

QT Equation of the Tangent to a Circle



1. The diagram shows a circle $x^2 + y^2 = 8$

A tangent line is drawn at point P (2,2).

(a) Find the gradient of the line OP

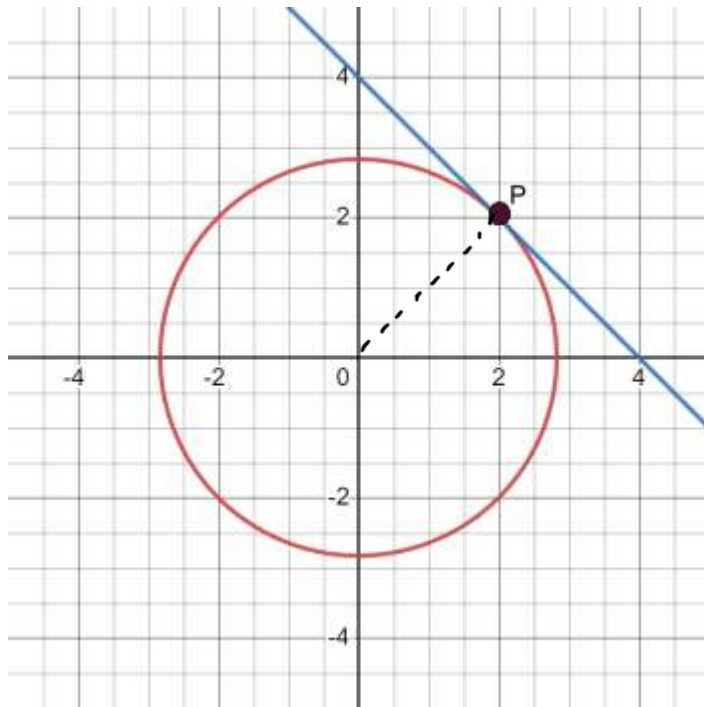
(1 mark)

(b) Find the gradient of the tangent

(2 marks)

(c) Find the equation of the tangent

(2 marks)



(a) of Gradient

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - 0}{2 - 0} = 1$$

(b) Tangent gradient
= negative reciprocal

$$= -\frac{1}{1} = -1$$

(c) Equation

$$y = mx + c$$

$$y = -1x + c$$

$$2 = -1(2) + c$$

$$2 = -2 + c$$

$$4 = c$$

$$\therefore y = -x + 4$$

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2. The diagram shows a circle $x^2 + y^2 = 25$.

A tangent line is drawn at point Q (-5,-3).

(a) Find the gradient of the line OQ

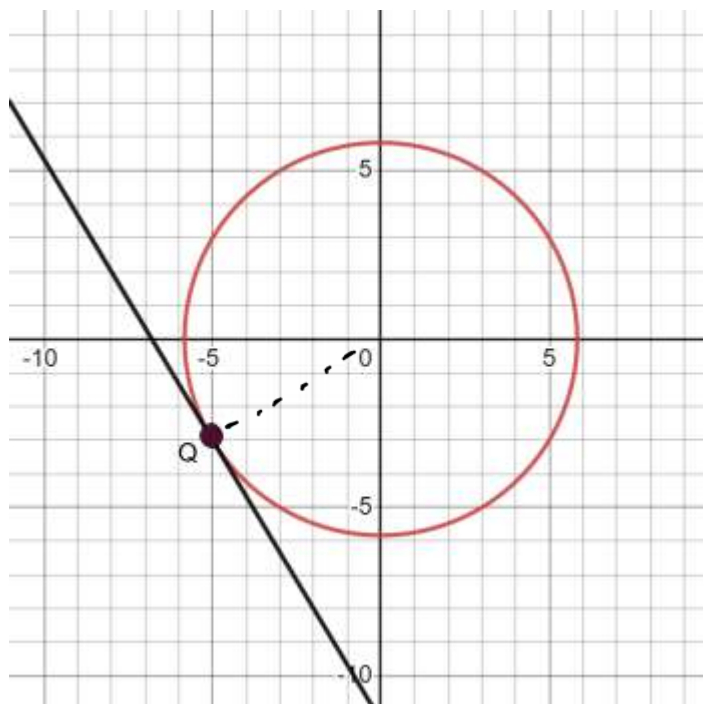
(1 mark)

(b) Find the gradient of the tangent

(2 marks)

(c) Find the equation of the tangent

(2 marks)



(a) Gradient OQ.

