

## EQUATION OF CIRCLE

### Pearson Edexcel – Thursday 4 June 2020 - Paper 2 (Calculator) Higher Tier

1.

|    |                  |    |  |                               |
|----|------------------|----|--|-------------------------------|
| 22 | $x^2 + y^2 = 80$ | P1 | for process to find gradient of tangent eg $\frac{10-0}{0--20} (= \frac{1}{2})$<br>or for $20^2 + 10^2 (= 500)$<br>or start to method to find angle between tangent and x axis,<br>eg $\tan\theta = \frac{10}{20}$   | Accept $(4\sqrt{5})^2$ for 80 |
|    |                  | P1 | for process to find gradient of normal/radius eg $\frac{-1}{"0.5"} (= -2)$<br>or for $\sqrt{20^2 + 10^2}$ or $\sqrt{500}$ or 22.36... or 22.4<br>or completes process to find angle between tangent and x axis.<br>eg $\theta = \tan^{-1}\left(\frac{10}{20}\right) (= 26.565\dots)$ |                               |
|    |                  | P1 | for equation of tangent eg $y = "0.5"x + 10$ oe<br>or for equation of radius eg $y = "-2"x$ oe<br>or for using similar triangles eg $\frac{r}{10} = \frac{20}{" \sqrt{500} "}$<br><br>or for $\sin("26.565\dots") = \frac{r}{20}$  |                               |
|    |                  | P1 | for process to find the x coordinate eg $"0.5"x + 10 = "-2"x$ ( $x = -4$ )<br>or for $r = \frac{20}{" \sqrt{500} "}$ $\times 10$<br>or $r = 20 \times \sin("26.565\dots")$   |                               |
|    |                  | A1 | oe   |                               |

### Pearson Edexcel - Tuesday 11 June 2019 - Paper 3 (Calculator) Higher Tier

2.

|    |     |    |   |  |
|----|-----|----|---|--|
| 22 | 2.5 | P1 | use of $\sin 30 = \frac{1}{2}$ to find $OA (= 8)$ or $OAB = 90^\circ$<br>eg $OA = 16\sin 30^\circ$ or right angle marked on diagram | Accept $3p^2 + p^2 = r^2$ for the award of this mark<br><br>Do not accept $3p^2 + p^2 = 8^2$ for the award of this mark<br><br>Accept $\sqrt{6.4}$ or $\frac{4\sqrt{10}}{5}$<br>If an answer within the given range is seen in working and rounded incorrectly award full marks.<br>Award 0 marks for the answer without supportive working. |
|    |     | P1 | recognition that equation of circle is $x^2 + y^2 = r^2$  |  |
|    |     | P1 | Correct substitution of $p$ , $3p$ and $r$ in $x^2 + y^2 = r^2$<br>eg $9p^2 + p^2 = OA^2$ or $(3p)^2 + p^2 = "8^2"$                 |  |
|    |     | A1 | for answer in the range 2.5 to 2.53   |  |

### Pearson Edexcel - Thursday 8 November 2018 - Paper 2 (Calculator) Higher Tier

3.

|    |     |    |    |   |
|----|-----|----|----|---|
| 15 | 6.5 | B1 | oe | Accept (eg) $6\frac{1}{2}$ and $\sqrt{42.25}$ |
|----|-----|----|----|---|

### OCR GCSE – Tuesday 3 November 2020 – Paper 4 (Calculator) Higher Tier

4.

|    |     |   |        |   |  |
|----|-----|---|--------|---|--|
| 18 | (a) | $\frac{6}{-3}$ or -2 and<br>$\frac{-1}{\text{their } -2}$ [= $\frac{1}{2}$ ] oe | 1<br>1 | accept any correct method   | Only award full marks if no wrong working<br>condone $\frac{-6}{3}$ for first mark |
|    | (b) | $y = \frac{1}{2}x + 7\frac{1}{2}$ oe  | 2      | <b>B1</b> for $y = \frac{1}{2}x + c$ or $y = mx + 7\frac{1}{2}$<br>or the equation of any line which goes through (-3, 6) | where $m \neq 0$   |

OCR GSCE – Tuesday 5 November 2019 – Paper 4 (Calculator) Higher Tier

5.

