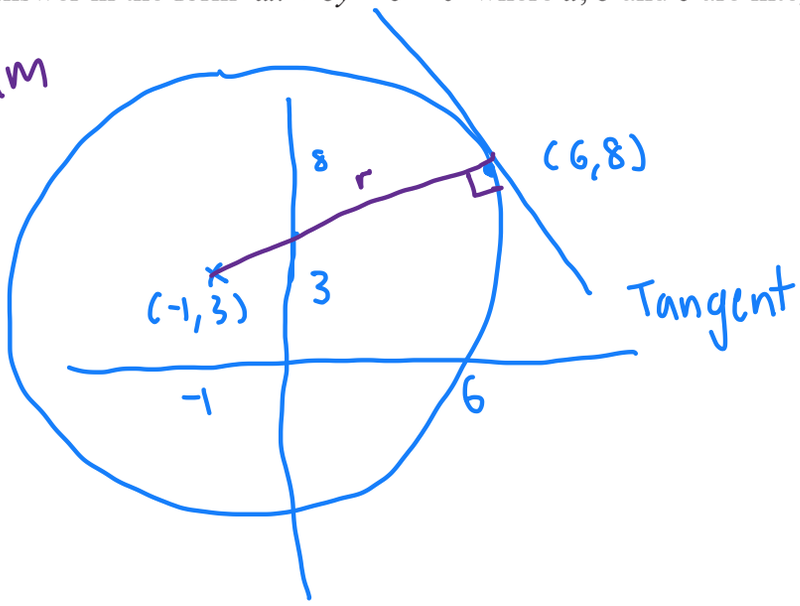
1 The centre of a circle is the point with coordinates $(-1, 3)$

$(x+1)^2 + (y-3)^2 = r^2$

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.

Diagram



the gradients of the radius and tangent are perpendicular

$m_{radius} = \frac{\Delta y}{\Delta x} = \frac{8-3}{6--1} = \frac{5}{7}$ ✓1

$m_{TANGENT} = -\frac{7}{5}$ ✓1 (negative reciprocal of radius)

$y - y_1 = m(x - x_1)$ → tangent hits $(x_1, y_1) = (6, 8)$

$y - 8 = -\frac{7}{5}(x - 6)$ ✓1

$5y - 40 = -7(x - 6)$

$5y - 40 = -7x + 42$

$7x + 5y - 82 = 0$ ✓1

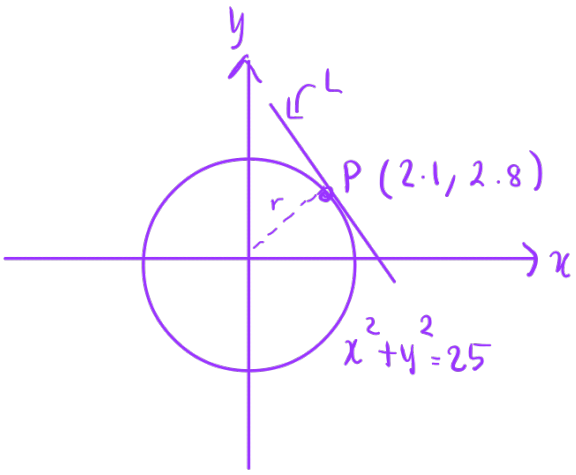
(Total for Question 1 is 4 marks)

2 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.



Finding gradient of radius, r

$m = \frac{2.8}{2.1} = \frac{4}{3}$ (1)

Finding gradient of tangent:

$m_{tangent} = \frac{-1}{m_{perpendicular}}$

$m_{tangent} = \frac{-1}{\frac{4}{3}}$

$= -\frac{3}{4}$ (1)

Finding equation of line L:

$m = -\frac{3}{4}$, known coordinate = P (2.1, 2.8)

substitute into $y = mx + c$ to get the c value

$2.8 = -\frac{3}{4}(2.1) + c$ (1)

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

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

$8y = -6x + 35$

$\therefore 6x + 8y = 35$ (1)

$6x + 8y = 35$

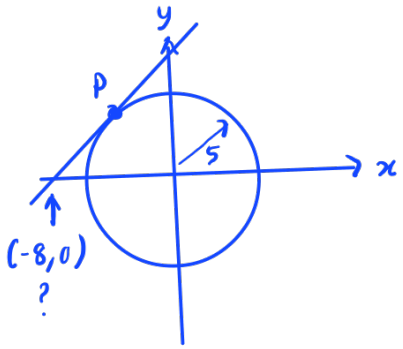
(Total for Question 2 is 4 marks)

3 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.



Finding the gradient of normal to the tangent :

$$m = \frac{4-0}{-3-0} = -\frac{4}{3}$$ (1)

Finding gradient of tangent :

$$m_{tangent} = \frac{-1}{m_{normal}} = \frac{-1}{-\frac{4}{3}} = \frac{3}{4}$$ (1)

Finding equation of the tangent line :

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

$$c = 4 + \frac{9}{4} = \frac{25}{4}$$

Tangent line equation : $y = \frac{3}{4}x + \frac{25}{4}$ (1)

Check if point $(-8,0)$ is a part of the line by substituting the x or y value into the equation :

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

when $x = -8$, $y = \frac{3}{4}(-8) + \frac{25}{4}$ (1)

$= \frac{1}{4}$ (not 0) ∴ No, Alex is not correct.

(Total for Question 3 is 4 marks)