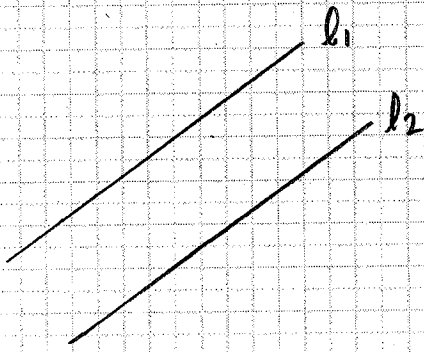
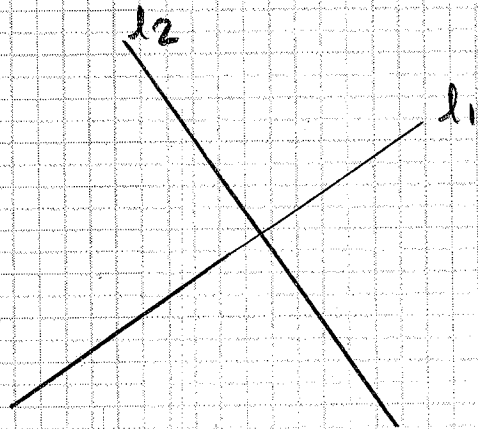


PARALLEL AND PERPENDICULAR LINES

$$l_1: y = m_1x + b_1$$

$$l_2: y = m_2x + b_2$$

$l_1 \parallel l_2$  if and only if  $m_1 = m_2$



$$l_1: y = m_1x + b_1$$

$$l_2: y = m_2x + b_2$$

$l_1 \perp l_2$  if and only if

$$m_1 = -\frac{1}{m_2}$$

Ex: Determine if the following two lines are parallel, perpendicular or neither

$$l_1: 4x + 2y = 12$$

$$2y = -4x + 12$$

$$y = -2x + 6$$

$$\boxed{m_1 = -2}$$

$$l_2: 8x + 4y = 2$$

$$4y = -8x + 2$$

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

$$\boxed{m_2 = -2}$$

$m_1 = m_2$   
parallel

EX: Find the equation of the line that goes through the point  $(\underset{x_1}{1}, \underset{y_1}{2})$  and is parallel to the line

$$-3x + 6y = 12 \Rightarrow 6y = 3x + 12 \Rightarrow$$

$$\Rightarrow y = \frac{1}{2}x + 2 \Rightarrow m = 1/2$$

$$y - y_1 = m(x - x_1)$$

$$y - 2 = \frac{1}{2}(x - 1)$$

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

$$y = \frac{1}{2}x + \frac{3}{2}$$

EX: Find the equation of the line that goes through the point  $(\underset{x_1}{-1}, \underset{y_1}{2})$  and is perpendicular to the line

$$-6x + 3y = 4 \Rightarrow 3y = 6x + 4 \Rightarrow y = 2x + \frac{4}{3}$$

$$m_1 = 2$$

$$m = -\frac{1}{2}$$

$$y - y_1 = m(x - x_1)$$

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

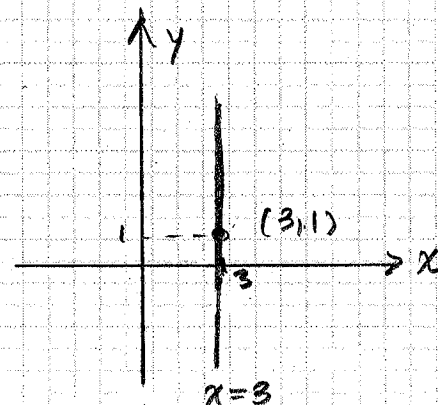
$$y - 2 = -\frac{1}{2}x - \frac{1}{2}$$

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

$$y = -\frac{1}{2}x + \frac{3}{2}$$

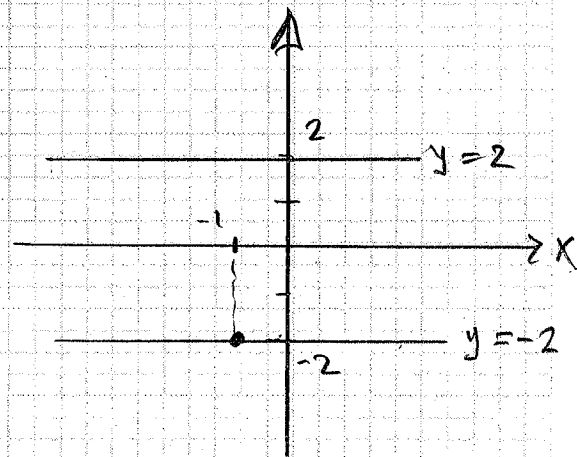
EX: Find the equation of the line that goes thru the point  $(3, 1)$  and is perpendicular to the  $x$ -axis

Equation:  $x = 3$



EX: Find the equation of the line that goes thru the point  $(-1, -2)$  and is parallel to the line  $y = 2$

Equation:  $y = -2$



EX: Use perpendicular lines to show that the triangle with vertices  $A=(1,1)$   $B=(2,3)$   $C=(4,2)$  is a right triangle

$$m_{AB} = \frac{3-1}{2-1} = \frac{2}{1} = 2$$

$$\frac{y_2 - y_1}{x_2 - x_1}$$

$$m_{BC} = \frac{2-3}{4-2} = \frac{-1}{2} = -\frac{1}{2}$$

