

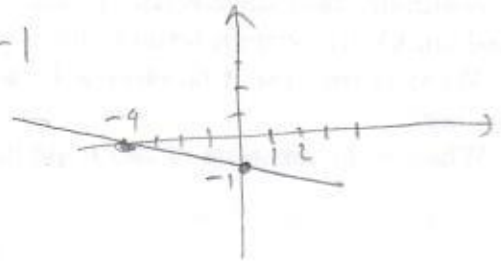
1. (6pts) Find the equation of the line (in form $y = mx + b$) whose x -intercept is -4 and y -intercept is -1 . Draw the graph of the line.

Line passes through

$$(-4, 0), (0, -1)$$

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

$$y = -\frac{1}{4}x - 1$$



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

$$2x + 3y = 6$$

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

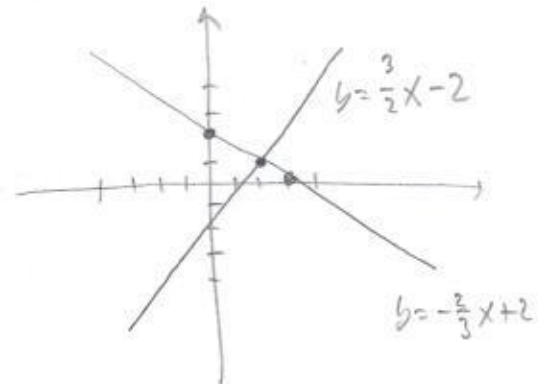
$$y = -\frac{2}{3}x + 2$$

Slope of perp. line = $\frac{3}{2}$

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

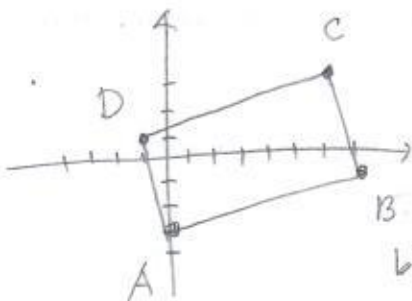
$$y = \frac{3}{2}x - 3 + 1$$

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



3. (8pts) Draw the quadrangle with vertices $A = (0, -3)$, $B = (7, -1)$, $C = (6, 3)$ and $D = (-1, 1)$.

- a) Find the slopes of the sides of the quadrangle.
 b) Use slopes to check if the quadrangle is a parallelogram (has two pairs of parallel sides).
 c) Is it a rectangle (a parallelogram with adjacent sides perpendicular)? Use slopes to check.



Slopes of lines:

$$m_{AB} = \frac{-1 - (-3)}{7 - 0} = \frac{2}{7} \quad m_{BC} = \frac{3 - (-1)}{6 - 7} = -4$$

$$m_{CD} = \frac{1 - 3}{-1 - 6} = \frac{-2}{-7} = \frac{2}{7} \quad m_{AD} = \frac{1 - (-3)}{-1 - 0} = -4$$

b) It is a parallelogram, because $m_{AD} = m_{CD}$ and $m_{BC} = m_{AB}$
 so AB, CD are parallel
 as are BC, AD

c) not a rectangle since no two slopes are opposite reciprocals

4. (4pts) According to the US census, there were 4,339,367 inhabitants of Kentucky in 2010, and 4,505,836 in 2020. What is the average rate of change of the population of Kentucky from 2010 to 2020? What are the units for the average rate of change?

$$\text{avg. rate of change of population} = \frac{4,505,836 - 4,339,367}{2020 - 2010} = \frac{166,469}{10} = 16,646.9 \text{ people per year}$$

5. (12pts) The electric bill for a household was \$158.21 in a month when it used 1123 kWh (kilowatt-hours) of electricity. In another month, it used 2546 kWh and was billed \$328.97.

a) Assuming that the electricity cost $C(x)$ is a linear function of the amount of electricity x used (in kWh), write a formula for $C(x)$.

b) What is the cost if no electricity 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 line through
 $(1123, 158.21), (2546, 328.97)$

b) $C(0) = 23.45$
 is the flat monthly fee

$$m = \frac{328.97 - 158.21}{2546 - 1123} = \frac{170.76}{1423} = 0.12$$

c) Slope is cost per kWh

$$y - 158.21 = 0.12(x - 1123)$$

$$y = 0.12x - 134.76 + 158.21$$

$$C(x) = 0.12x + 23.45$$

6. (20pts) A statistician is trying to establish a trend for the annual number of vehicle accident fatalities in the US. In the table, D is the number of fatalities during year x , in thousands. Solve the problems below with accuracy 6 decimal points.

a) Draw the scatterplot of the data. Does the relationship look linear?

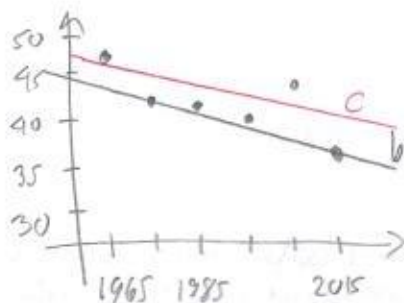
b) Use two points in the scatterplot to get an equation of a line that models the relationship between D and x . Draw the line on the graph.

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 D ?

e) How many fatalities can one expect in year 2020?

x	D
1965	47.1
1975	44.5
1985	43.8
1995	41.8
2005	43.5
2015	35.5



Seems generally linear

b) Use $(1975, 44.5)$ and $(2015, 35.5)$

$$m = \frac{35.5 - 44.5}{2015 - 1975} = \frac{-9}{40} = -\frac{9}{40} = -0.225$$

$$y - 44.5 = -0.225(x - 1975)$$

$$y = -0.225x + 444.375 + 44.5$$

$$y = -0.225x + 488.875$$

c) $y = -0.18x + 400.9$ (via calculator)

d) $r = -0.857560$ linear relationship not so strong

$$e) -0.18 \cdot 2020 + 400.9 = 37.3$$