Question	Scheme	Marks
1(a)	$f(\pm 2) = a\times(\pm 2)^3 + 7(\pm 2)^2 \pm 46\times 2 + 24$	M1
	[Remainder is] $8a-40$	A1
		(2)
(b)	$8a-40=0 \Rightarrow a=5$ *	B1*
		(1)
(c)	$5x^3+7x^2-46x+24=(x-2)(5x^2+17x-12)$	M1 A1
	$5x^2+17x-12=(5x-3)(x+4)$	dM1
	$[f(x)]=(x-2)(5x-3)(x+4)$	A1
		(4)
		(7 marks)

Notes:

(a)

M1: Attempts $f(\pm 2)$

OR Polynomial Division

$$
\begin{array}{r|l}
 & ax^2+(7+2a)x+4a-32 \\
\hline
x-2 & ax^3+7x^2-46x+24 \\
 & \underline{ax^3-2ax^2} \\
 & (7+2a)x^2-46x+24 \\
 & \underline{(7+2a)x^2-2(7+2a)x} \\
 & (4a-32)x+24 \\
 & \underline{(4a-32)x-2(4a-32)} \\
 & 8a-40
\end{array}
$$

M1 for a complete method to obtain a quotient of $ax^2+f(a)x+g(a)$ where f(a) and g(a) are linear in a and then obtains a linear expression in a for the remainder.

OR Tabular method

	ax^2	$(7+2a)x$	$4a-32$
x	ax^3	$(7+2a)x^2$	$(4a-32)x$
-2	$-2ax^2$	$-2(7+2a)x$	$64-8a$

So remainder is $24-(64-8a)$

M1: A complete method as above and reaches a linear expression in a in the bottom right hand box and subtracts it from 24

A1: Correct expression in a [Accept $f(2)=8a-40$]

Following polynomial division the remainder must be extracted or identified as the remainder.
If their remainder has **not** been clearly identified or extracted, but then used in part (b) then award A1 here.

(b)

B1*: Sets $8a-40=0$ and correctly shows $a = 5$. Allow a restart, but the work must be correct for this mark, there is no ft.

(c)

M1: Attempts to factor out, or divide through, by the $(x-2)$.

Look for $(x-2)(5x^2+\alpha x+\beta)$ OR $(5x^2+\alpha x+\beta)$ as the quotient from long division where $\alpha, \beta \neq 0$

A1: Correct quadratic factor found.

dM1: Factorises their quadratic factor (usual rules).

A1: Fully factorised cubic all together on one line. Accept $[f(x)]=5(x-2)\left(x-\frac{3}{5}\right)(x+4)$ but not forms with common factors in the linear terms.

Note: Question specifies all stages of working must be shown, so answers without first finding the quadratic factor score no marks. Accept alternative forms of long division.

Question	Scheme	Marks
2(a)	$\int kx^{-3} + 4x^{\frac{3}{2}}\,\mathrm{d}x = k\dfrac{x^{-2}}{-2} + 4\dfrac{x^{\frac{5}{2}}}{5/2} \quad (+c)$	**M1 A1**
	$\displaystyle\int_1^4 kx^{-3} + 4x^{\frac{3}{2}}\,\mathrm{d}x = \left[-\frac{k}{2x^2} + \frac{8x^{\frac{5}{2}}}{5}\right]_1^4 = \left(-\frac{k}{2\times 16} + \frac{8(4)^{\frac{5}{2}}}{5}\right) - \left(-\frac{k}{2} + \frac{8}{5}\right)$	**M1**
	$= \dfrac{15k}{32} + \dfrac{248}{5}$	**A1**
		(4)
(b)	$\dfrac{15k}{32} + \dfrac{248}{5} = 50 \Rightarrow k = \ldots$	**M1**
	$k = \dfrac{64}{75}$ o.e.	**A1**
		(2)
		(6 marks)

Notes:

(a)

M1: Raises the power by 1 in **both** terms. Need not be simplified

Accept for example, $\alpha x^{-3+1} + \beta x^{\frac{3}{2}+1}$ for this mark.

A1: Correct integral with or without +*c*. Need not be simplified although indices must be simplified for this mark. Look for $k\dfrac{x^{-2}}{-2} + 4\dfrac{x^{\frac{5}{2}}}{5/2}$ as a minimum.

M1: Substitutes and subtracts either way around into an expression with changed indices.

A1: Correct simplified answer. Accept e.g., $\dfrac{75k + 7936}{160}$

condone e.g., $0.46875k + 49.6$ with no rounded decimals.

(b)

M1: Sets the result of their changed expression from (a) [provided it is a linear expression of least **2 terms** in terms of *k*] equal to 50, and solves to find *k*

A1: Correct answer from a correct equation. Accept equivalent fractions and also accept $0.85\dot{3}$