Perpendicular Lines Exam Practice

Q1. A line has the equation $2x + 3y = 15$. Find the equation of the line which is perpendicular to this line, and passes through the point (-18,10)

$2x+3y=15$

$3y = -2x+15$

$y = -\frac{2}{3}x+15$

gradient of perpendicular line is $\frac{-1}{(-\frac{2}{3})}$

which is $\frac{3}{2}$

$y=mx+c$ where $m=\frac{3}{2}$; find c

using $(-18,10)$

$10 = \frac{3}{2}(-18)+c$

$10 = -27+c$

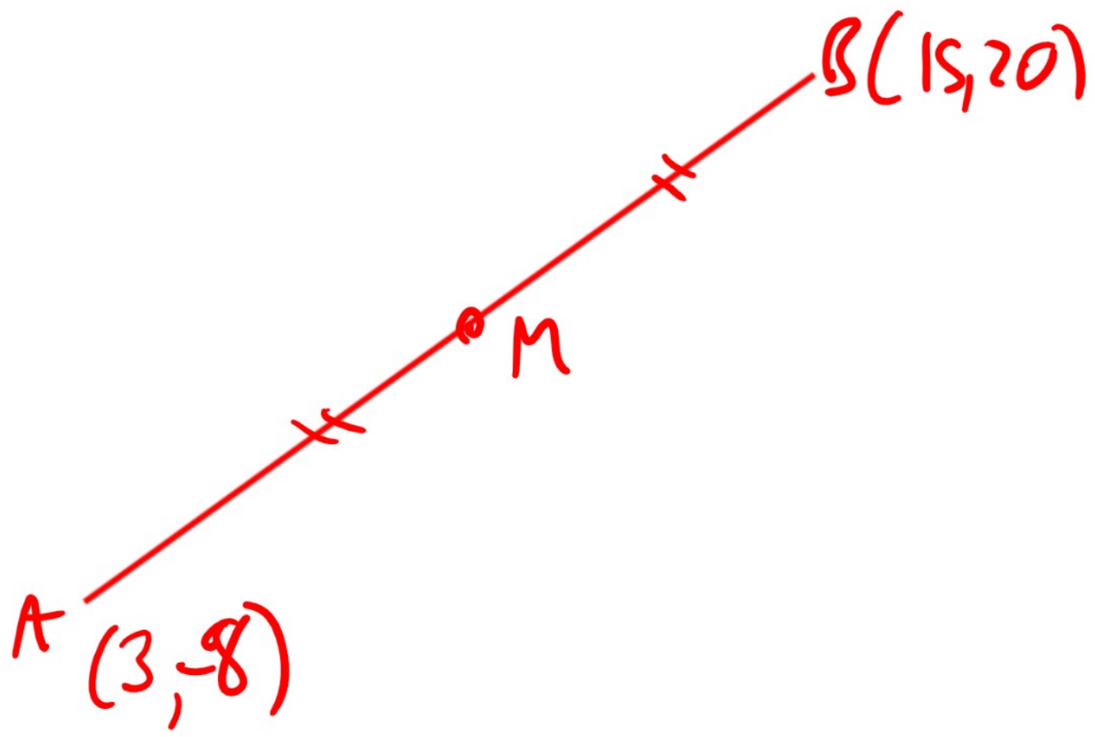
$c=37$

$\Rightarrow y=\frac{3}{2}x+37$

Answer: $y=\frac{3}{2}x+37$

(3 marks)

Q2. A line segment AB has end-points (3, -8) and (15, 20).
Find the equation of the line which is the perpendicular bisector of AB.



- $M = \left(\frac{3+15}{2}, \frac{-8+20}{2}\right)$

$= (9, 6)$

- gradient $AB = \frac{20 - -8}{15-3}$

$= \frac{28}{12}$

$= \frac{7}{3}$

∴ gradient of perpendicular bisector $= -\frac{3}{7}$

$y = -\frac{3}{7}x + c$; now substitute (9,6)

$6 = -\frac{3}{7}(9) + c \Rightarrow c = \frac{69}{7}$

Answer: $y = -\frac{3}{7}x + \frac{69}{7}$

(4 marks)

Q3. Line L has the equation $8x = 15 - 6y$ whilst line M has the the equation $3x + 4y = 13$.
Decide whether the lines L and M are perpendicular or not, explaining all your reasoning carefully.

