Name: SOLUTIONS

GCSE (1 - 9)

Equation of a Circle and Tangent to a Circle

Solutions by
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These questions are compiled from released Pearson Edexcel GCSE maths exam papers

They contain exam questions from up until the ***November 2023*** exam series

More recent exam papers do exist but are withheld for mock exams

As new exam papers are released these worksheets will gradually be updated

The **most current** version of these worksheets will always be available at: kennethstafford.co.uk

Past Papers:	Similar Worksheets:
Solutions:	This worksheet:

1

L is the circle with equation $x^2 + y^2 = 4$

$P\left(\frac{3}{2}, \frac{\sqrt{7}}{2}\right)$ is a point on **L**.

Find an equation of the tangent to **L** at the point P.

gradient of radius $= \frac{\sqrt{7}}{2} \times \frac{2}{3} = \frac{\sqrt{7}}{3}$

gradient of tangent $= -\frac{3}{\sqrt{7}}$

Tangent $y = \frac{-3}{\sqrt{7}}x + c$

$P\left(\frac{3}{2}, \frac{\sqrt{7}}{2}\right)$

$\frac{\sqrt{7}}{2} = \frac{-3}{\sqrt{7}} \times \frac{3}{2} + c$

$\frac{\sqrt{7}}{2} = -\frac{9}{2\sqrt{7}} + c$

$c = \frac{\sqrt{7}}{2} + \frac{9}{2\sqrt{7}}$

$c = \frac{7}{2\sqrt{7}} + \frac{9}{2\sqrt{7}} = \frac{16}{2\sqrt{7}} = \frac{8}{\sqrt{7}}$

$y = \frac{-3}{\sqrt{7}}x + \frac{8}{\sqrt{7}}$

$y = \frac{-3\sqrt{7}}{7}x + \frac{8\sqrt{7}}{7}$

(Total for Question 23 is 3 marks)

[Edexcel, GCSE, Summer 2017, Paper 2H, Q23]

2

The equation of a curve is $y = a^x$
A is the point where the curve intersects the y-axis.

(a) State the coordinates of A.

y axis is where $x = 0$

$y = a^0 = 1$

(0 , 1)

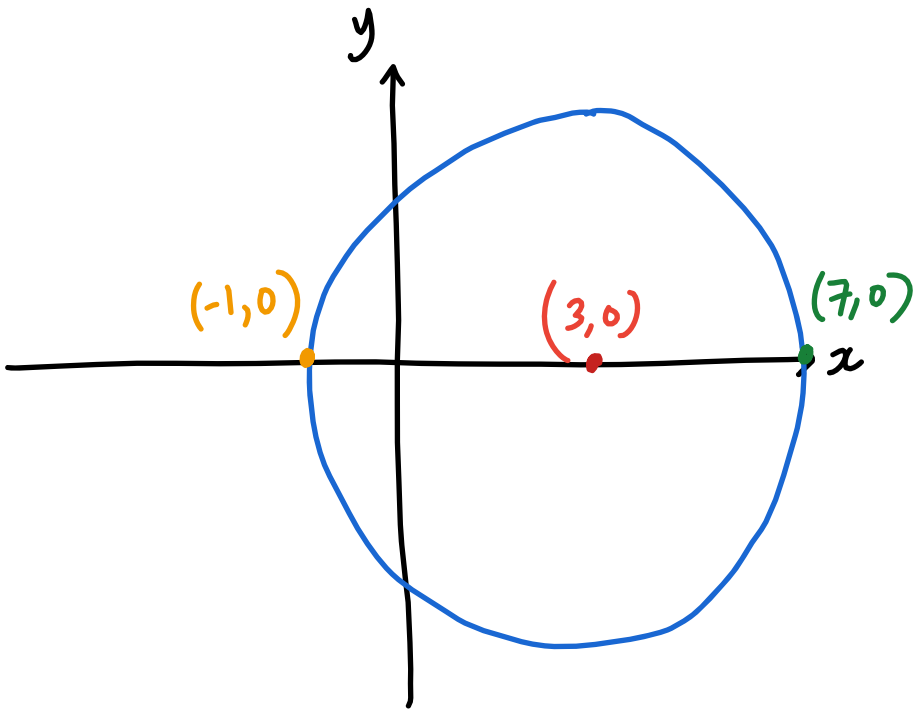
(1)

The equation of circle **C** is $x^2 + y^2 = 16$

The circle **C** is translated by the vector $\begin{pmatrix} 3 \\ 0 \end{pmatrix}$ to give circle **B**.

