KS5 "Full Coverage": Equations of Circles

This worksheet is designed to cover one question of each type seen in past papers, for each GCSE Higher Tier topic. This worksheet was automatically generated by the DrFrostMaths Homework Platform: students can practice this set of questions interactively by going to www.drfrostmaths.com, logging on, *Practise → Past Papers* (or *Library → Past Papers* for teachers), and using the 'Revision' tab.

Question 1

Categorisation: Appreciate that the midpoint of the ends of a diameter is the centre of the circle.

[Edexcel C2 May 2014(R) Q10a]

The circle C, with centre A, passes through the point P with coordinates $(-9,8)$ and the point Q with coordinates $(15,-10)$.

Given that PQ is a diameter of the circle C, find the coordinates for A.

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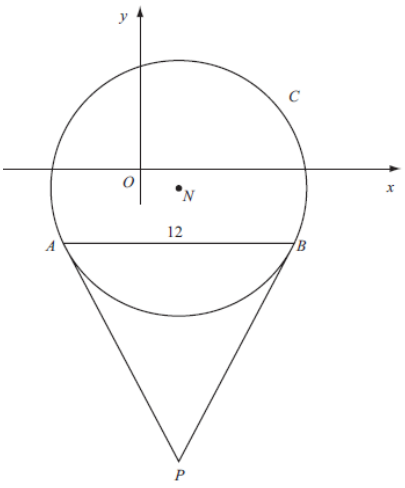
Question 2

Categorisation: Determine the centre of radius of a circle given an equation in the form $(x-a)^2+(y-b)^2=r^2$.



[Edexcel C2 Jan 2010 Q8b]

The figure shows a sketch of the circle C with centre N and equation $(x-2)^2+(y+1)^2=\frac{169}{4}$

Find the radius of C.

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Question 3

Categorisation: Determine the equation of a circle given its centre and a point on the circumference.

[Edexcel AS Specimen Papers P1 Q10a]

A circle C has centre $(2,5)$.

Given that the point $P(-2,3)$ lies on C, find an equation for C.

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Question 4

Categorisation: Determine the equation of a circle given the endpoints of a diameter.

[Edexcel C2 Jan 2011 Q9b]

The points A and B have coordinates $(-2,11)$ and $(8,1)$.

Given that AB is a diameter of the circle C, find an equation for C.

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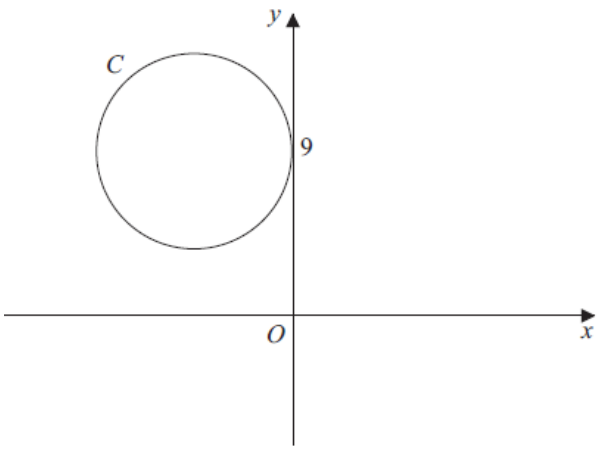
Question 5

Categorisation: Use basic geometric problem solving to determine the equation of a circle.



[Edexcel C2 May 2013 Q10a] The circle C has radius 5 and touches the y-axis at the point $(0,9)$, as shown in the figure.

Write down an equation for the circle C.

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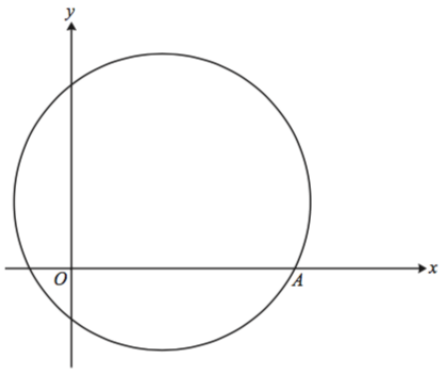
Question 6

Categorisation: Determine the radius of a circle by completing the square.



[OCR C1 June 2016 Q10i]

The diagram shows the circle with equation $x^2 + y^2 - 8x - 6y - 20 = 0$

Find the centre and radius of the circle.

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Question 7

Categorisation: Determine the centre of a circle by completing the square.

[Edexcel C2 May 2012 Q3a] The circle C with centre T and radius r has equation $x^2 + y^2 - 20x - 16y + 139 = 0$

Find the coordinates of the centre of C .

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Question 8

Categorisation: As above, but with an algebraic centre/radius.

[Edexcel A2 SAM P1 Q3b]

A circle C has equation $x^2 + y^2 - 4x + 10y = k$ where k is a constant.

