Question Number	Scheme	Marks
3 (a)	"Strip width" or $h = 2$	B1
	Area $\approx \frac{"h"}{2}(\{0+\}\ 2.8284+2\times(1.4142+2+2.4495))$	M1
	= awrt 14.556	A1
		(3)
(b)	$\left\{\int_{-2}^{6}\left(2x+\sqrt{4x+8}\right)\mathrm{d}x=\right\}\ \left[x^2\right]_{-2}^{6}+2\times"14.556"$	M1
	$=6^2-(-2)^2+2\times"14.556"$	dM1
	= awrt 61.1S	A1
		(3)
		(6 marks)

(a) **Note: Algebraic integration in part (a) scores 000. They can go on to score 110 in part (b).**

B1: Uses a strip width of 2 units. This may be embedded in the (correct) trapezium rule or seen as $h = 2$.

M1: Uses the correct form of the trapezium rule.

Look for $\frac{\cdots}{2}(2.8284+2\times(1.4142+2+2.4495))$ condoning transcription errors but they must be using the y values in the correct places.

Just $2.8284+2\times(1.4142+2+2.4495)$ scores B1M1 (and the A1 is available if they get awrt 14.556)

Note that $\frac{2}{2}(0+2.8284)+2\times(1.4142+2+2.4495)$ is acceptable unless it follows an incorrect formula e.g. $\frac{h}{2}(y_0+y_4)+2\times(y_1+y_2+y_3)$

A1: awrt 14.556. Note the unrounded value is 14.5558 and scores full marks.
Calculator integration achieves 15.085 (to 3 d.p.) and scores no marks unless a valid attempt is seen.
Ignore any units or e.g. u^2 if seen.

(b)

M1: For an attempt to split up the integral and achieve an expression of one of the below forms:
Look for e.g. $\left[x^2\right]_{-2}^{6}+k\times"14.556"$ **or** $32+k\times"14.556"$ **or** $\left[\alpha x^n\right]_{-2}^{6}+2\times"14.556"$ with $n\neq 1$ but allow $k = 1$ for this mark. They may attempt the two parts separately but must combine for M1.
The $\left[x^2\right]_{-2}^{6}$ might be seen as e.g. $\frac{1}{2}\times6\times12-\frac{1}{2}\times2\times4$ or $\frac{1}{2}\times6\times12+\frac{1}{2}\times2\times(-4)$ if they treat it as the area of two triangles or they might apply the trapezium rule to $2x$ only (which should give the correct 32).
Condone slips in the base and/or height of the triangles if the other aspect $2\times"14.556"$ is correct.

dM1: Full and correct **method** using their answer to part (a) to find a value.

Condone the use of a calculator to find $\int_{-2}^{6} 2x\,\mathrm{d}x = 32$ and condone a sign slip/bracketing error when substituting their limits in e.g. $6^2 - -2^2 + 2\times"14.556"$ but not just $6^2 + 2^2 + 2\times"14.556"$ (they must clearly be subtracting).

A minimally acceptable response is e.g. $32 + 2\times"14.556" = ...$

A1: awrt 61.1 following award of M1 and dM1. If they just have 61.1 with no working send to review. Note that calculator integration achieves 62.169889… and will score no marks unless other valid attempts are seen. If they start again with the trapezium rule allow SC 100 if they achieve awrt 61.1

Question Number	Scheme	Marks
4 (a)	$f(2)=0 \Rightarrow 24+4a+2b-10=0$ $\Rightarrow 2a+b=-7$ *	M1 A1* **(2)**
(b)	$f(-1)=-36 \Rightarrow -3+a-b-10=-36 \quad \{\Rightarrow a-b=-23\}$ Solve simultaneously $\Rightarrow a=-10, b=13$	M1, A1 dM1, A1 **(4)**
(c)	$f(x)=3x^3-10x^2+13x-10$ Full method to find both quotient and remainder e.g. $3x^3-10x^2+13x-10 \equiv (x-5)(3x^2+5x+38)+180$ States quotient is $(3x^2+5x+38)$ and remainder is 180	 M1, A1 A1 **(3)** **(9 marks)**

(a) **Note that attempts using algebraic division in part (a) score no marks.**

M1: Attempts to set $f(2)=0$ to form an equation in a and b, e.g., $3(2)^3+a(2)^2+2b-10=0$
The = 0 may be implied for this mark only, by e.g., $f(2)=24+4a+2b-10 \Rightarrow -14=4a+2b$
but not by proceeding directly to the given answer e.g. $f(2)=24+4a+2b-10 \Rightarrow -7=2a+b$

A1*: Shows that $2a + b = -7$ via an intermediate line.
$f(2)=0$ must be present but may be seen as e.g. f (2) = … = 0
Allow e.g. when $x = 2$, f(x) = … = 0
Some examples:
$f(2)=3(2)^3+a(2)^2+2b-10 \Rightarrow 2a+b=-7$ scores M0A0* (no equation prior to given answer)
$3(2)^3+a(2)^2+2b-10=24+4a+2b-10=0 \Rightarrow 2a+b=-7$ scores M1A0* (no $f(2)=0$)
$f(2)=24+4a+2b-10=0 \Rightarrow 2a+b=-7$ scores M1A1*
$f(2)=24+4a+2b-10 \Rightarrow 14+4a+2b=0 \Rightarrow 2a+b=-7$ scores M1A1*

(b)

M1: Sets $f(-1)=-36$ to form an equation in a and b, e.g., $3(-1)^3+a(-1)^2-b-10=-36$
Alternatively, attempts to divide f(x) algebraically by (x + 1) leading to a quotient of the form $(3x^2+Px+S)$ with remainder T where P, S and T are functions of a and/or b, followed by setting their remainder T equal to –36. For reference $P = a – 3$, $S = b + 3 – a$ and $T = a – b – 13$

A1: Correct unsimplified equation in a and b.
Any indices must be correctly evaluated but terms do not need to be collected.
e.g., $-3+a-b-10=-36$ or $a-b=-23$ o.e.

dM1: Solves simultaneously to find values for a **and** b. Dependent upon the previous M mark.
Don't be concerned with the process of solving their simultaneous equations provided they are using the given answer to (a) (or a miscopy) and arrive at a solution for a **and** b.

A1: $a=-10, b=13$ following award of all previous marks in part (b).