(b) Draw a sketch of circle **B**.

Label with coordinates
the centre of circle **B**
and any points of intersection with the x-axis.



(3)

(Total for Question 20 is 4 marks)

[Edexcel, GCSE, Summer 2017, Paper 3H, Q20]

3

Prove algebraically that the straight line with equation $x - 2y = 10$ is a tangent to the circle with equation $x^2 + y^2 = 20$

$x - 2y = 10$

$x = 2y + 10$

$x^2 = (2y+10)(2y+10)$

$x^2 = 4y^2 + 40y + 100$

$x^2 + y^2 = 20$

$4y^2 + 40y + 100 + y^2 = 20$

$5y^2 + 40y + 80 = 0$

$y^2 + 8y + 16 = 0$

$(y+4)(y+4) = 0$

$y = -4$

$x - 2(-4) = 10$

$x + 8 = 10$

$x = 2$

Lines intersect at $(2, -4)$ only

so $x - 2y = 10$ is a tangent to $x^2 + y^2 = 20$

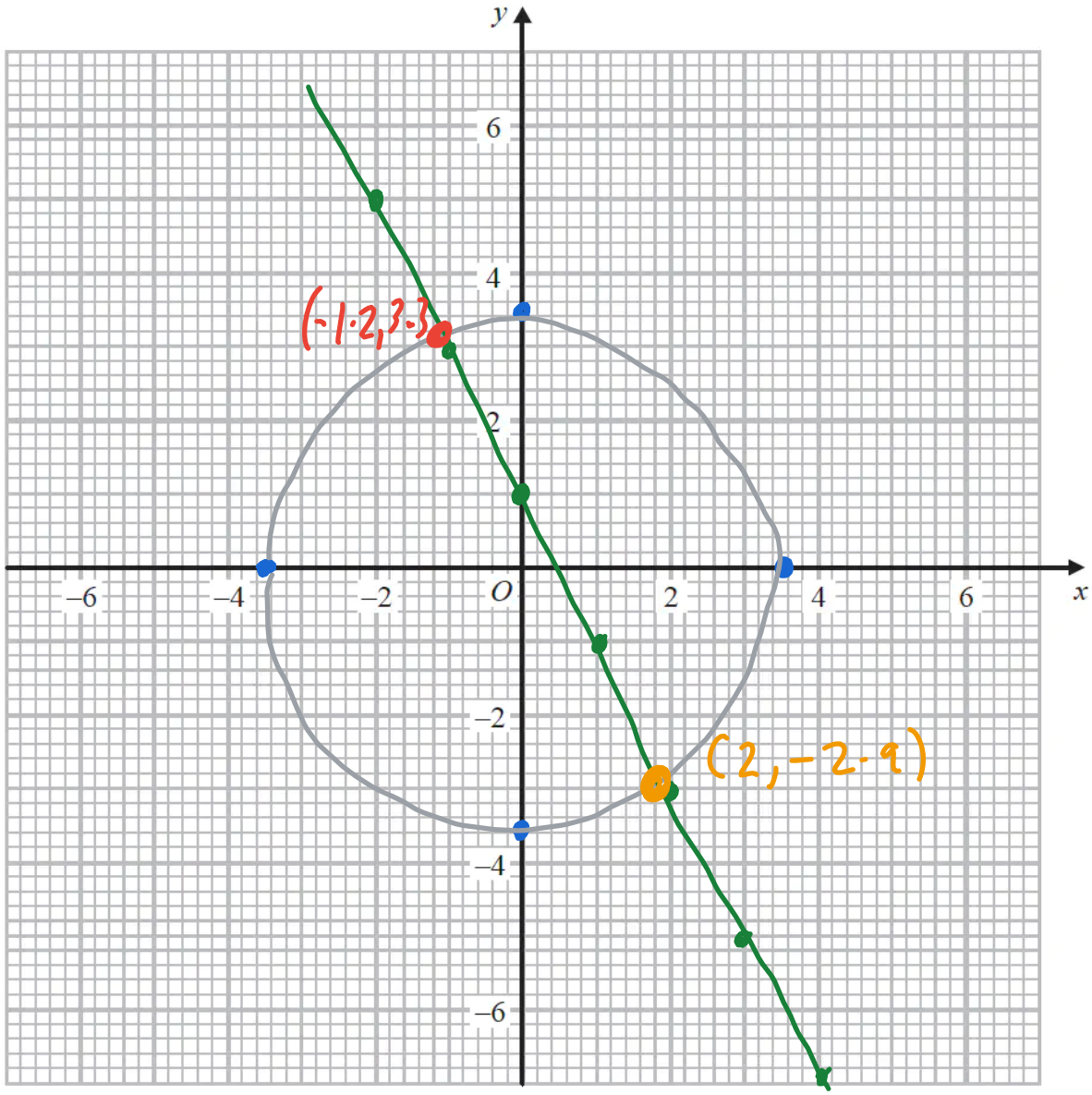
(Total for Question 19 is 5 marks)