|    |  |    |   |  |   |
|----|--|----|---|--|---|
| 14 |  | 25 | 5 | <b>M1</b> for $m_1 = \frac{16}{-12}$ oe<br><b>M1</b> for $m_2 = \frac{-1}{\text{their } m_1}$ or $\frac{12}{16}$ oe<br><b>M1</b> for $y = (\text{their } \frac{12}{16})x + p$<br><b>M1</b> for substituting (-12,16) into <i>their</i> equation<br>accept any correct method | gradient of radius<br>gradient of tangent |
|----|--|----|---|--|---|

OCR GSCE – Thursday 7 November 2019 – Paper 5 (Non-Calculator) Higher Tier

6.

|    |     |             |        |  |  |
|----|-----|-------------|--------|--|--|
| 21 | (a) | 6<br>(0, 0) | 1<br>1 |  |  |
| 21 | (b) | 10          | 4      | <b>B3</b> for 5 and -5<br>Or<br><b>M2</b> for $x^2 = 25$<br>Or<br><b>M1</b> for $x^2 + (\sqrt{11})^2 = 36$ | Accept <i>a</i> or <i>b</i> for <i>x</i> |

OCR GSCE – Tuesday 11 June 2019 – Paper 6 (Calculator) Higher Tier

7.

|    |   |                         |   |  |  |
|----|---|-------------------------|---|--|--|
| 19 | a | $x^2 + y^2 = 29$ oe     | 4 | <b>B2</b> for 29 or $\sqrt{29}$ or 5.38(5...) to 5.39<br>or<br><b>M1</b> for $2^2 + 5^2$ or $\sqrt{2^2 + 5^2}$ or $2^2 + (-5)^2$ or $\sqrt{2^2 + (-5)^2}$<br><b>AND</b><br><b>B1</b> for $x^2 + y^2 = k$ where $k$ is a number $> 0$<br>or $x^2 + y^2 = r^2$ | Condone poor use of or missing brackets for <b>M1</b><br>eg $-5^2 + 2^2$ or $2^2 + -5^2$ earns <b>M1</b> ,<br>but $2^2 - 5^2$ does NOT earn <b>M1</b><br><br>Condone other letters instead of <i>r</i> ,<br>except <i>x</i> and <i>y</i> . |
|    | b | 2.5 or $\frac{5}{2}$ oe | 2 | <b>M1</b> for $-\frac{2}{5}$ oe or -0.4 seen or<br>use of $m_1 m_2 = -1$ with <i>their</i> radius gradient   | <b>M1</b> for $[y = ]\frac{5}{2}x [+ c]$ oe<br>Condone $-\frac{2}{5}x$ seen for <b>M1</b>  |

OCR GSCE – Monday 12 November 2018 – Paper 6 (Calculator) Higher Tier

8.

|    |  |   |   |  |  |
|----|--|---|---|--|--|
| 17 |  | $(\sqrt{6}, 2\sqrt{6})$ and $(-\sqrt{6}, -2\sqrt{6})$ | 5 | <p><b>B4</b> for <math>(x =) \pm\sqrt{6}</math> or one intersection</p> <p>or</p> <p><b>M3</b> for <math>x^2 = 6</math></p> <p>or</p> <p><b>M2</b> for <math>x^2 + 4x^2 = 30</math> or <math>5x^2 = 30</math></p> <p>or</p> <p><b>M1</b> for <math>x^2 + (2x)^2</math></p> | Condone missing brackets for <b>M1</b> |
|----|--|---|---|--|--|

OCR GSCE – Wednesday 8 November 2017 – Paper 6 (Calculator) Higher Tier

9.

|    |     |   |   |   |   |
|----|-----|---|---|---|---|
| 17 | (a) | $x^2 + y^2 = 100$ oe                            | 1 |   |   |
|    | (b) | $8^2 + (-6)^2 = 100$ , so it's on the circle oe | 2 | <p><b>M1</b> for <math>8^2 + (-6)^2</math> seen or for substituting <math>x = 8</math> and <math>y = -6</math> into <i>their</i> part (a)</p> | <p><u>Alternative</u> using Pythagoras <math>\sqrt{8^2 + 6^2} = 10</math></p> <p><i>their</i> part (a) must be an equation in both x and y.</p> |

