Question Number	Scheme	Marks
3 (a)	States $h = 3$, or use of $\frac{1}{2}\times 3$	B1
	$\left\{8.485 + 1.100 + 2\left(2.502 + 1.524\right)\right\}$	M1
	$= \frac{1}{2}\times 3 \times \left\{17.637\right\} =$ awrt 26.46	A1
		(3)
(b)	Either adds 9 or halves their answer from part (a)	M1
	Full attempt using a correct method Estimate = 9 + 13.23 = awrt 22.2	dM1A1ft
		(3)
		(6 marks)

(a)Note using the integration button on the calculator gives 22.307… and is unlikely to score any marks.

B1: for using $\frac{1}{2}\times 3$ or 1.5 or equivalent (allow for sight of a correct calculation or expression for h) or just states $h = 3$

M1: requires the correct $\{.....\}$ bracket structure. It typically requires

- the "outside" brackets to contain first y value plus last y value and the "inside" bracket
- the "inside" bracket needs to be multiplied by 2 and to be the summation of the remaining y values in the table with no additional values.

If the only mistake is a copying error this may be regarded as a slip and the M mark can be allowed

Condone a missing trailing bracket and condone invisible brackets if the correct structure is implied by their answer.

M0 if values used in brackets are x values instead of y values

May attempt separate trapezia which is acceptable condoning a copying error only.

A1: awrt 26.46 after attempt at trapezium rule. isw

(b) Note using the integration button on the calculator gives 20.153623… with no working scores M0dM0A0
Attempts at using the trapezium rule instead of the answer to part (a) scores M0dM0A0

M1: Correct attempt at one aspect of the integral.

Either 9 +…. or calculates ½ of their answer to part (a) . Allow $11-2$ for 9.

The expression or calculation is sufficient but may be implied by their answer provided it is not 20.1536…. You may need to check this on your calculator.

dM1: Attempts 9+ ½ their answer to part (a). It is dependent on the previous method mark. The expression or calculation is sufficient but may be implied by their answer provided it is not 20.1536…. You may need to check this on your calculator.

A1ft: awrt 22.2 or ft on their answer to part (a) giving an answer to 3sf or better. isw.

Question Number	Scheme	Marks
4 (a)(i)	e.g. $f(-3) = 13-9-(k-3)^2 = 4-(k-3)^2$ and states when $k=5, f(-3)=0$	B1*
(a)(ii)	Uses $f(-3)=0 \Rightarrow (k-3)^2 = 4 \Rightarrow k = (5), 1$	M1A1 **(3)**
(b)(i)	$13+3x+(x+2)(x+5)^2 = 13+3x+(x+2)(x^2+10x+25) = 13+3x+x^3+....$	M1
	$= x^3+12x^2+48x+63$	A1
	Hence $f(x) = (x+3)(x^2+9x+21)$	dM1A1 **(4)**
(b)(ii)	e.g. Attempts "b^2-4ac" for their $(x^2+9x+21)$	M1
	e.g. $b^2-4ac=-3<0 \Rightarrow (x^2+9x+21)$ has no roots and hence $f(x)=0$ has one solution, -3	A1 **(2)**
		(9 marks)

(a) Mark (a) parts (i) and (ii) together

(i)

B1*: Either sets $f(-3)=0$ and states or shows $k=5$, or finds $f(-3)$ and states or shows that when $k=5, f(-3)=0$ Must be *k* not *x*. **The "=0" must be seen somewhere it cannot be implied.**

May be found at the same time as the other possible value for *k* which is fine as we mark both parts together. Allow the root to be stated once a correct equation in *k* only is formed.

May see e.g. $-k^2+6k-5=0 \Rightarrow k=5$

A conclusion referring to $k=5$ is only required if $k=5$ is used in their solution by setting $f(-3)=0$

e.g. $13-9-(k-3)^2 \Rightarrow 13-9-(2)^2=0$ "so $k=5$" or if they attempt to divide the cubic by $x+3$ with $k=5$ substituted to reach a remainder of 0

Allow a preamble followed by a minimal conclusion e.g. proven, shown, tick QED is condoned.

(ii)

M1: Sets up and attempts to solve a quadratic in *k* using a correct valid method (they cannot just state the roots):

e.g. $4-(-3+k)^2=0 \Rightarrow (-3+k)^2=4 \Rightarrow -3+k=\pm 2 \Rightarrow k=5,1$

e.g. $4-(-3+k)^2=0 \Rightarrow k^2-6k+5=0 \Rightarrow (k-5)(k-1)=0 \Rightarrow k=5,1$

(may use the quadratic formula)

Do not allow this mark to be scored for poor attempts at multiplying out the brackets i.e.

$(k-3)^2=4 \Rightarrow k^2-9=4 \Rightarrow k=...$

The "= 0" may be implied.