[Edexcel, GCSE, Autumn 2017, Paper 3H, Q19]

4

(a) On the grid, draw the graph of $x^2 + y^2 = 12.25$

$\sqrt{12.25} = \sqrt{\frac{49}{4}} = \pm\frac{7}{2} = \pm 3.5$



(2)

(b) Hence find estimates for the solutions of the simultaneous equations

$x^2 + y^2 = 12.25$
$2x + y = 1$

$2x + y = 1$

$y = -2x + 1$

$x = 2 \quad y = -2.9$

$x = -1.2 \quad y = 3.3$

(3)

(Total for Question 16 is 5 marks)

[Edexcel, GCSE, Summer 2018, Paper 2H, Q16]

5

The equation of a circle is $x^2 + y^2 = 42.25$

Find the radius of the circle.

radius $= \sqrt{42.25}$

$= \frac{\sqrt{169}}{\sqrt{4}} = \frac{13}{2} = 6.5$

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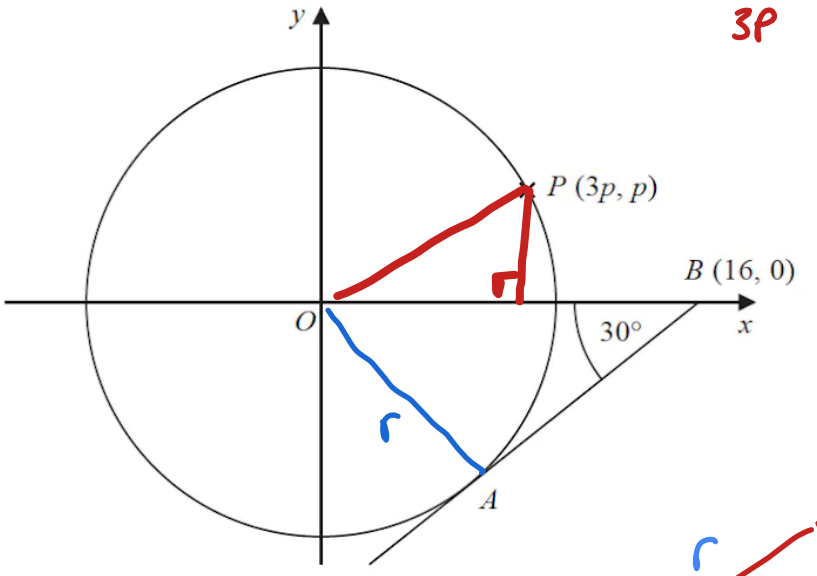
(Total for Question 15 is 1 mark)

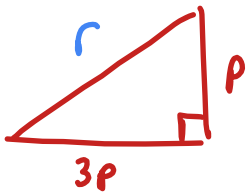
[Edexcel, GCSE, Autumn 2018, Paper 2H, Q15]

6

The diagram shows a circle, centre O.

