3.2 Coordinate Geometry of the Circle: 2-hour Pack

AQA 8365 · Calculator allowed · about 120 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A(3, 5) and B(5, -1) are the end points of a diameter of a circle. Find the equation of the circle.

(Total for Question 1 is 4 marks)

2 A circle has equation $(x + 5)^2 + (y + 1)^2 = 26$. Is the point P(-3, 3) inside the circle, on the circle or outside the circle? You must show your working.

(Total for Question 2 is 3 marks)

3 A circle has equation $x^2 + y^2 - 10x + 7 = 0$. Find the coordinates of the centre and the radius of the circle.

(Total for Question 3 is 4 marks)

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4 A circle has equation $(x + 4)^2 + (y + 4)^2 = 169$. The line $x = 8$ cuts the circle at two points, P and Q. Find the length of PQ.

(Total for Question 4 is 4 marks)

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5 Write down the equation of the circle with centre (-6, 7) and radius 10.

(Total for Question 5 is 2 marks)

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6 A circle has centre (7, 2) and passes through the point (-1, 7). Find the equation of the circle.

(Total for Question 6 is 3 marks)

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7 A(4, 3) and B(0, -1) are the end points of a diameter of a circle. Find the equation of the circle.

(Total for Question 7 is 4 marks)

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8 The point P(-13, 2) lies on the circle $(x + 2)^2 + (y - 4)^2 = 125$. Find the equation of the tangent to the circle at P. Give your answer in the form $ax + by = c$, where a, b and c are integers.

(Total for Question 8 is 4 marks)

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9 A circle has equation $x^2 + y^2 - 6x + 12y - 5 = 0$. Find the coordinates of the centre and the radius of the circle.

(Total for Question 9 is 4 marks)

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10 Write down the equation of the circle with centre (5, 1) and radius 10.

(Total for Question 10 is 2 marks)

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11 A circle has centre (0, -1) and passes through the point (4, 7). Find the equation of the circle.

(Total for Question 11 is 3 marks)

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12 A circle has equation $(x + 1)^2 + (y + 2)^2 = 25$. The line $x = 3$ cuts the circle at two points, P and Q. Find the length of PQ.

(Total for Question 12 is 4 marks)

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13 A circle has equation $(x + 1)^2 + (y - 1)^2 = 20$. Is the point P(-4, -1) inside the circle, on the circle or outside the circle? You must show your working.

(Total for Question 13 is 3 marks)

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14 A circle has equation $(x + 1)^2 + (y - 3)^2 = 169$. The line $y = 8$ cuts the circle at two points, P and Q. Find the length of PQ.

(Total for Question 14 is 4 marks)

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15 A circle has equation $x^2 + y^2 - 4x - 12y + 32 = 0$. Find the coordinates of the centre and the radius of the circle.

(Total for Question 15 is 4 marks)

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16 Write down the equation of the circle with centre (-1, 5) and radius $\sqrt{10}$.

(Total for Question 16 is 2 marks)

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17 A circle has equation $(x + 2)^2 + (y - 5)^2 = 100$. The line $x = -10$ cuts the circle at two points, P and Q. Find the length of PQ.

(Total for Question 17 is 4 marks)

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18 A circle has equation $(x - 3)^2 + (y - 3)^2 = 36$. Is the point P(7, 8) inside the circle, on the circle or outside the circle? You must show your working.

(Total for Question 18 is 3 marks)

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19 A circle has equation $(x + 3)^2 + (y - 2)^2 = 225$. The line $x = 6$ cuts the circle at two points, P and Q. Find the length of PQ.

(Total for Question 19 is 4 marks)

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20 A circle has equation $x^2 + y^2 - 10x + 6y + 18 = 0$. Find the centre and radius of the circle, showing your method clearly.

(Total for Question 20 is 4 marks)

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21 Write down the radius of the circle with equation $x^2 + y^2 = 64$.

(Total for Question 21 is 1 mark)

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22 Find the diameter of the circle with equation $x^2 + y^2 = 169$.

(Total for Question 22 is 2 marks)

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23 Write down the centre and radius of the circle $(x - 3)^2 + (y + 2)^2 = 25$.