State the range of possible values for k .

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Question 9

Categorisation: As above.

[Edexcel A2 SAM P1 Q3a] A circle C has equation $x^2 + y^2 - 4x + 10y = k$ where k is a constant. Find the coordinates of the centre of C.

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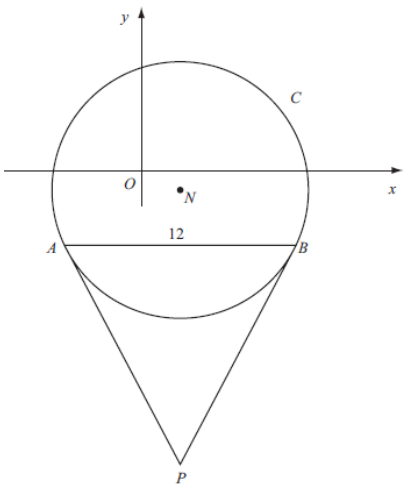
Question 10

Categorisation: Determine the intersection of a circle with a horizontal or vertical straight line.



[Edexcel C2 Jan 2010 Q8c] The figure shows a sketch of the circle C with centre N and equation $(x-2)^2 + (y+1)^2 = \frac{169}{4}$

The chord AB of C is parallel to the x-axis, lies below the x-axis and is of length 12 units as shown in the figure.

Find the coordinates of A and the coordinates of B.

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Question 11

Categorisation: Determine the equation of a tangent to a circle.

[Edexcel AS Specimen Papers P1 Q10b]

A circle C has centre $(2,5)$. The point $P(-2,3)$ lies on C, and an equation for C is $(x-2)^2 + (y-5)^2 = 20$.

The line l is the tangent to C at the point P. The point $Q(2,k)$ lies on l. Find the value of k.

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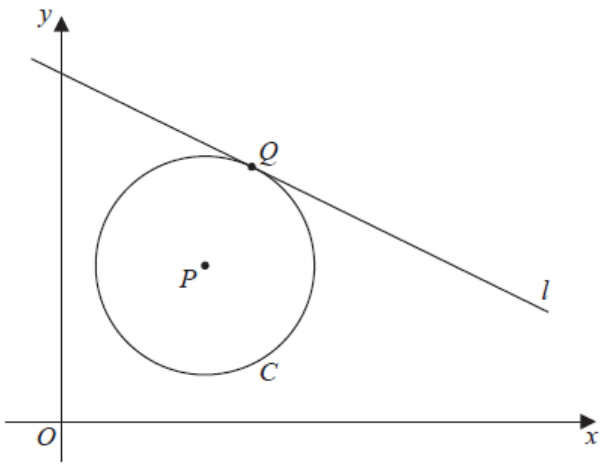
Question 12

Categorisation: As above.

[Edexcel C2 May 2016 Q3c]



The circle C has centre $P(7,8)$ and passes through the point $Q(10,13)$, as shown in the figure.

The line l is a tangent to C at the point Q, as shown in the figure. Find an equation for l, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers.

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Question 13

Categorisation: Find intersections of tangents to a circle with the x and y axis.

[Edexcel AS SAM P1 Q17b Edited] A circle C with centre at $(-2,6)$ passes through the point $(10,11)$.

The tangent to the circle C at the point $(10,11)$ meets the y axis at the point P and the tangent to the circle C at the point $(10,1)$ meets the y axis at the point Q.

Find the distance PQ.

$PQ =$ .....

Question 14

Categorisation: Find an area involving a tangent to a circle.

[OCR C1 June 2017 Q10ii Edited]

The circle $x^2 + y^2 - 8x + 2y = 0$ passes through the origin O. Line OA is a diameter to this circle. The equation of the line OA is $x + 4y = 0$. The tangent to the circle at point A meets the x-axis at the point B. Find the area of triangle OAB.

Area = ...

Question 15

Categorisation: Find the equation of a diameter of the circle.

[OCR C1 June 2017 Q10i]

The circle $x^2 + y^2 - 8x + 2y = 0$ passes through the origin O. Line OA is a diameter to this circle. Find the equation of the line OA, giving your answer in the form $ax + by = 0$, where a and b are integers.

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Question 16

Categorisation: Use Pythagoras to find lengths involving chords.

[Edexcel A2 Specimen Papers P2 Q9c Edited] A circle with centre $A(3,-1)$ passes through the point $P(-9,8)$ and the point $Q(15,-10)$

PQ is a diameter of the circle and an equation of the circle is $(x-3)^2+(y+1)^2=225$
A point R also lies on the circle.

Given that the length of the chord PR is 20 units, find the length of the shortest distance from A to the chord PR. Give your answer as a surd in its simplest form.

..... units

Question 17

Categorisation: Find angles in right-angled triangles involving a circle.