$m = \frac{p}{3p} = \frac{1}{3}$





AB is the tangent to the circle at the point A.
Angle $OBA = 30°$

Point B has coordinates $(16, 0)$
Point P has coordinates $(3p, p)$

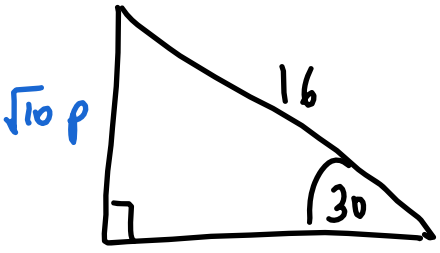
Find the value of p.
Give your answer correct to 1 decimal place.
You must show all your working.

$r^2 = (3p)^2 + (p)^2$

$r^2 = 9p^2 + p^2$

$r^2 = 10p^2$

$r = \sqrt{10}\,p$



$\sqrt{10}\,p = \sin(30) \times 16$

$\sqrt{10}\,p = \frac{1}{2} \times 16$

$\sqrt{10}\,p = 8$

$p = \frac{8}{\sqrt{10}} = \frac{8\sqrt{10}}{10} = \frac{4\sqrt{10}}{5}$

$p = \frac{4\sqrt{10}}{5} = 2.5$

(Total for Question 22 is 4 marks)

[Edexcel, GCSE, Summer 2019, Paper 3H, Q22]

7

C is a circle with centre the origin.

A tangent to **C** passes through the points (–20, 0) and (0, 10)

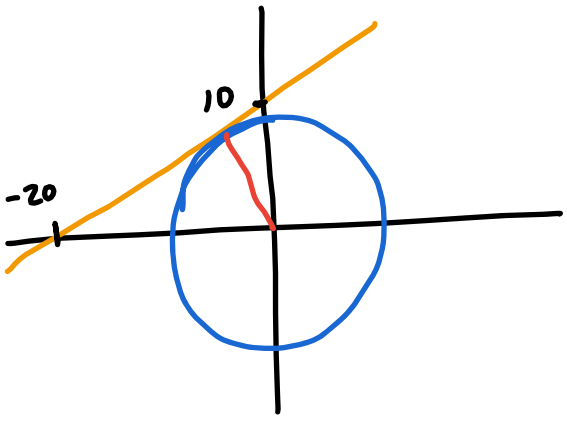
Work out an equation of **C**.
You must show all your working.

$y = \frac{1}{2}x + 10$

Tangent to C y intercept = 10

Gradient of tangent = $\frac{10 - 0}{0 - -20} = \frac{10}{20} = \frac{1}{2}$

Gradient of radius = -2



$y = -2x$

$-2x = \frac{1}{2}x + 10$

$-2.5x = 10$

$x = -\frac{10}{2.5}$

$x = -4$

$y = -2(-4)$

$y = 8$

$x^2 + y^2 = (-4)^2 + (8)^2$

$= 16 + 64$

$x^2 + y^2 = 80$

.....

(Total for Question 22 is 5 marks)

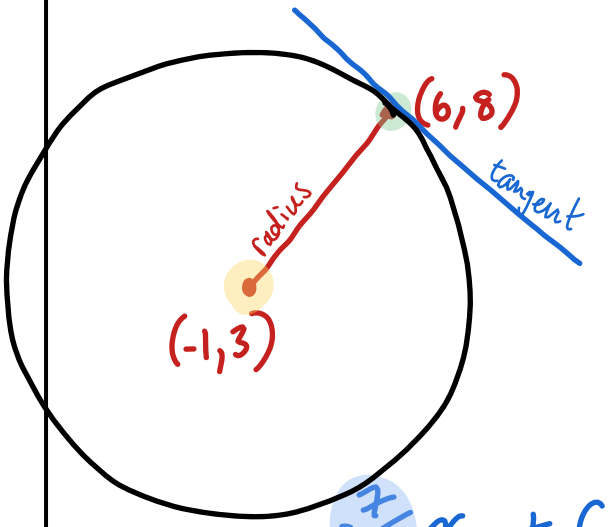
[Edexcel, GCSE, Autumn 2020, Paper 2H, Q22]

8

The centre of a circle is the point with coordinates $(-1, 3)$

The point A with coordinates $(6, 8)$ lies on the circle.

