $(3x-2)(x+2)(x-4)$ on one line following B1M1A1M1

isw $(3x-2)(x+2)(x-4)\Rightarrow x=\frac{2}{3},-2,4$ and allow $3(x-\frac{2}{3})(x+2)(x-4)$

Note the question says using algebra and showing each step.

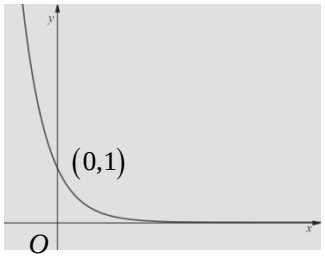
$f(x)=3x^3-8x^2-20x+16\Rightarrow(3x-2)(x+2)(x-4)$ is 10000.

Beware $f(x)=3x^3-8x^2-20x+16=0\Rightarrow\ x=\frac{2}{3},-2,4\Rightarrow(3x-2)(x+2)(x-4)$ is 10000

$f(x)=3x^3-8x^2-20x+16=0\Rightarrow(x-\frac{2}{3})(x+2)(x-4)$ is 10000

isw $(3x-2)(x+2)(x-4)\Rightarrow x=\frac{2}{3},-2,4$

isw $3(x-\frac{2}{3})(x+2)(x-4)\Rightarrow(x-\frac{2}{3})(x+2)(x-4)$

Question Number	Scheme	Marks
5.(a)		
	Shape or intercept at 1	M1
	Fully correct	A1
		(2)
	$h = 0.5$	B1
(b)	Area $\approx \frac{0.5}{2}\left\{4.25+16.06+2\times\left(6.427+9.125+12.34\right)\right\}$	M1
	= awrt 19.0	A1
		(3)
(c)	$\int_2^4\left(x(x-3)+\left(\frac{1}{2}\right)^x\right)\mathrm{d}x = \int_2^4\left(x^2+\left(\frac{1}{2}\right)^x-3x\right)\mathrm{d}x = (b)-\left[\frac{3}{2}x^2\right]_2^4$	M1
	= awrt 1.0	A1ft
		(2)
		(7 marks)

(a)

M1 For either the shape in quadrants 1 and 2 only or the *y*-intercept at 1. Condone slips of the pen but the gradient should be tending to 0 as x increases. Condone (1,0) marked on the correct axis.

A1 Fully correct. Shape in quadrants 1 and 2 only with the *y*-intercept at 1. Condone slips of the pen towards the *x*-axis but the graph should not cross the *x*-axis. Condone (1,0) marked on the correct axis. For a fully correct graph its asymptote should not appear to be $y = 1$. As a rule of thumb look for the asymptote to be at least half way below its *y*-intercept.

Do not be too concerned about relative position of the curve in the second quadrant as long as the curve gets steeper as $x \to -\infty$

(b)

B1 For $h = 0.5$ seen or implied by sight of $\frac{0.5}{2}$ in front of the bracket

M1 For the correct bracket structure $\left\{4.25+16.06+2\times(6.427+9.125+12.34)\right\}$ condoning slips copying from the table or the omission of the final bracket.

eg $\frac{1}{2}\times 0.5\times(4.25+16.06+2\times(6.427+9.125+12.34)$

Recovery from missing brackets to achieving the correct answer can still score full marks.

A1 19.0235 but awrt 19.0 will usually score full marks

Note: The calculator answer for the integral is 18.937… which is A0.