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{-3 - 0}{-5 - 0}$$

$$= \frac{-3}{-5} = \frac{3}{5}$$

(b) Gradient of tangent

= negative reciprocal

$$= \frac{-5}{3}$$

(c) Equation of the tangent

$$y = mx + c$$

$$y = -\frac{5}{3}x + c$$

$$-3 = -\frac{5}{3}(-5) + c$$

$$-3 = \frac{25}{3} + c$$

$$-3 - \frac{25}{3} = c$$

$$-\frac{34}{3} = c$$

$$\therefore y = -\frac{5}{3}x - \frac{34}{3}$$

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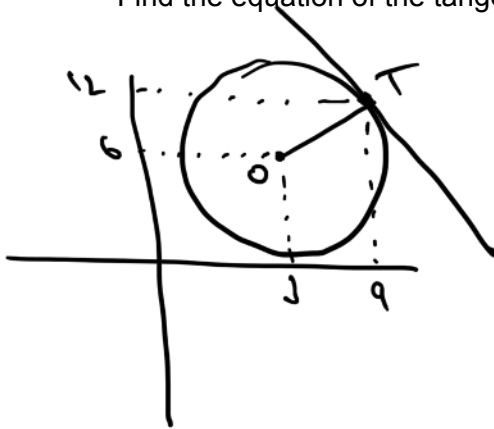


3. A circle has a centre at (3,6).

The point T (9,12) lies on the circumference of the circle.

Find the equation of the tangent to the circle at point T.

(5 marks)



$$\text{Gradient } OT = \frac{12-6}{9-3} = \frac{6}{6} = 1$$

$$\text{Gradient of tangent} = -1$$

$$\therefore y = -1x + c$$

$$12 = -1(9) + c$$

$$12 = -9 + c$$

$$21 = c$$

$$\therefore \underline{\underline{y = -x + 21}}$$

4. A circle has the equation $x^2 + y^2 = 20$ ← r^2

(a) Write down the centre of the circle

(1 mark)

(b) Write down the exact length of the radius of the circle

(1 mark)

(c) The point S (2,4) lies on the circumference of the circle.

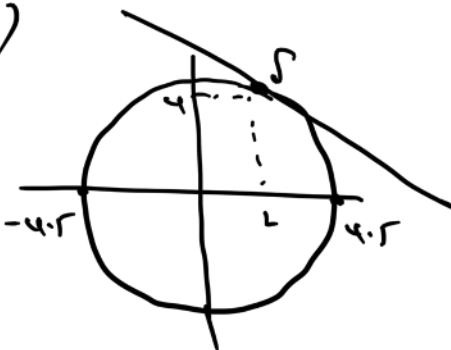
Find the equation of the tangent to the circle at point S

(4 marks)

(a) Centre is (0,0)

(b) Radius exact length = $\sqrt{20}$

(c)