Find an equation of the tangent to the circle at A.
Give your answer in the form $ax + by + c = 0$ where a, b and c are integers.



gradient of radius $= \frac{8-3}{6--1} = \frac{5}{7}$

gradient of tangent $= -\frac{7}{5}$

$y = -\frac{7}{5}x + C$

$(8) = -\frac{7}{5}(6) + C$

$8 = -\frac{42}{5} + C$

$C = 8 + \frac{42}{5}$

$C = \frac{82}{5}$

$y = -\frac{7}{5}x + \frac{82}{5}$

$5y = -7x + 82$

$7x + 5y - 82 = 0$

$7x+5y-82=0$

(Total for Question 20 is 4 marks)

[Edexcel, GCSE, Summer 2022, Paper 1H, Q20]

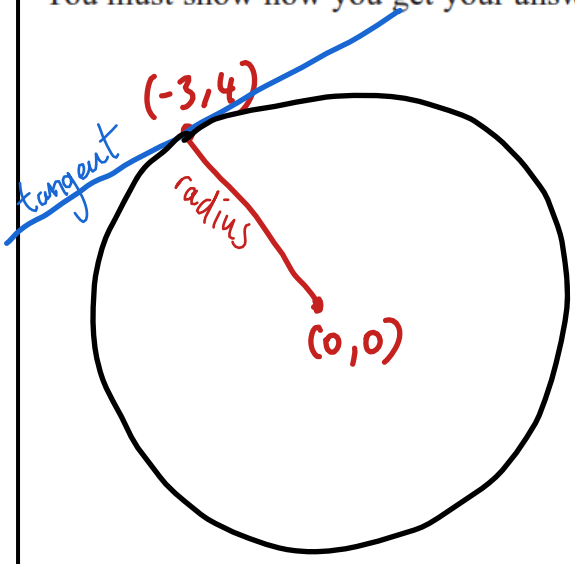
9

A circle has equation $x^2 + y^2 = 25$

The point P with coordinates $(-3, 4)$ lies on the circle.

Alex says that the tangent to the circle at P crosses the x-axis at the point $(-8, 0)$

Is Alex correct?
You must show how you get your answer.



gradient of radius $= \frac{4-0}{-3-0} = -\frac{4}{3}$

gradient of tangent $= +\frac{3}{4}$

$y = \frac{3}{4}x + c$

$4 = \frac{3}{4}(-3) + c$

$4 = -\frac{9}{4} + c$

$c = 4 + \frac{9}{4}$

$c = \frac{25}{4}$

$y = \frac{3}{4}x + \frac{25}{4}$

when $x = -8$

$y = \frac{3}{4}(-8) + \frac{25}{4}$

$y = -6 + 6.25$

$y = 0.25$

No

doesn't pass through $(-8, 0)$

passes through $(-8, 0.25)$

(Total for Question 23 is 4 marks)

[Edexcel, GCSE, Summer 2023, Paper 3H, Q23]

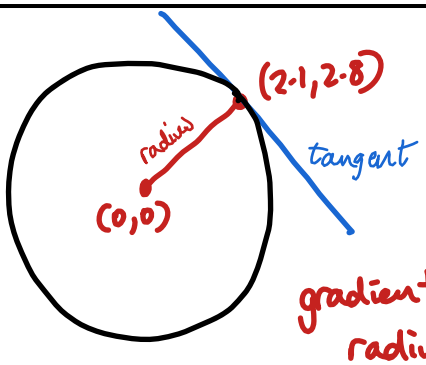
10

A circle has equation $x^2 + y^2 = 12.25$

The point P lies on the circle.
The coordinates of P are (2.1, 2.8)

The line **L** is the tangent to the circle at point P.

Find an equation of **L**.
Give your answer in the form $ax + by = c$, where a, b and c are integers.