(Total for Question 23 is 1 mark)

---

24 A circle has centre (0, 0) and radius 7. Write down its equation.

(Total for Question 24 is 1 mark)

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25 Write down the centre of the circle $(x + 4)^2 + (y - 6)^2 = 100$.

(Total for Question 25 is 1 mark)

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26 The point P(5, 12) lies on the circle with equation $x^2 + y^2 = 169$ and centre O, the origin.

(a) Show that P lies on the circle. **(1)**

(b) Find the gradient of the radius OP. **(1)**

(c) Hence find the equation of the tangent to the circle at P, giving your answer in the form $ax + by = c$. **(3)**

(Total for Question 26 is 5 marks)

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27 A circle has centre C(3, -2) and radius 13. A chord AB of the circle has its midpoint at M(3, 3).

(a) Find the length CM. **(2)**

(b) The line from the centre to the midpoint of a chord is perpendicular to the chord. Use Pythagoras' theorem to find the length of the chord AB. **(3)**

(Total for Question 27 is 5 marks)

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28 The point (a, 7), where $a > 0$, lies on the circle $x^2 + y^2 = 50$. Find the value of a.

(Total for Question 28 is 2 marks)

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29 Find the radius of the circle with equation $x^2 + y^2 = 45$, giving your answer in simplified surd form.

(Total for Question 29 is 2 marks)

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30 Find the equation of the circle with centre (2, -5) and radius 6.

(Total for Question 30 is 2 marks)

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31 A circle has centre (0, 0) and passes through the point (6, 8). Find the equation of the circle.

(Total for Question 31 is 2 marks)

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32 A circle has equation $x^2 + y^2 = 40$. Determine whether the point (3, 7) lies inside, on, or outside the circle, showing your calculation.

(Total for Question 32 is 3 marks)

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33 A circle has centre (3, 4) and passes through the point (7, 1). Find the equation of the circle.

(Total for Question 33 is 3 marks)

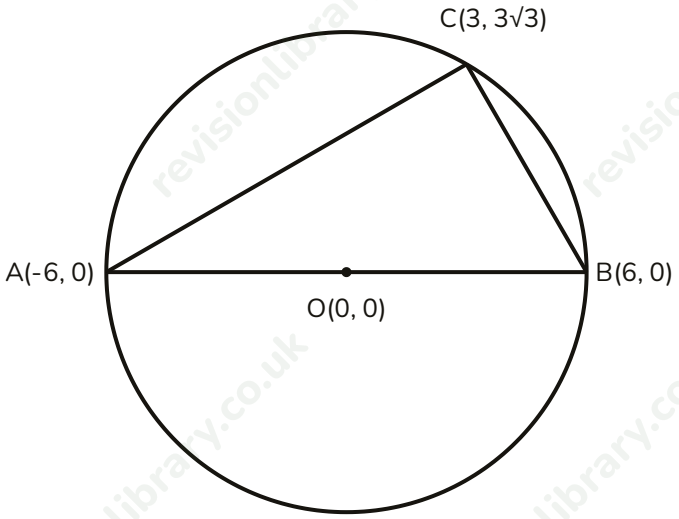
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34 Find the points where the circle $x^2 + y^2 = 121$ crosses the x-axis.

(Total for Question 34 is 3 marks)

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35 A, B and C are points on a circle with centre O, the origin, where A(-6, 0), B(6, 0) and C(3, $3\sqrt{3}$). AB is a diameter of the circle.



(a) Show that C lies on the circle $x^2 + y^2 = 36$. **(2)**

(b) Find the gradient of AC and the gradient of BC, leaving your answers in surd form where necessary. **(3)**

(c) Hence prove that angle ACB = 90 degrees. **(2)**

(Total for Question 35 is 7 marks)

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Mark scheme · 3.2 Coordinate Geometry of the Circle: 2-hour Pack

Question 1

centre = midpoint = (4, 2)	**M1**
radius^2 from a distance calculation	**M1**
radius^2 = 10	**A1**
$(x - 4)^2 + (y - 2)^2 = 10$ oe cao	**A1**

Answer: $(x - 4)^2 + (y - 2)^2 = 10$

Question 2

substitutes: $(-3 + 5)^2 + (3 + 1)^2$	**M1**
20 found	**A1**
compares 20 with 26: P is inside the circle	**B1**