$$\text{Gradient } OS = \frac{4}{2} = 2$$

$$\text{Gradient of tangent} = -\frac{1}{2}$$

$$y = -\frac{1}{2}x + c$$

$$4 = -\frac{1}{2}(2) + c$$

$$5 = c$$

$$\therefore \underline{\underline{y = -\frac{1}{2}x + 5}}$$

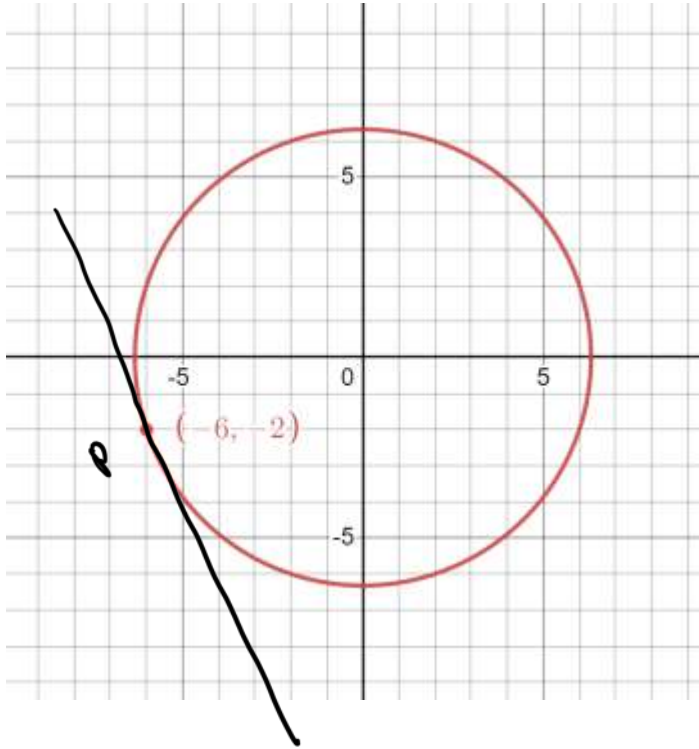
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5. The diagram shows a circle of radius $\sqrt{40}$ cm, centre $(0,0)$

Find the equation of the tangent to the circle at the point $(-6,-2)$

(5 marks)



$$\text{Gradient of } OP = \frac{-2}{-6} = \frac{1}{3}$$

$$\text{Gradient of tangent} = -3$$

$$y = -3x + c.$$

$$-2 = -3(-6) + c.$$

$$-2 = 18 + c$$

$$-20 = c$$

$$\therefore \underline{\underline{y = -3x - 20}}$$

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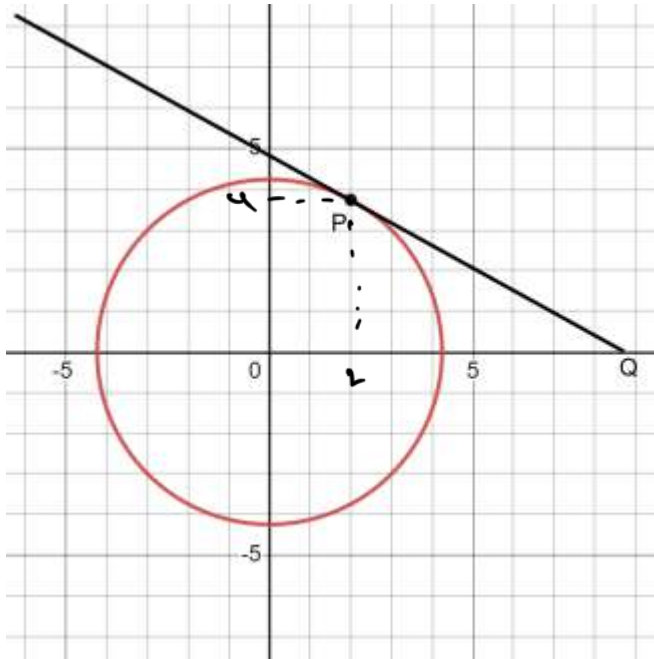
6. The diagram shows a circle $x^2 + y^2 = 20$

A point P lies on the circumference and has an x coordinate of 2.

The tangent at P intersects the x-axis at point Q

Work out the coordinates of point Q

(6 marks)



$$\text{At } x = 2$$

$$x^2 + y^2 = 20$$

$$(2)^2 + y^2 = 20$$

$$4 + y^2 = 20$$

$$y^2 = 16$$

$$y = 4$$

$$\text{Gradient of OP} = \frac{y}{x} = 2$$

$$\text{Gradient of tangent} = -\frac{1}{2}$$

$$y = mx + c$$

$$y = -\frac{1}{2}x + c$$

$$4 = -\frac{1}{2}(2) + c$$

$$4 = -1 + c$$

$$5 = c$$

\therefore Tangent line

$$y = -\frac{1}{2}x + 5$$

Coordinates of Q (when $y = 0$)

$$0 = -\frac{1}{2}x + 5$$

$$\frac{1}{2}x = 5$$

$$x = 10$$

$$\therefore \underline{\underline{(10, 0)}}$$