gradient of radius $= \frac{2.8}{2.1} = \frac{4}{3}$

gradient of tangent $= -\frac{3}{4}$

$y = -\frac{3}{4}x + c$

$2.8 = -\frac{3}{4}(2.1) + c$

$2.8 = -\frac{63}{40} + c$

$c = \frac{35}{8}$

$y = -\frac{3}{4}x + \frac{35}{8}$

$8y = -6x + 35$

$8y + 6x = 35$

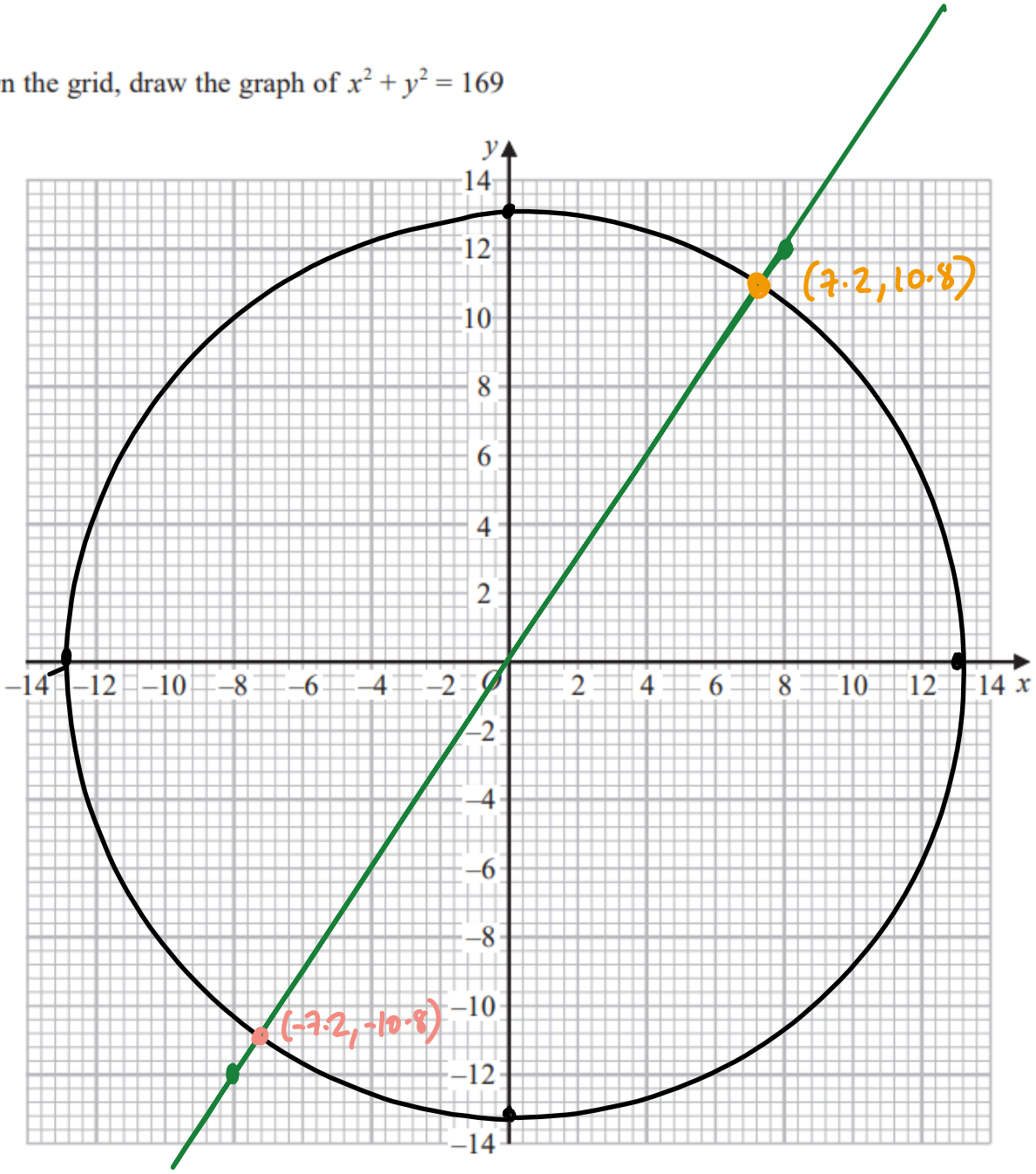
$8y + 6x = 35$

(Total for Question 24 is 4 marks)

[Edexcel, GCSE, November 2022, Paper 2H, Q24]

11

(a) On the grid, draw the graph of $x^2 + y^2 = 169$



(2)

(b) Use your graph to find estimates for the solutions of the simultaneous equations

$$x^2 + y^2 = 169$$
$$2y = 3x$$

$x = 7.2, y = 10.8$ and $x = -7.2, y = -10.8$

(3)

(Total for Question 21 is 5 marks)

[Edexcel, GCSE, November 2023, Paper 1H, Q21]