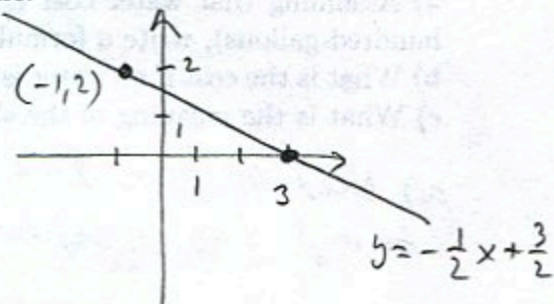


1. (6pts) Find the equation of the line (in form $y = mx + b$) whose x -intercept is 3 and that passes through point $(-1, 2)$. Draw the graph of the line.

Goes through pts $(3, 0)$ and $(-1, 2)$

$$m = \frac{2-0}{-1-3} = \frac{2}{-4} = -\frac{1}{2}$$

$$y-0 = -\frac{1}{2}(x-3), \quad y = -\frac{1}{2}x + \frac{3}{2}$$



2. (10pts) Find the equation of the line (in form $y = mx + b$) passing through $(-1, 3)$ that is perpendicular to the line $3x - 2y = 4$. Draw both lines.

$$3x - 2y = 4$$

$$-2y = -3x + 4 \quad | \div -2$$

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

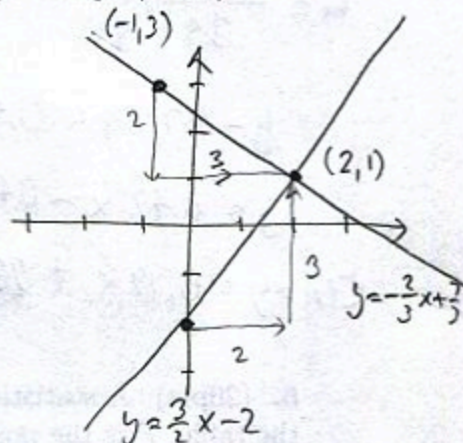
$$y = \frac{3}{2}x - 2 \quad \text{slope} = \frac{3}{2}$$

Slope of perpendicular line is $-\frac{1}{\frac{3}{2}} = -\frac{2}{3}$

Equation of perp. line:

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

$$y = -\frac{2}{3}x - \frac{2}{3} + 3 = -\frac{2}{3}x + \frac{7}{3}$$

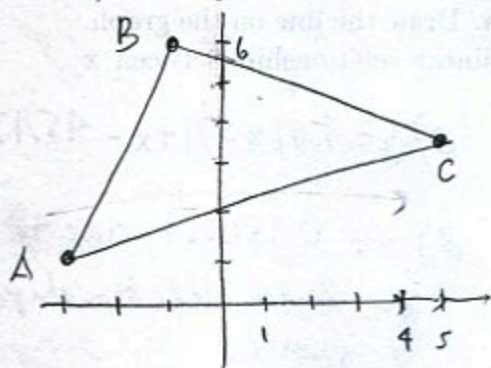


3. (8pts) Draw the triangle with vertices $A = (-3, 1)$, $B = (-1, 6)$ and $C = (5, 4)$.

a) Does the triangle look like it is a right triangle? *it could be, with a right angle at B*

b) Find the slopes of the sides of the triangle.

c) Use slopes to check if the triangle is right.



line	slope
AB	$\frac{6-1}{-1-(-3)} = \frac{5}{2}$
BC	$\frac{4-6}{5-(-1)} = \frac{-2}{6} = -\frac{1}{3}$
AC	$\frac{4-1}{5-(-3)} = \frac{3}{8}$

these two are not opposite reciprocal, so lines are not perpendicular. Not a right triangle.

4. (4pts) According to government data, the price (on average) of a pound of chicken breast was \$3.52 in September of 2021, and \$4.31 in May of 2022. What is the average rate of change of the price of a pound of chicken breast from September 2021 to May 2022? (Time is measured in months here.) What are the units for the average rate of change?

$$\text{avg. rate of change of price} = \frac{4.31 - 3.52}{\text{May '22} - \text{Sep '21}} = \frac{0.79}{8} \approx 0.09875 \text{ dollars/month}$$

8 months

5. (12pts) The water bill for a household was \$39.56 in a month when it used 40 hundred-gallons of water. In another month, it used 34 hundred-gallons and was billed \$37.04.

- a) Assuming that water cost $C(x)$ is a linear function of the amount of water x used (in hundred-gallons), write a formula for $C(x)$.
 b) What is the cost if no water is used during a month? What is the meaning of this number?
 c) What is the meaning of the slope in this example?

a) Need eq. of a line through $(40, 39.56)$ and $(34, 37.04)$

b) $C(0) = 22.76$ is the flat monthly fee.

$$m = \frac{37.04 - 39.56}{34 - 40} = \frac{-2.52}{-6} = 0.42$$

$$y - 37.04 = 0.42(x - 34)$$

$$y = 0.42x - 0.42 \cdot 34 + 37.04$$

$$C(x) = y = 0.42x + 22.76$$

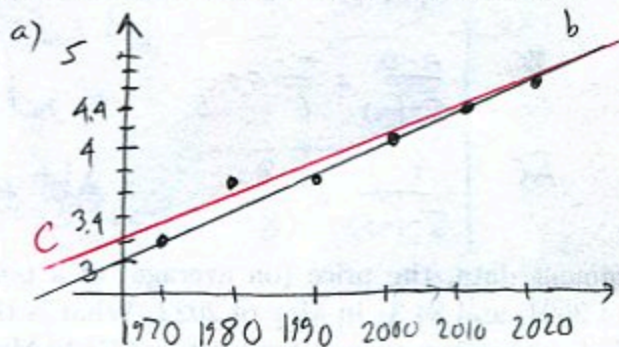
c) Slope is cost per hundred-gallons of water,

\$0.42 per hundred-gallons

6. (20pts) A statistician is trying to establish a trend for the population of Kentucky. In the table, P is the population, in millions, of Kentucky in year x . 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 P and x . 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 x and P ?
 e) What population of Kentucky can we expect for 2027?

x	P
1970	3.2
1980	3.7
1990	3.7
2000	4.0
2010	4.3
2020	4.5



Relationship seems linear.

$$m = \frac{4.3 - 3.2}{2010 - 1970} = \frac{1.1}{40} = 0.0275$$

$$y - 3.2 = 0.0275(x - 1970)$$

$$y = 0.0275x - 54.175 + 3.2 = 0.0275x - 50.975$$

b) Use $(1970, 3.2)$
 $(2010, 4.3)$

$$c) y = 0.0245714x - 45.12$$

d) $r = 0.980061$, close to 1, so linear relationship is strong.

$$e) y = 0.0245714 \cdot 2027 - 45.12 = 4.685417$$