

(16) (a)

$P(4, k)$

$C(1, -2)$

$$d = \sqrt{(4-1)^2 + (k-(-2))^2}$$

$$= \sqrt{3^2 + (k+2)^2}$$

$$= \sqrt{9 + k^2 + 4k + 4}$$

$$= \sqrt{k^2 + 4k + 13}$$

(b) radius = 5

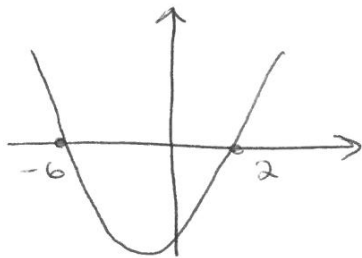
$$\sqrt{k^2 + 4k + 13} > 5$$

$$k^2 + 4k + 13 > 25$$

$$k^2 + 4k - 12 > 0$$

$$(k + 6)(k - 2)$$

$$k = -6 \quad k = 2$$



$$k^2 + 4k - 12 > 0$$

when  $k < -6$ ,  $k > 2$

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| Question                                                                                                                                                                                                                                       |     |  | Generic scheme                                                                                                                                                                                                                                                                  | Illustrative scheme                                                                                                                                                                                                                                                                     | Max mark |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 16.                                                                                                                                                                                                                                            | (a) |  | <ul style="list-style-type: none"> <li>•<sup>1</sup> identify centre</li> <li>•<sup>2</sup> apply distance formula and demonstrate result</li> </ul>                                                                                                                            | <ul style="list-style-type: none"> <li>•<sup>1</sup> (1, -2) stated or implied by •<sup>2</sup></li> <li>•<sup>2</sup> <math>\sqrt{(4-1)^2 + (k-(-2))^2}</math> leading to <math>\sqrt{k^2 + 4k + 13}</math></li> </ul>                                                                 | 2        |
| <b>Notes:</b>                                                                                                                                                                                                                                  |     |  |                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                         |          |
| 1. Beware of candidates who ‘fudge’ their working between • <sup>1</sup> and • <sup>2</sup> .                                                                                                                                                  |     |  |                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                         |          |
| <b>Commonly Observed Responses:</b>                                                                                                                                                                                                            |     |  |                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                         |          |
|                                                                                                                                                                                                                                                | (b) |  | <ul style="list-style-type: none"> <li>•<sup>3</sup> interpret information</li> <li>•<sup>4</sup> express inequality in standard quadratic form</li> <li>•<sup>5</sup> determine zeros of quadratic expression</li> <li>•<sup>6</sup> state range with justification</li> </ul> | <ul style="list-style-type: none"> <li>•<sup>3</sup> <math>\sqrt{k^2 + 4k + 13} &gt; 5</math></li> <li>•<sup>4</sup> <math>k^2 + 4k - 12 &gt; 0</math></li> <li>•<sup>5</sup> -6, 2</li> <li>•<sup>6</sup> <math>k &lt; -6, k &gt; 2</math> with eg sketch or table of signs</li> </ul> | 4        |
| <b>Notes:</b>                                                                                                                                                                                                                                  |     |  |                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                         |          |
| 2. Where a candidate has used an incorrect expression from part (a), • <sup>3</sup> is not available. However, • <sup>4</sup> , • <sup>5</sup> and • <sup>6</sup> are still available for dealing with an expression of equivalent difficulty. |     |  |                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                         |          |
| 3. Candidates who do not work with an inequation from the outset lose • <sup>3</sup> , • <sup>4</sup> and • <sup>6</sup> . However, • <sup>5</sup> is still available. See Candidate A.                                                        |     |  |                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                         |          |
| <b>Commonly Observed Responses:</b>                                                                                                                                                                                                            |     |  |                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                         |          |
| <b>Candidate A</b>                                                                                                                                                                                                                             |     |  |                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                         |          |
| $\sqrt{k^2 + 4k + 13} = 5$                                                                                                                                                                                                                     |     |  | • <sup>3</sup> ✗                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                         |          |
| $k^2 + 4k - 12 = 0$                                                                                                                                                                                                                            |     |  | • <sup>4</sup> ✗                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                         |          |
| $k = -6, k = 2$                                                                                                                                                                                                                                |     |  | • <sup>5</sup> ✓                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                         |          |
| For P to lie outside the circle                                                                                                                                                                                                                |     |  |                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                         |          |
| $k < -6, k > 2$                                                                                                                                                                                                                                |     |  | • <sup>6</sup> ✗                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                         |          |