Question Number	Scheme	Marks
9(a)	2	B1
		(1)
(b)	1	B1
		(1)
(c)	200	B1
		(1)
(d)	0	B1
		(1)
		4 marks

Notes

You may see diagrams, calculations etc, BUT you are looking for the final answers of:

(a)
B1: 2 or equivalent e.g. “two”
(b)
B1: 1 or equivalent e.g. “one”
(c)
B1: 200 or equivalent e.g. “two hundred”
(d)
B1: 0 or equivalent e.g. “none”, “no solutions”, “no real solutions”

If more than one answer is given in any part, mark the final answer.

Question Number	Scheme	Marks
10(a)	$(\mathrm{f}(x)=)k(x+1)(x-4)^2$	M1 A1
	Uses $(0,12)\Rightarrow 12=16k\Rightarrow k=...$ $(\mathrm{f}(x)=)\frac{3}{4}(x+1)(x-4)^2$	**d**M1 A1
		(4)
	(a) Alternative 1 by simultaneous equations	
	$(\mathrm{f}(x)=)ax^3+bx^2+cx+d$ $(0,\ 12)\rightarrow d=12$ $(-1,\ 0)\rightarrow 0=-a+b-c+12$ $(4,\ 0)\rightarrow 0=64a+16b+4c+12$ $\mathrm{f}'(x)=3ax^2+2bx+c\rightarrow 0=48a+8b+c$	M1 A1
	$a=\frac{3}{4}, b=-\frac{21}{4}, c=6\rightarrow(\mathrm{f}(x)=)\frac{3}{4}x^3-\frac{21}{4}x^2+6x+12$	**d**M1 A1
	(a) Alternative 2 using roots	
	$(\mathrm{f}(x)=)ax^3+bx^2+cx+d$ $(0,\ 12)\rightarrow d=12$ Sum: $4+4-1=-\frac{b}{a}$, Pair sum: $-4-4+16=\frac{c}{a}$, product: $-16=-\frac{12}{a}$	M1 A1
	$a=\frac{3}{4}, b=-\frac{21}{4}, c=6\rightarrow(\mathrm{f}(x)=)\frac{3}{4}x^3-\frac{21}{4}x^2+6x+12$	**d**M1 A1

(a) Notes

In part (a) "f(x) =" is not required so just look the correct expression.

M1: States or implies that $(\mathrm{f}(x)=)k(x\pm1)(x\pm4)^2$ allowing for $k=1$

A1: States or implies that $(\mathrm{f}(x)=)k(x+1)(x-4)^2$ allowing for $k=1$

dM1: Uses $(0,12)$ in $(\mathrm{f}(x)=)k(x\pm1)(x\pm4)^2$ to find a value for k

Depends upon the first method mark.

A1: $(\mathrm{f}(x)=)\frac{3}{4}(x+1)(x-4)^2$ oe e.g. $(\mathrm{f}(x)=)\frac{3}{4}(x+1)(4-x)^2$

Condone a spurious "= 0" e.g. $(\mathrm{f}(x)=)\frac{3}{4}(x+1)(x-4)^2=0$ Apply isw once a correct answer is seen.

Alternative 1:

M1: Starts with a general cubic and uses the given information to produce 3 equations in 3 unknowns.

A1: Correct equations including $d = 12$.

dM1: Solves to find all unknowns. You do not need to check the working as long as all values are found.

A1: $(\mathrm{f}(x)=)\frac{3}{4}x^3-\frac{21}{4}x^2+6x+12$ oe. Condone a spurious "= 0" e.g. $(\mathrm{f}(x)=)\frac{3}{4}x^3-\frac{21}{4}x^2+6x+12=0$

Apply isw once a correct answer is seen.

Alternative 2:

M1: Starts with a general cubic and uses the correct roots to produce 3 equations in 3 unknowns.

A1: Correct equations including $d = 12$.

dM1: Solves to find all unknowns. You do not need to check the working as long as all values are found.

A1: $(\mathrm{f}(x)=)\frac{3}{4}x^3-\frac{21}{4}x^2+6x+12$ oe. Condone a spurious "= 0" e.g. $(\mathrm{f}(x)=)\frac{3}{4}x^3-\frac{21}{4}x^2+6x+12=0$

Apply isw once a correct answer is seen.

A correct function with no working scores 4/4 in (a)

(b)	$x=-1$	B1
	$\frac{3}{4}\cancel{(x+1)}(x-4)^2=6\cancel{(x+1)}(x-2)\Rightarrow x^2-16x+32=0$	M1
	$x^2-16x+32=0\Rightarrow(x-8)^2=32\Rightarrow x=8\pm4\sqrt{2}$	**d**M1 A1
		(4)

	(b) Alternative by expanding.	
	$x=-1$	B1
	$\frac{3}{4}x^3-\frac{21}{4}x^2+6x+12=6(x+1)(x-2)=6x^2-6x-12$ $\Rightarrow\frac{3}{4}x^3-\frac{45}{4}x^2+12x+24=0$	M1
	$\frac{3}{4}x^3-\frac{45}{4}x^2+12x+24=0\Rightarrow(x+1)\left(\frac{3}{4}x^2-12x+24\right)=0$ $\frac{3}{4}x^2-12x+24=0\Rightarrow x=\frac{12\pm\sqrt{12^2-4\times\frac{3}{4}\times24}}{2\times\frac{3}{4}}=8\pm4\sqrt{2}$	**d**M1 A1
		8 marks

(b) Notes

(b)

B1: States $x=-1$ Condone $(-1, 0)$ You do not need to be concerned where this comes from.

M1: Sets their $\frac{3}{4}\cancel{(x+1)}(x-4)^2=6\cancel{(x+1)}(x-2)$ cancels $(x+1)$ and proceeds to a 3TQ

or factorises out $(x+1)$ to obtain a 3 term quadratic factor which must be seen and it cannot be implied by their final answer(s).

It is dependent upon having achieved $f(x)=k(x+1)(x-4)^2 \quad k\neq1$

dM1: Dependent upon the previous method mark, it is for a **non-calculator** method for solving their 3TQ leading to at least one value for *x*.

A1: $x=8\pm4\sqrt{2}$ o.e.

Alternative:

B1: States $x=-1$ Condone $(-1, 0)$ You do not need to be concerned where this comes from.

M1: Expands both sides and collects terms to one side to obtain a 4 term cubic equation and then uses the factor (*x* + 1) to find a 3 term quadratic factor which must be seen and it cannot be implied by their final answer(s).

It is dependent upon having achieved $f(x)=k(x+1)(x-4)^2 \quad k\neq1$ **from the main scheme or** $f(x)=ax^3+bx^2+cx+d, \quad a\neq1$ **from alternatives 1 and 2**

dM1: Dependent upon the previous method mark, it is for a **non-calculator** method for solving their 3TQ leading to at least one value for *x*.

A1: $x=8\pm4\sqrt{2}$ o.e.