[Edexcel A2 Specimen Papers P2 Q9d Edited]

A circle with centre $A(3,-1)$ passes through the point $P(-9,8)$ and the point $Q(15,-10)$

PQ is a diameter of the circle and an equation of the circle is $(x-3)^2+(y+1)^2=225$

A point R also lies on the circle.

Given that the length of the chord PR is 20 units, find the size of angle ARQ, giving your answer to the nearest 0.1 of a degree.

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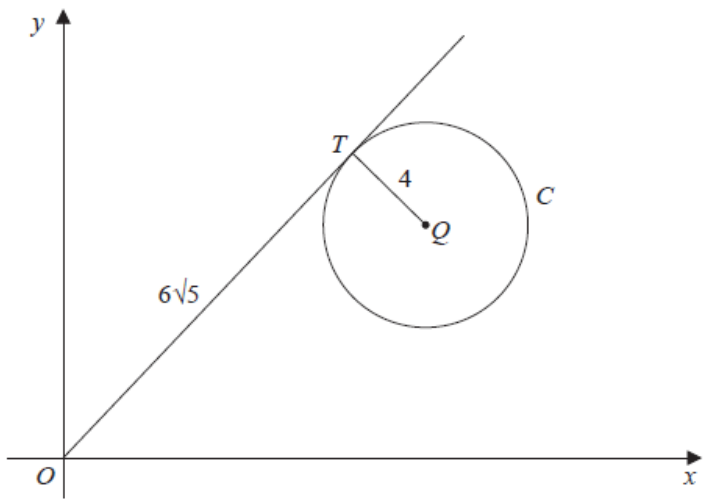
Question 18

Categorisation: Use Pythagoras to solve problems involving tangents of a circle.



[Edexcel C2 May 2014 Q9a]

The figure shows a circle C with centre Q and radius 4 and the point T which lies on C .

The tangent to C at the point T passes through the origin O and $OT = 6\sqrt{5}$

Given that the coordinates of Q are $(11, k)$ where k is a positive constant, find the exact value of k .

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Question 19

Categorisation: As per Q17.

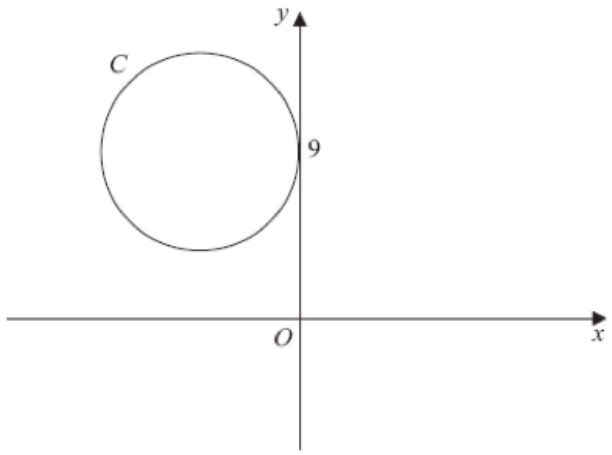

Figure 4

[Edexcel C2 May 2013 Q10b]

The circle *C* has radius 5 and touches the y -axis at the point (0, 9), as shown in Figure 4.

An equation of the circle is $(x + 5)^2 + (y - 9)^2 = 25$

A line through the point *P*(8, –7) is a tangent to the circle *C* at the point *T*.

Find the length of PT .

$PT =$ .....

Question 20

Categorisation: Show that a line does not intersect a circle.

[OCR C1 June 2014 Q9iii]

A circle with centre C has equation $(x-2)^2+(y+5)^2=25$.

Prove that the line $2y=x$ does not meet the circle.

Answers

Question 1

$(3, -1)$

Question 2

$\frac{13}{2}$

Question 3

$(x-2)^2 + (y-5)^2 = 20$

Question 4

$(x-3)^2 + (y-6)^2 = 50$

Question 5

$(x+5)^2 + (y-9)^2 = 25$

Question 6

$x = 4$, $y = 3$, $radius = \sqrt{45}$

Question 7

$(10,8)$

Question 8

$k > -29$

Question 9

$(2, -5)$

Question 10

$(-4, -3.5)$

Question 11

$k = -5$

Question 12

$3x + 5y - 95 = 0$

Question 13

$PQ =$ 58

Question 14

Area = $\frac{17}{2}$

Question 15

$x + 4y = 0$

Question 16

$5\sqrt{5}$

Question 17

41.8 °

Question 18

$\sqrt{75}$

Question 19

$PT =$ 20

Question 20

$(2y-2)^2 + (y+5)^2 = 25$
$4y^2 - 8y + 4 + y^2 + 10y + 25 = 25$
$5y^2 + 2y + 4 = 0$
Discriminant:
$2^2 - 4 \times 5 \times 4 = -76 < 0$ therefore no point of intersection.