|  |     |                       |   |  |  |
|--|-----|-----------------------|---|--|--|
|  | (c) | $3y - 4x + 50 = 0$ oe | 5 | <p><b>B2</b> for [tangent gradient =] <math>\frac{4}{3}</math> oe</p> <p>or</p> <p><b>M1</b> for <math>\pm\frac{6}{8}</math> or <math>\pm\frac{8}{6}</math> oe</p> <p>AND</p> <p><b>M2</b> for <math>y + 6 = \text{their } \frac{4}{3}(x - 8)</math> oe</p> <p>or</p> <p><b>M1</b> for <math>y = \text{their } \frac{4}{3}x + 'c'</math></p> | <p>Equivalents include:</p> <p><math>y = \frac{4}{3}x - \frac{50}{3}</math></p> <p>Condone decimals with at least 2 decimal places rot:<br/>Eg. <math>y = 1.33x - 16.67</math></p> <p>Equivalent for <b>M2</b> includes <math>y = \text{their } \frac{4}{3}x + c</math> and then attempt to find c by substituting in <math>y = -6</math> and <math>x = 8</math></p> |
|--|-----|-----------------------|---|--|--|

AQA GSCE – Thursday 8 June 2020 – Paper 3 (Calculator) Higher Tier

10.

|    |   |    |  |
|----|---|----|--|
| 25 | 6 | B1 |  |
|----|---|----|--|

AQA GSCE – Tuesday 11 June 2019 – Paper 3 (Calculator) Higher Tier

11.

|   |  |       |  |
|---|--|-------|--|
| 27  | $\sqrt{144}$ or 12   | B1    | radius of larger circle<br>may be seen on diagram  |
|   | $\frac{4}{5} \times$ their 12 or 9.6   | M1    | their 12 must be a value<br>may be seen on diagram |
|   | (cos AOB =)<br>$\frac{\text{their } 12^2 + \text{their } 9.6^2 - 20^2}{2 \times \text{their } 12 \times \text{their } 9.6}$<br>or $\frac{144 + 92.16 - 400}{230.4}$<br>or $-\frac{32}{45}$ or $-0.71\dots$ | M1dep | oe   |
|   | $\cos^{-1}$ their $-\frac{32}{45}$   | M1dep | dep on M2  |
|   | 135.(...)  | A1    |  |
|   | <b>Additional Guidance</b>   |       |  |
|   | 144<br>$\frac{4}{5} \times 144 = 115.2$<br>(cos AOB =) $\frac{144^2 + 115.2^2 - 20^2}{2 \times 144 \times 115.2}$  |       | B0<br>M1<br>M1M0A0                                 |
|   | 12 seen, but a different value used for the radius of the larger circle<br>cannot score B1M1   |       |  |
| $x + y = 12$ seen, but $x = 6$ used to find radius OA = 4.8 |  | B0M1  |  |

**AQA GCSE – Thursday 7 June 2018 – Paper 2 (Calculator) Higher Tier**

12.

|    |                            |    |  |
|----|----------------------------|----|--|
| 22 | $x^2 + y^2 = 25$           | B1 |  |
|    | <b>Additional Guidance</b> |    |  |
|    |                            |    |  |

**AQA GCSE – Tuesday 12 June 2018 – Paper 3 (Calculator) Higher Tier**

13.

|    |  |    |  |
|----|--|----|--|
| 28 | $4^2 + y^2 = 80$<br>or $y = \sqrt{64}$   | M1 | oe<br>May be implied from 8 on diagram |
|    | $y = -8$   | A1 | Accept (4, -8)                         |
|    | $\frac{\text{their } -8}{4}$ or $-2$   | M1 | oe<br>gradient of radius $OP$          |
|    | $-1 + \text{their } -2$ or $\frac{1}{2}$<br>or $-1 + \text{their gradient}$                  | M1 | gradient of tangent at $P$             |
|    | $y = \frac{1}{2}x - 10$<br>or $y + 8 = \frac{1}{2}(x - 4)$                                   | A1 | oe<br>Ignore further working           |
|    | <b>Additional Guidance</b>   |    |  |
|    | $y + 8 = \frac{1}{2}(x - 4)$ followed by error expanding and/or collecting terms             |    | M1A1M1M1A1                             |
|    | $y = \frac{1}{2}x - 10$ in working and $\frac{1}{2}x - 10$ only on answer                    |    | M1A1M1M1A1                             |
|    | $\frac{1}{2}x - 10$  |    | M1A1M1M1A0                             |
|    | $(y = \sqrt{64})$<br>$y = 8$<br>Gradient $OP = 2$<br>Perpendicular gradient = $-\frac{1}{2}$ |    | M1<br>A0<br>M1<br>M1<br>A0             |

AQA GCSE – Thursday 2 November 2017 – Paper 1 (Non - Calculator) Higher Tier

14.