Answer: inside

Question 3

completes the square for x	**M1**
completes the square for y	**M1**
centre (5, 0)	**A1**
radius $3\sqrt{2}$	**A1**

Answer: centre (5, 0), radius $3\sqrt{2}$

Question 4

substitutes x = 8 into the circle equation	**M1**
solves to find the two y values or uses a right-angled triangle	**M1**
half chord = 5	**A1**
10 cao	**A1**

Answer: 10

Question 5

$(x - a)^2 + (y - b)^2 = r^2$ with the centre correct	**M1**
$(x + 6)^2 + (y - 7)^2 = 100$ oe cao	**A1**

Answer: $(x + 6)^2 + (y - 7)^2 = 100$

Question 6

$r^2 = (-1 - 7)^2 + (7 - 2)^2$ or equivalent	**M1**
$r^2 = 89$	**A1**
$(x - 7)^2 + (y - 2)^2 = 89$ oe cao	**A1**

Answer: $(x - 7)^2 + (y - 2)^2 = 89$

Question 7

centre = midpoint = (2, 1)	**M1**
radius^2 from a distance calculation	**M1**
radius^2 = 8	**A1**
$(x - 2)^2 + (y - 1)^2 = 8$ oe cao	**A1**

Answer: $(x - 2)^2 + (y - 1)^2 = 8$

Question 8

gradient of radius = 2/11	**M1**
tangent gradient is the negative reciprocal	**M1**
substitutes P into the equation of a line	**M1**
11x + 2y = -139 oe cao	**A1**

Answer: 11x + 2y = -139

Question 9

completes the square for x	**M1**
completes the square for y	**M1**
centre (3, -6)	**A1**
radius $5\sqrt{2}$	**A1**

Answer: centre (3, -6), radius $5\sqrt{2}$

Question 10

$(x - a)^2 + (y - b)^2 = r^2$ with the centre correct	**M1**
$(x - 5)^2 + (y - 1)^2 = 100$ oe cao	**A1**

Answer: $(x - 5)^2 + (y - 1)^2 = 100$

Question 11

$r^2 = (4 - 0)^2 + (7 + 1)^2$ or equivalent	**M1**
$r^2 = 80$	**A1**
$x^2 + (y + 1)^2 = 80$ oe cao	**A1**

Answer: $x^2 + (y + 1)^2 = 80$

Question 12

substitutes x = 3 into the circle equation	**M1**
solves to find the two y values or uses a right-angled triangle	**M1**
half chord = 3	**A1**
6 cao	**A1**

Answer: 6

Question 13

substitutes: $(-4 + 1)^2 + (-1 - 1)^2$	**M1**
13 found	**A1**
compares 13 with 20: P is inside the circle	**B1**

Answer: inside

Question 14

substitutes y = 8 into the circle equation	**M1**
solves to find the two x values or uses a right-angled triangle	**M1**
half chord = 12	**A1**
24 cao	**A1**

Answer: 24

Question 15

completes the square for x	**M1**
completes the square for y	**M1**
centre (2, 6)	**A1**
radius $2\sqrt{2}$	**A1**

Answer: centre (2, 6), radius $2\sqrt{2}$

Question 16

$(x - a)^2 + (y - b)^2 = r^2$ with the centre correct	**M1**
$(x + 1)^2 + (y - 5)^2 = 10$ oe cao	**A1**

Answer: $(x + 1)^2 + (y - 5)^2 = 10$

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Question 17

substitutes x = -10 into the circle equation **M1**

solves to find the two y values or uses a right-angled triangle **M1**

half chord = 6 **A1**

12 cao **A1**

Answer: 12

Question 18

substitutes: $(7 - 3)^2 + (8 - 3)^2$ **M1**

41 found **A1**

compares 41 with 36: P is outside the circle **B1**

Answer: outside

Question 19

substitutes x = 6 into the circle equation **M1**

solves to find the two y values or uses a right-angled triangle **M1**

half chord = 12 **A1**

24 cao **A1**

Answer: 24

Question 20

completes the square for x: $x^2 - 10x = (x-5)^2 - 25$ **M1**

completes the square for y: $y^2 + 6y = (y+3)^2 - 9$ **M1**

$(x-5)^2 + (y+3)^2 = 16$ oe **A1**

centre (5, -3), radius = 4 cao **A1**

Answer: Centre (5, -3), radius 4

Question 21

8 cao **B1**

Answer: radius = 8

Question 22

radius = $\sqrt{169} = 13$ **M1**

diameter = 26 cao **A1**

Answer: 26

Question 23

centre (3, -2), radius 5 (both required) cao **B1**

Answer: centre (3, -2), radius 5

Question 24

$x^2 + y^2 = 49$ cao **B1**

Answer: $x^2 + y^2 = 49$

Question 25

(-4, 6) cao **B1**

Answer: (-4, 6)

