| | |
|---|---|
| **(b)** | **Alternative 1** (substitutes $y=k$ into the given or their circle equation and uses $b^2-4ac=0$ or $b^2-4ac>0$)<br>Scores in the same way following e.g.<br>$x^2+10x+\left(k^2-4k+1\right)=0,\ 10^2-4\left(k^2-4k+1\right)>0,\ 24+4k-k^2=0$ |
| **B1:** | $2+2\sqrt{7}$ **or** $2-2\sqrt{7}$ seen. Accept $\sqrt{28}$ for $2\sqrt{7}$ throughout this question. |
| **M1:** | $"2-2\sqrt{7}"<k<"2+2\sqrt{7}"$<br>Selects the inside interval for their endpoints which must come from a correct method condoning slips. Condone use of *y* for *k*.<br>May be seen separately e.g. $"2-2\sqrt{7}"<k,\quad k<"2+2\sqrt{7}"$<br>Condone e.g. $"2-\sqrt{28}" \leqslant k \leqslant "2+\sqrt{28}"$ and allow inexact e.g. $"-3.291..." < k < "7.291..."$<br>If when finding their endpoints they make a sign error and obtain e.g. $k^2-4k-24>0$ and then choose the outside region, this scores M1 but it must be consistent with their inequality. |
| **A1:** | Correct answer in exact form in set notation or interval notation in terms of *k*.<br>Allow: $\left\{k:2-2\sqrt{7}<k<2+2\sqrt{7}\right\}$ or $\left\{k:2-2\sqrt{7}<k\right\}\cap\left\{k:k<2+2\sqrt{7}\right\}$ or $\left\{2-2\sqrt{7}<k<2+2\sqrt{7}\right\}$ or $\left\{2-2\sqrt{7}<k\right\}\cap\left\{k<2+2\sqrt{7}\right\}$ or $\left(2-2\sqrt{7},\ 2+2\sqrt{7}\right)$ or $\left\{k:2-2\sqrt{7}<k\cap k<2+2\sqrt{7}\right\}$ or $\left\{k:2-2\sqrt{7}<k\right\}$ and $\left\{k:k<2+2\sqrt{7}\right\}$ but **not** $\left\{2-2\sqrt{7}<k\right\}\cup\left\{k<2+2\sqrt{7}\right\}$ and **not** $\left[2-2\sqrt{7},\ 2+2\sqrt{7}\right]$ and **not** $\left\{2-2\sqrt{7}\leqslant k\leqslant 2+2\sqrt{7}\right\}$ |
| **(b)** | **Alternative 2** (substitutes $x="-5"$ into the given or their circle equation and solves for *y*)<br>Scores in the same way following e.g.<br>$25+y^2-50-4y+1-0\Rightarrow y^2-4y-24=0\Rightarrow y=$ |
| **B1:** | $2+2\sqrt{7}$ **or** $2-2\sqrt{7}$ seen. Accept $\sqrt{28}$ for $2\sqrt{7}$ throughout this question. |
| **M1:** | $"2-2\sqrt{7}"<k<"2+2\sqrt{7}"$<br>Selects the inside interval for their endpoints which must come from a correct method condoning slips. Condone use of *y* for *k*.<br>May be seen separately e.g. $"2-2\sqrt{7}"<k,\quad k<"2+2\sqrt{7}"$<br>Condone e.g. $"2-\sqrt{28}" \leqslant k \leqslant "2+\sqrt{28}"$ and allow inexact e.g. $"-3.291..." < k < "7.291..."$ |
| **A1:** | Correct answer in exact form in set notation or interval notation in terms of *k*.<br>Allow: $\left\{k:2-2\sqrt{7}<k<2+2\sqrt{7}\right\}$ or $\left\{k:2-2\sqrt{7}<k\right\}\cap\left\{k:k<2+2\sqrt{7}\right\}$ or $\left\{2-2\sqrt{7}<k<2+2\sqrt{7}\right\}$ or $\left\{2-2\sqrt{7}<k\right\}\cap\left\{k<2+2\sqrt{7}\right\}$ or $\left(2-2\sqrt{7},\ 2+2\sqrt{7}\right)$ or $\left\{k:2-2\sqrt{7}<k\cap k<2+2\sqrt{7}\right\}$ or $\left\{k:2-2\sqrt{7}<k\right\}$ and $\left\{k:k<2+2\sqrt{7}\right\}$ but **not** $\left\{2-2\sqrt{7}<k\right\}\cup\left\{k<2+2\sqrt{7}\right\}$ and **not** $\left[2-2\sqrt{7},\ 2+2\sqrt{7}\right]$ and **not** $\left\{2-2\sqrt{7}\leqslant k\leqslant 2+2\sqrt{7}\right\}$ |

| Question | Scheme | Marks | AOs |
| --- | --- | --- | --- |
| 5(a) | $\frac{x^5-12x^{\frac{1}{2}}}{4x}=...x^4+...$ or $\frac{x^5-12x^{\frac{1}{2}}}{4x}=...+...x^{-\frac{1}{2}}$ | M1 | 1.1b |
| | $\frac{1}{4}x^4$ or $-3x^{-\frac{1}{2}}$ | A1 | 1.1b |
| | $\frac{1}{4}x^4-3x^{-\frac{1}{2}}$ | A1 | 1.1b |
| | | **(3)** | |

**Note that some candidates are clearly not understanding the demand in part (a) and score no marks there. They do, however, start (b) from scratch and effectively answer part (a) there – in such cases we will allow work in (b) to score in (a).**

**If there is no labelling of parts, mark in the order presented.**

**(a) Notes**

**M1:** Attempts to split the fraction up and obtains at least one correct index.
Allow this mark even if they have more than 2 terms and allow the terms to be seen in isolation.

e.g. $\frac{x^5-12x^{\frac{1}{2}}}{4x}=...x^4+...$ or $\frac{x^5-12x^{\frac{1}{2}}}{4x}=...+...x^{-\frac{1}{2}}$

Allow equivalents for $x^{-\frac{1}{2}}$ e.g. $\frac{1}{x^{\frac{1}{2}}}$ or $\frac{1}{\sqrt{x}}$. Score as soon as one of these terms is seen.

**A1:** One correct **simplified** term so either $\frac{1}{4}x^4$ or $-3x^{-\frac{1}{2}}$.

Allow equivalent simplified expressions e.g. $0.25x^4$, $-\frac{3}{x^{\frac{1}{2}}}$, $-\frac{3}{\sqrt{x}}$

Score as soon as one of these simplified terms is seen then isw.

**A1:** $\frac{1}{4}x^4-3x^{-\frac{1}{2}}$ or equivalent as one simplified expression e.g. $0.25x^4-\frac{3}{\sqrt{x}}$ or e.g. $\frac{1}{4}x^4-\frac{3}{x^{\frac{1}{2}}}$

Condone $\frac{1}{4}x^4+-3x^{-\frac{1}{2}}$

Do **not** apply isw for this mark. E.g. many candidates are reaching $\frac{1}{4}x^4-3x^{-\frac{1}{2}}$ and stating $\frac{1}{4}x^4-3x^{-\frac{1}{2}}=x^4-12x^{-\frac{1}{2}}$ and this scores M1A1A0.

But isw can be applied if they simply miscopy their work rather than "change" it.

Apply isw for $\frac{1}{4}x^4-3x^{-\frac{1}{2}}=0$

Correct answer only scores full marks in (a)