L: $6y = -8x + 15$

$y = -\frac{8}{6}x + 15$

$\therefore$ gradient $= -\frac{8}{6}$

$= -\frac{4}{3}$

M: $3x + 4y = 13$

$4y = -3x + 13$

$y = -\frac{3}{4}x + 13$

$\therefore$ gradient $= -\frac{3}{4}$

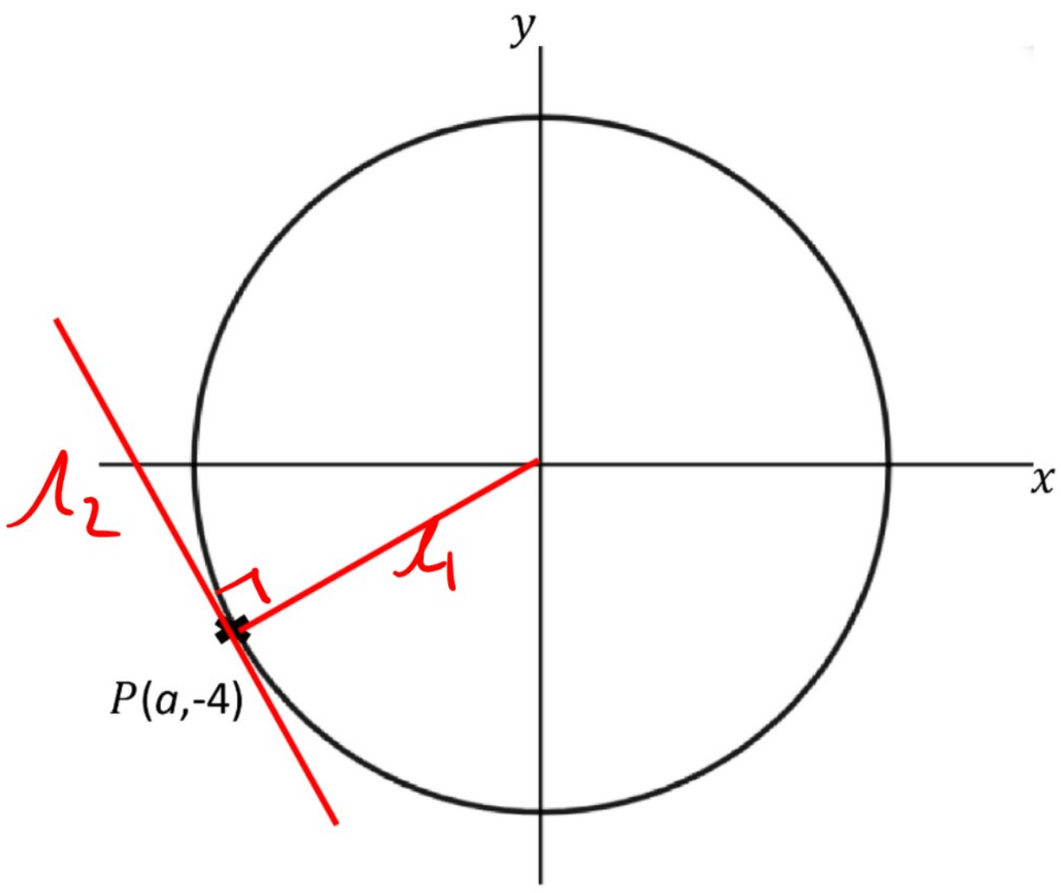
$-\frac{4}{3} \times -\frac{3}{4} = 1 \neq -1$, so L, M are not perpendicular

Answer: NO

(3 marks)

Q4. The sketch shows a circle which has equation $x^2 + y^2 = 80$ and a point P(a, -4) which lies on the circle.

(i) Find the value of a



$a^2 + (-4)^2 = 80$

$a^2 + 16 = 80$

$a^2 = 64$

$a = \pm\sqrt{64}$

$a = -8, 8$

From the diagram, only $a = -8$ is possible

Answer: $(-8, -4)$

(1 mark)

(ii) Find the equation of the tangent to the circle at P, giving your answer in the form $ax + by = c$ where a, b and c are whole numbers.

gradient $l_1 = \frac{0 - -4}{0 - -8}$

$= \frac{1}{2}$

$\therefore$ gradient $l_2 = -2$, and $y = -2x + c$

sub $(-8, -4)$, $-4 = -2(-8) + c$

$\Rightarrow c = -20$

Answer: $y + 2x + 20 = 0$

(5 marks)