

1. (10pts) Find the equation of the line (in form $y = mx + b$) that passes through point $(2, -5)$ and is perpendicular to the line $2x - 3y = 6$. Draw both lines.

$$2x - 3y = 6 \quad | -2x$$

$$-3y = -2x + 6 \quad | \div (-3)$$

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

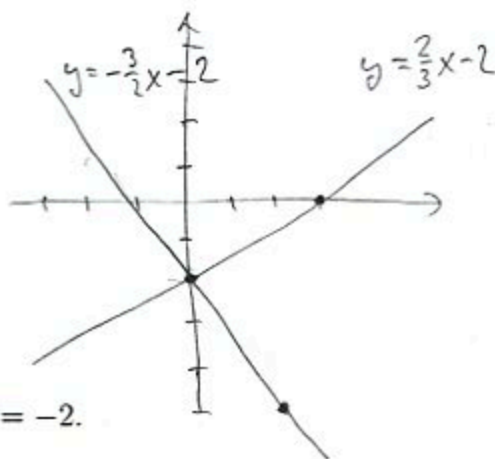
$$y = \frac{2}{3}x - 2 \quad \text{Green line has slope } \frac{2}{3}$$

Perpendicular line has slope $-\frac{3}{2}$

$$y - (-5) = -\frac{3}{2}(x - 2)$$

$$y + 5 = -\frac{3}{2}x + 3 \quad | -5$$

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



2. (5pts) Find the linear function f its x -intercept is 3 and $f(5) = -2$.

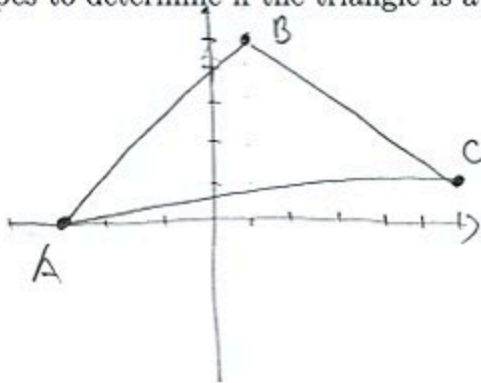
Need line through points $(3, 0)$ and $(5, -2)$

$$m = \frac{-2 - 0}{5 - 3} = -\frac{2}{2} = -1$$

$$y - 0 = -(x - 3)$$

$$y = -x + 3$$

3. (9pts) Draw the triangle with vertices $A = (-3, 0)$, $B = (1, 5)$, and $C = (6, 1)$. Use slopes to determine if the triangle is a right triangle.



$$m_{AB} = \frac{5 - 0}{1 - (-3)} = \frac{5}{4}$$

$$m_{BC} = \frac{1 - 5}{6 - 1} = -\frac{4}{5}$$

$$m_{AC} = \frac{1 - 0}{6 - (-3)} = \frac{1}{9}$$

these are opposite reciprocals so sides AB and BC are perpendicular

4. (4pts) The consumption of gasoline in the U.S. has varied over the years. In 2012, 3.178 billion barrels were consumed; in 2016, 3.413 billion barrels of gasoline were consumed. What is the average rate of change of gasoline consumed from 2012 to 2016? What are the units for the average rate of change?

$$\frac{3.413 - 3.178}{2016 - 2012} = \frac{0.235}{4} = 0.05875 \text{ billion barrels per year}$$

(58.75 million barrels per year)

5. (12pts) A business that manufactures decorative mirrors keeps track of its expenses. One month, it produced 213 mirrors and had expenses of \$6463.36. Another month, it produced 327 mirrors and had expenses of \$9395.44.

- a) Assuming that the business expenses $E(x)$ is a linear function of the number of mirrors x produced, write a formula for $E(x)$.
 b) What are the expenses if no mirrors are produced? What is the meaning of this number?
 c) What is the meaning of the slope in this example?

a) Need line through
 (213, 6463.36) and (327, 9395.44)

$$m = \frac{9395.44 - 6463.36}{327 - 213} = \frac{2932.08}{114} = 25.72$$

$$y - 6463.36 = 25.72(x - 213)$$

$$y - 6463.36 = 25.72x - 5478.36$$

$$y = 25.72x + 985$$

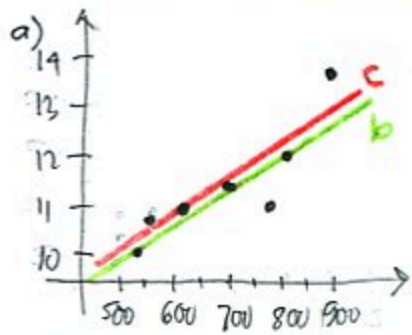
b) $E(0) = 985$
 These are fixed costs.

c) Slope is cost-per-mirror

6. (20pts) A farmer is trying to establish the relationship between the amount of rainfall during growing season and the yield of corn on his farm. The table shows the data: W is the amount of rainfall in millimeters and Y is the corn yield in tons. Solve the problems below with accuracy 6 decimal points.

- a) Draw the scatterplot of the data. Does the relationship look linear?
 b) Use two points in the scatterplot to get an equation of a line that models the relationship between W and Y . Draw the line on the graph.
 c) Use your calculator to find the "line of best fit" for the data. Draw the line on the graph.
 d) Find the coefficient of correlation r . How strong is the linear relationship between W and Y ?
 e) What yield can the farmer expect if the the amount of rainfall in a year is 750 millimeters?

W	Y
540	10
558	10.7
620	10.9
700	11.2
790	11
825	12
900	13.5



Seems generally linear.

b) Use (540, 10) and (825, 12)

$$m = \frac{12 - 10}{825 - 540} = \frac{2}{285} = 0.00701754$$

$$y - 10 = \frac{2}{285}(x - 540)$$

$$y = 0.00701754x + 6.210526$$

c) $y = 0.00712635x + 6.306529$

d) $r = 0.87743$, pretty close to 1, so fairly strong

e) $0.00712635 \cdot 750 + 6.306529 = 11.651292$ tons