Question 26

(a) $5^2 + 12^2 = 25 + 144 = 169$, cso **B1**

(a) Answer: $5^2 + 12^2 = 169$

(b) 12/5 oe **B1**

(b) Answer: 12/5

(c) uses perpendicular gradient = -5/12, ft their gradient OP **M1**

(c) sets up y - 12 = -5/12 (x - 5) oe **M1**

(c) 5x + 12y = 169 oe cao **A1**

(c) Answer: 5x + 12y = 169

Question 27

(a) CM = $\sqrt{(3-3)^2 + (3-(-2))^2}$ **M1**

(a) = 5 cao **A1**

(a) Answer: CM = 5

(b) uses (half of AB)^2 = 13^2 - CM^2 oe, ft their CM **M1**

(b) half of AB = $\sqrt{169 - 25} = \sqrt{144} = 12$ **M1**

(b) AB = 24 cao **A1**

(b) Answer: AB = 24

Question 28

substitutes to obtain $a^2 + 49 = 50$ **M1**

a = 1 (taking the positive root) cao **A1**

Answer: a = 1

Question 29

radius = $\sqrt{45}$ **M1**

$3*\sqrt{5}$ oe cao **A1**

Answer: $3*\sqrt{5}$

Question 30

uses the form $(x - a)^2 + (y - b)^2 = r^2$ with a=2, b=-5, r=6 **M1**

$(x - 2)^2 + (y + 5)^2 = 36$ cao **A1**

Answer: $(x - 2)^2 + (y + 5)^2 = 36$

Question 31

finds the radius using the distance from the origin: $\sqrt{6^2 + 8^2} = 10$ **M1**

$x^2 + y^2 = 100$ cao **A1**

Answer: $x^2 + y^2 = 100$

Question 32

substitutes the point into $x^2 + y^2$ to obtain $3^2 + 7^2 = 58$ **M1**

compares 58 with the value 40 on the right-hand side of the circle's equation **M1**

concludes the point lies outside the circle, since 58 > 40 **A1**

Answer: The point lies outside the circle

Question 33

finds the radius using the distance formula: $\sqrt{(7-3)^2 + (1-4)^2}$ **M1**

radius = $\sqrt{16+9} = 5$, dependent on previous M1 (dM1) **M1**

$(x - 3)^2 + (y - 4)^2 = 25$ cao **A1**

Answer: $(x - 3)^2 + (y - 4)^2 = 25$

Question 34

substitutes y = 0 into the circle equation **M1**

solves $x^2 = 121$ to find x = 11 and x = -11, dependent on previous M1 (dM1) **M1**

(11, 0) and (-11, 0) (both required) cao **A1**

Answer: (11, 0) and (-11, 0)

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Question 35

(a) substitutes $3^2 + (3\sqrt{3})^2$ **M1**

(a) = 9 + 27 = 36, cso **A1**

(a) Answer: $3^2 + (3\sqrt{3})^2 = 36$

(b) gradient AC = $(3\sqrt{3}-0)/(3-(-6))$ **M1**

(b) = $\sqrt{3}/3$ oe **A1**

(b) gradient BC = $(3\sqrt{3}-0)/(3-6) = -\sqrt{3}$ cao **A1**

(b) Answer: Gradient AC = $\sqrt{3}/3$, gradient BC = $-\sqrt{3}$

(c) multiplies the two gradients: $(\sqrt{3}/3) \times (-\sqrt{3}) = -1$, ft their gradients **M1**

(c) since the product of the gradients is -1, AC is perpendicular to BC, so angle ACB = 90 degrees, cso **A1**

(c) Answer: Angle ACB = 90 degrees, since gradient AC x gradient BC = -1

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