3.2 Coordinate Geometry of the Circle: Test Pack

AQA 8365 · Calculator allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A circle has equation $x^2 + y^2 = 81$.

(a) Write down the coordinates of the centre of the circle and the radius of the circle. **(2)**

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(b) Write down the equation of a circle with centre (0, 0) and radius 3.5 **(1)**

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(Total for Question 1 is 3 marks)

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2 A circle has centre (6, 5) and passes through the point (-3, 6). Find the equation of the circle.

(Total for Question 2 is 3 marks)

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3 A circle has equation $(x + 4)^2 + (y - 1)^2 = 36$.

(a) Write down the coordinates of the centre and the radius of the circle. **(2)**

.....

(b) Determine whether the point (2, 1) lies on the circle. Show your working. **(2)**

(Total for Question 3 is 4 marks)

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4 A circle has equation $(x + 2)^2 + (y - 1)^2 = 45$. Is the point P(4, 3) inside the circle, on the circle or outside the circle? You must show your working.

(Total for Question 4 is 3 marks)

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5 A circle has centre (-1, 3) and passes through the point (2, -1).

(a) Calculate the radius of the circle. **(3)**

(b) Write down the equation of the circle in the form $(x - a)^2 + (y - b)^2 = r^2$. **(1)**

(Total for Question 5 is 4 marks)

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6 A circle has equation $x^2 + y^2 + 2x + 4y - 76 = 0$. Find the coordinates of the centre and the radius of the circle.

(Total for Question 6 is 4 marks)

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7 Determine whether the point (4, 7) lies on the circle $x^2 + y^2 = 50$.

(Total for Question 7 is 2 marks)

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8 Points A(1, 7) and B(9, 1) lie on a circle whose centre lies on the x-axis.

(a) Find the midpoint of AB. **(1)**

(b) Find the gradient of AB, and hence the gradient of the perpendicular bisector of AB. **(2)**

(c) Find the equation of the perpendicular bisector of AB. **(3)**

(d) The centre of the circle lies on the x-axis. Use this fact and your answer to part (c) to find the coordinates of the centre. **(3)**

(e) Hence find the radius of the circle, giving your answer as a surd in its simplest form. **(2)**

(Total for Question 8 is 11 marks)

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9 A circle has equation $x^2 + y^2 = 20$. The line with equation $y = 2x + b$, where $b > 0$, is a tangent to the circle.

(a) Show that substituting the equation of the line into the equation of the circle gives $5x^2 + 4bx + (b^2 - 20) = 0$. **(2)**

(b) Given that $b > 0$, use the condition for a tangent to find the value of b. **(4)**

.....

(c) Find the coordinates of the point of contact for this value of b. **(3)**

.....

(Total for Question 9 is 9 marks)

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10 The line $y = x + 3$ intersects the circle $x^2 + y^2 = 29$ at two points. Find the coordinates of these points.

(Total for Question 10 is 4 marks)

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11 A circular pond has centre O at the origin of a garden's coordinate grid, where 1 unit represents 1 metre, and equation $x^2 + y^2 = 49$. A straight path is to be built along the line $y = 2x - 3$.

(a) Show that the path crosses the edge of the pond by substituting the line into the circle's equation and showing that the resulting equation has two real solutions. **(2)**

(b) Find the x-coordinates of the two points where the path crosses the edge of the pond, giving your answers correct to 2 decimal places. **(2)**

(Total for Question 11 is 4 marks)

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Mark scheme · 3.2 Coordinate Geometry of the Circle: Test Pack