|       |   |    |    |
|-------|---|----|----|
| 28(a) | $(0^2 +) 6^2 = 36$<br>or $(OA =) \text{radius} = 6$<br>or $\sqrt{36} = 6$ | B1 | oe |
|       | <b>Additional Guidance</b>  |    |    |
|       | $0 + 36 = 36$   |    | B0 |

|       |        |    |  |
|-------|--------|----|--|
| 28(b) | (6, 0) | B1 |  |
|-------|--------|----|--|

|   |   |                                 |                                 |
|---|---|---------------------------------|---------------------------------|
| 28(c)   | <b>Alternative method 1</b>   |                                 |                                 |
|   | $\frac{6 - \text{their } 0}{0 - \text{their } 6}$ or $\frac{\text{their } 0 - 6}{\text{their } 6 - 0}$<br>or $\frac{6}{-6}$ or $\frac{-6}{6}$ or $-1$ | M1                              | gradient AB                     |
|   | gradient $OM \times$ gradient $AB = -1$<br>and<br>gradient $OM = 1$ (and $y = x$ )  | A1                              | must see correct working for M1 |
|   | <b>Alternative method 2</b>   |                                 |                                 |
|   | $\left(\frac{6+0}{2}, \frac{0+6}{2}\right)$ or (3, 3)   | M1                              | coordinates of M                |
| gradient $OM = 1$ (and $y = x$ )<br>or (0, 0) and (3, 3) (and $y = x$ ) | A1  | must see correct working for M1 |                                 |

|       |  |    |              |
|-------|--|----|--------------|
| 28(d) | $x^2 + x^2 = 36$ or $2x^2 = 36$<br>or $y^2 + y^2 = 36$ or $2y^2 = 36$<br>or $(-6 \cos 45^\circ)$ or $(-6 \sin 45^\circ)$   | M1 | oe equation  |
|       | $(-)\sqrt{\frac{36}{2}}$ or $(-)\sqrt{18}$ or $(-)3\sqrt{2}$<br>or $(-)\frac{6\sqrt{2}}{2}$ or $(-)\frac{6}{\sqrt{2}}$   | M1 |              |
|       | $(-\sqrt{18}, -\sqrt{18})$ or $(-3\sqrt{2}, -3\sqrt{2})$<br>or $(-\frac{6\sqrt{2}}{2}, -\frac{6\sqrt{2}}{2})$<br>or $(-\frac{6}{\sqrt{2}}, -\frac{6}{\sqrt{2}})$ | A1 | oe surd form |

**AQA GSCE – Wednesday 25 May 2017 – Paper 1 (Non - Calculator) Higher Tier**

15.

|    |    |    |  |
|----|----|----|--|
| 20 | 16 | B1 |  |
|----|----|----|--|

**AQA GSCE – Sample Paper 1 (Non - Calculator) Higher Tier**

16.

|    |  |       |   |
|----|--|-------|---|
| 28 | <b>Alternative method 1</b>  |       |   |
|    | $P(1, 3)$ or $y = 3$ or $\text{grad } OP = 3$  | B1    |   |
|    | $\text{grad } PQ = -\frac{1}{\text{their } 3}$ or $-\frac{1}{3}$   | M1    |   |
|    | $y = (\text{their } -\frac{1}{3})x + c$<br>and substitutes $(1, \text{their } 3)$<br>or<br>$y - \text{their } 3 = (\text{their } -\frac{1}{3})(x - 1)$ | M1dep | oe<br>$\frac{\text{their } 3}{x-1}$ or $-\frac{\text{their } 3}{x-1}$ |
|    | Substitutes $y = 0$ in their equation  | M1dep | $-\frac{\text{their } 3}{x-1} = \text{their } -\frac{1}{3}$           |
|    | $(10, 0)$  | A1    |   |
|    | <b>Alternative method 2</b>  |       |   |
|    | $P(1, 3)$ or $y = 3$ or $\text{grad } OP = 3$  | B1    |   |
|    | $\frac{\text{their } 3}{1} = \frac{QN}{\text{their } 3}$   | M1dep |   |
|    | $\text{their } 3 \times \text{their } 3$ or 9  | M1dep |   |
|    | $\tan PON = \frac{\text{their } 3}{1}$   | M1    | $N$ is on the $x$ -axis<br>$PN$ is perpendicular to the $x$ -axis     |
|    | $(10, 0)$  | A1    |   |