| Question Number | Scheme | Marks |
|---|---|---|
| **1 (a)** | $(2,\ -4)$ | B1, B1 **(2)** |
| **(b)** | $(8,\ 6)$ | B1, B1 **(2)** |
| **(c)** | $(-2,\ 6)$ | B1 **(1)** **(5 marks)** |

Notes:

1. Candidates may build up their answer in stages.

E.g. $(6,\ -2) \rightarrow (8,\ -2) \rightarrow (8,\ 6)$ In such cases you mark the final coordinates only

2. Condone the omission of brackets. So, allow 8, 6 for $(8,\ 6)$

3. Allow for example, $x = 2$ for $(2,...)$ and $x = 2,\ y = -4$ for $(2,\ -4)$

4. There are no marks for transposed coordinates i.e $(6,\ 8)$ for $(8,\ 6)$

(a)

B1: For either $(2,...)$ or $(...,-4)$

B1: $(2,\ -4)$

(b)

B1: For either $(8,...)$ or $(...,6)$

B1: $(8,\ 6)$

(c)

B1: $(-2,\ 6)$

| Question Number | Scheme | Marks |
|---|---|---|
| **2. (a)** | $f(1)=4\times1^3+2\times1^2-12=-6$ AND $f(2)=4\times2^3+2\times2^2-12=28$ | M1 |
| | States change of sign, continuous and hence root | A1 |
| | | **(2)** |
| **(b)** | $4x^3+2x^2-12=0\Rightarrow x^2(4x+2)=12$ | M1 |
| | $\Rightarrow x^2=\dfrac{12}{4x+2}=\dfrac{6}{2x+1}\Rightarrow x=\sqrt{\dfrac{6}{2x+1}}$ | A1 |
| | | **(2)** |
| **(c) (i)** | $\left(x_2=\sqrt{\dfrac{'6'}{2+1}}=1.4...\right),\qquad x_3=1.2519$ | M1, A1 |
| **(ii)** | $\alpha=1.2934$ | B1 |
| | | **(3)** |
| | | **(7 marks)** |

(a)

M1: Attempts the value of $f(x)$ at 1 and 2 with at least one correct.

Candidates who state $f(1)<0$, $f(2)>0$ without finding the values will score M0, A0

A smaller interval could be chosen but unlikely. The root must lie within the interval

A1: Both values correct with reason and minimal conclusion (root)

For the reason accept, for example,

- 'Sign change and continuous function'
- '$f(1)=-6<0$, $f(2)=28>0$ and cts'

For the minimal conclusion accept, for example

- Root
- ✓
- QED
- Hence $\alpha$ in the range 1 to 2

(b)

M1: Either writes $4x^3+2x^2-12=0$ OR states $f(x)=0$ with $4x^3+2x^2=12$ o.e.

a**nd** 'correctly' reaches one of the following factorised forms

- $x^2(4x\pm2)=\pm12$
- $x^2(2x\pm1)=\pm6$
- $2x^2(2x\pm1)=\pm12$

Alternatively, they reach $4x^3+2x^2=12$ with evidence as stated above in line 1.

- and then divide each term by $2x^2$ giving $2x+1=\dfrac{12}{2x^2}$ o.e

The key step in the above is an attempt that isolates the $2x+1$ or $4x+2$ term

A1: Shows **each** of the following steps in correctly showing $x=\sqrt{\dfrac{6}{2x+1}}$