| Question | Scheme | Marks | AOs |
|---|---|---|---|
| **2 (a)** | (i) Centre $(-3, 4)$ | B1 | 1.1b |
| | (ii) States or implies that $r^2 = 24$ or $r = \sqrt{24}$ | M1 | 1.1b |
| | $2\sqrt{6}$ | A1 | 1.1b |
| | | **(3)** | |
| **(b)** | Attempts a valid method<br>e.g. Finds distance of centre from origin,<br>Sets $y = 0$ and finds values of $x$ | M1 | 3.1a |
| | Correct calculations, reason and conclusion (see notes) | A1 | 2.4 |
| | | **(2)** | |
| | | | **(5 marks)** |

**Notes:**

**Mark (i) and (ii) together**

**(a)(i)**

B1: Centre $(-3, 4)$ Accept without brackets. May be written e.g. $x = -3,\ y = 4$

**(a)(ii)**

M1: States or implies that $r^2 = 24$ or $r = \sqrt{24}$. A final answer of $\sqrt{24}$ or $2\sqrt{6}$ implies the radius

May multiply out the brackets, collect terms ( $x^2 + y^2 + 6x - 8y + 1 = 0$ ) and states the radius is $r^2 = \frac{6^2}{4} + \frac{(-8)^2}{4} - 1$ o.e. Do not condone slips for this mark.

A1: $2\sqrt{6}$ isw if they proceed to write as a decimal

**(b) Note that if their radius is incorrect in (a) then maximum score is M1A0 unless they restart in (b)**

M1: Attempts a valid method. For example

- Finds the distance (or distance $^2$) of the centre from the origin.
  They must be attempting $(d =)\sqrt{(\pm"3")^2 + ("\pm"4")^2} = ...$ or
  $(d^2 =)(\pm"3" - 0)^2 + (\pm"4" - 0)^2 = ...$ and proceed to a value.
  May be seen as substituting the coordinates of the origin into the equation for $C$ proceeding to a value for the left hand side e.g. 25 (to be able to compare with 24)
- Sets $y = 0$ and attempts to solve $(x+3)^2 + (-4)^2 = 24 \Rightarrow x = ...$ (at least one value)
- Sets $x = 0$ and attempts to solve $(3)^2 + (y-4)^2 = 24 \Rightarrow y = ...$ (at least one value)

In each method the starting expression or equation must be correct but do not be concerned by slips when evaluating or processing in finding the distance, the $x$ coordinate or $y$ coordinate.

A1: Correct calculation(s), reason and conclusion examples:

| Calculation examples | Reason examples | Conclusion examples |
|---|---|---|
| e.g. $\left(d^2 =\right) 25$<br>or<br>e.g. $(d =)\ 5$ | $25 > 24$ o.e.<br>or<br>$5 > \sqrt{24}$ o.e. (allow 4.9 or better) | e.g. origin does NOT lie within circle / origin lies outside circle / not in circle o.e. |
| e.g. $(x+3)^2 + (-4)^2 = 24$<br>$\Rightarrow (x =) -3 \pm \sqrt{8}$<br>(allow decimals awrt $-0.2$ and awrt $-5.8$) | roots are both negative (same signs) o.e. | |
| e.g. $(3)^2 + (y-4)^2 = 24$<br>$\Rightarrow (y =)\ 4 \pm \sqrt{15}$<br>(allow decimals awrt $0.1$ and awrt $7.9$) | roots are both positive (same signs) o.e. | |

**Note if their reasoning is incorrect e.g. referring to the radius as 24 instead of $\sqrt{24}$ then A0 but allow referencing to "the radius of *C*" provided their radius in (a) was correct.**

Note if they give a reason that the origin does not lie inside the circle *C* because e.g. $25 \neq 24$ this scores M1A0 (M1 for 25 but A0 incorrect reasoning)