Question 1

(a) centre (0, 0) **B1**

(a) radius = 9 **B1**

(a) Answer: Centre (0, 0), radius 9

(b) $x^2 + y^2 = 12.25$ oe **B1**

(b) Answer: $x^2 + y^2 = 12.25$

Question 2

$r^2 = (-3 - 6)^2 + (6 - 5)^2$ or equivalent **M1**

$r^2 = 82$ **A1**

$(x - 6)^2 + (y - 5)^2 = 82$ oe cao **A1**

Answer: $(x - 6)^2 + (y - 5)^2 = 82$

Question 3

(a) centre (-4, 1) **B1**

(a) radius = 6 **B1**

(a) Answer: Centre (-4, 1), radius 6

(b) substitutes $(2+4)^2 + (1-1)^2$ **M1**

(b) = 36 + 0 = 36 = r^2, so the point lies on the circle, cao **A1**

(b) Answer: Yes, (2, 1) lies on the circle

Question 4

substitutes: $(4 + 2)^2 + (3 - 1)^2$ **M1**

40 found **A1**

compares 40 with 45: P is inside the circle **B1**

Answer: inside

Question 5

(a) uses $r^2 = (-1-2)^2 + (3-(-1))^2$ oe **M1**

(a) = 9 + 16 = 25 **M1**

(a) r = 5 cao **A1**

(a) Answer: r = 5

(b) $(x + 1)^2 + (y - 3)^2 = 25$ ft their r^2 **B1**

(b) Answer: $(x + 1)^2 + (y - 3)^2 = 25$

Question 6

completes the square for x **M1**

completes the square for y **M1**

centre (-1, -2) **A1**

radius 9 **A1**

Answer: centre (-1, -2), radius 9

Question 7

substitutes to find $4^2 + 7^2 = 65$ **M1**

concludes the point does not lie on the circle, since 65 is not equal to 50 **A1**

Answer: No, the point does not lie on the circle

Question 8

(a) (5, 4) cao **B1**

(a) Answer: (5, 4)

(b) gradient AB = (1-7)/(9-1) = -3/4 **M1**

(b) perpendicular gradient = 4/3 cao **A1**

(b) Answer: Gradient AB = -3/4, perpendicular gradient = 4/3

(c) uses y - 4 = 4/3 (x - 5), ft their midpoint and gradient **M1**

(c) rearranges correctly **M1**

(c) y = 4/3 x - 8/3 oe cao **A1**

(c) Answer: y = (4/3)x - 8/3

(d) sets y = 0 in the perpendicular bisector equation, ft their equation from (c) **M1**

(d) solves 0 = 4/3 x - 8/3 to get 4x = 8 **M1**

(d) centre (2, 0) cao **A1**

(d) Answer: (2, 0)

(e) radius = $\sqrt{(2-1)^2 + (0-7)^2}$, ft their centre **M1**

(e) $5\sqrt{2}$ cao **A1**

(e) Answer: $5\sqrt{2}$

Question 9

(a) substitutes to get $x^2 + (2x+b)^2 = 20$ **M1**

(a) expands and rearranges to $5x^2 + 4bx + (b^2-20) = 0$, cso, answer printed **A1**

(a) Answer: $5x^2 + 4bx + (b^2 - 20) = 0$

(b) sets discriminant = 0: $(4b)^2 - 4(5)(b^2-20) = 0$, ft their quadratic from (a) **M1**

(b) simplifies to $16b^2 - 20b^2 + 400 = 0$, i.e. $-4b^2 + 400 = 0$ **M1**

(b) $b^2 = 100$ **A1**

(b) b = 10 (rejecting b = -10 since b > 0), cao **A1**

(b) Answer: b = 10

(c) substitutes b = 10 into $5x^2 + 40x + 80 = 0$, ft their b **M1**

(c) simplifies to $(x+4)^2 = 0$, giving x = -4 **M1**

(c) (-4, 2) cao **A1**

(c) Answer: (-4, 2)

Question 10

substitutes y = x + 3 into $x^2 + y^2 = 29$ **M1**

expands and simplifies to $x^2 + 3x - 10 = 0$, dependent on previous M1 (dM1) **M1**

factorises to (x + 5)(x - 2) = 0, giving x = -5 and x = 2 (both values) **A1**

(-5, -2) and (2, 5) (both points, ft from the x-values) **A1**

Answer: (-5, -2) and (2, 5)

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Question 11

(a) substitutes $y = 2x - 3$ into $x^2 + y^2 = 49$ and simplifies to $5x^2 - 12x - 40 = 0$ **M1**

(a) evaluates the discriminant $(-12)^2 - 4(5)(-40) = 944$, which is greater than 0, so there are two real solutions and the path crosses the pond's edge **A1**

(a) Answer: $5x^2 - 12x - 40 = 0$, discriminant $944 > 0$, so the path crosses the pond's edge at two points

(b) uses the quadratic formula on $5x^2 - 12x - 40 = 0$, ft from part (a) **M1**

(b) $x = 4.27$ and $x = -1.87$ (awrt 2 decimal places, both values) **A1**

(b) Answer: $x = 4.27$ or $x = -1.87$ (awrt 2 dp)

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