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).

(c)

M1: Full method to find both the quotient and the remainder when their f(x) is divided by ($x - 5$)
By division look for an attempt with a quadratic quotient of the form $\left(3x^2 + dx + e\right)$ with $d \neq 0$ and a constant remainder.

A1: For a correct quotient **or** remainder which can be scored within $\left(x-5\right)\left(3x^2+5x+38\right)+180$ or their attempt at algebraic division which may be via a grid method.

A1: **States** quotient is $3x^2+5x+38$ and remainder is 180 but may be seen as e.g. $Q\left(x\right)=3x^2+5x+38$ and R = 180 i.e. they must be extracted in some way, not left as e.g. $\left(x-5\right)\left(3x^2+5x+38\right)+180$

SC: Allow SC M1A0A0 for those that **correctly** find the remainder is 180 using $\mathrm{f}(5)=3(5)^3-10(5)^2+13(5)-10=180$ even if there is no attempt to find the quotient.
Note that you might see this followed by $\mathrm{f}(x)-180=3x^3-10x^2+13x-190=\left(x-5\right)\left(3x^2+5x+38\right)$ which scores the first A1 and the final mark is available if they extract the quotient and remainder.

Question Number	Scheme	Marks
5	$4x^{-\frac{1}{2}} \to \ldots x^{\frac{1}{2}}$ **or** $k \to \ldots x$	M1
	$\left\{\int \left(\frac{4}{\sqrt{x}}+k\right)\mathrm{d}x =\right\} \int \left(4x^{-\frac{1}{2}}+k\right)\mathrm{d}x = \frac{4x^{\frac{1}{2}}}{\left(\frac{1}{2}\right)}+kx \ \{+c\}$	A1
	$\left[\frac{4x^{\frac{1}{2}}}{\left(\frac{1}{2}\right)}+kx\right]_2^4 = 30 \Rightarrow \left(8\sqrt{4}+4k\right)-\left(8\sqrt{2}+2k\right)=30$	dM1
	$\Rightarrow 2k+16-8\sqrt{2}=30$	
	$\Rightarrow k = 7+4\sqrt{2}$	ddM1A1
		(5)
		(5 marks)

Note: Condone spurious inclusion of $\int$ throughout.

M1: Increases the power by one on a correct term. Score for either $4x^{-\frac{1}{2}} \to \ldots x^{\frac{1}{2}}$ or $k \to \ldots x$ where … is a constant and may be unsimplified.

The indices must be evaluated, so do not score for $4x^{-\frac{1}{2}} \to \ldots x^{-\frac{1}{2}+1}$

Candidates that write e.g. $\frac{4}{\sqrt{x}} = 4x^{\frac{1}{2}} \to \frac{4}{\left(\frac{3}{2}\right)}x^{\frac{3}{2}}$ or e.g. $\frac{4}{\sqrt{x}} = 4x^{-2} \to \frac{4}{(-1)}x^{-1}$ will not score this mark (unless they integrate k to … x).

A1: Correct integration (may be unsimplified) $\frac{4x^{\frac{1}{2}}}{\left(\frac{1}{2}\right)}+kx \ \{+c\}$ ignoring limits.

The indices must be evaluated, so do not score for $4x^{-\frac{1}{2}} \to \ldots x^{-\frac{1}{2}+1}$

There is no need for $+c$ in the whole question.

dM1: Substitutes both $x=4$ and $x=2$ into an integrated expression (at least one term must have been integrated), subtracts the correct way round and sets equal to 30.
Condone missing brackets which lead to a sign error, e.g., $8\sqrt{4}+4k-8\sqrt{2}+2k=30$
It is dependent upon the previous method mark i.e. there must be some clear algebraic integration.
If there is no algebraic integration but you think it may be implied then send to review.

ddM1: Dependent upon both previous method marks **and** having correctly integrated k to kx
It is for an attempt to solve the resulting equation in k leading to a value which may be inexact.
Condone slips when solving their equation: do not be concerned about their processing provided they proceed from a linear equation in k to a value for k.