

1. (10pts) Find the equation of the line (in form $y = mx + b$) passing through $(-4, 3)$ and is parallel to the line $3x + 2y = 8$. Draw both lines.

$$3x + 2y = 8 \quad | -3x$$

$$2y = -3x + 8 \quad | \div 2$$

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

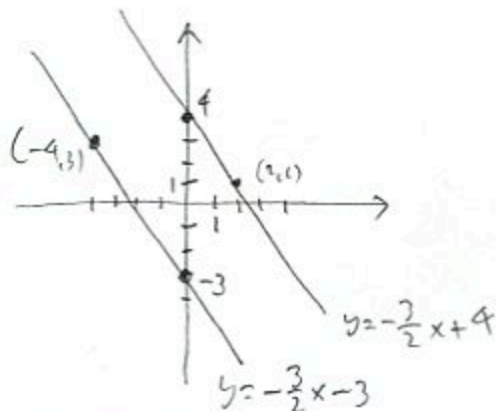
Parallel line has same slope, $m = -\frac{3}{2}$

Parallel line

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

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

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

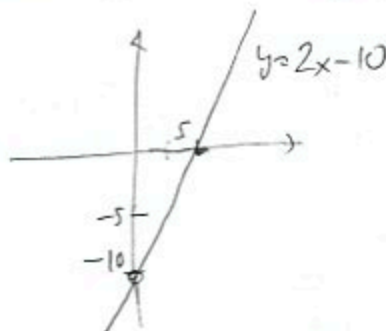


2. (4pts) Find the equation of a line that has x -intercept 5 and slope 2. Draw the graph of the line.

Passes through $(5, 0)$

$$y - 0 = 2(x - 5)$$

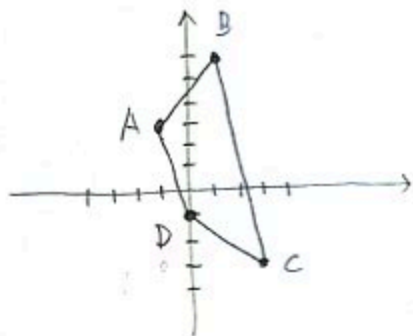
$$y = 2x - 10$$



3. (10pts) Draw the quadrangle with vertices $A = (-1, 3)$, $B = (1, 6)$, $C = (3, -3)$ and $D = (0, -1)$.

a) Find the slopes of the sides of the quadrangle.

b) Use slopes to see if any two sides are parallel or perpendicular and identify which ones are (perpendicular sides need not meet at a vertex).



$$m_{AB} = \frac{6-3}{1-(-1)} = \frac{3}{2}$$

$$m_{BC} = \frac{-3-6}{3-1} = -\frac{9}{2}$$

$$m_{CD} = \frac{-1-(-3)}{0-3} = -\frac{2}{3}$$

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

No two slopes are same, so there are no parallel sides

$$m_{CD} = -\frac{1}{m_{AB}} \text{ so sides}$$

AB and CD are

perpendicular.

4. (4pts) According to the census bureau, the median household income in Kentucky was \$41,724 in 2012, and \$46,659 in 2016. What is the average rate of change of Kentucky's median household income from 2012 to 2016? What are the units for the average rate of change?

$$\text{avg. rate of change of h. income} = \frac{46,659 - 41,724}{2016 - 2012} = \frac{4,935}{4} = 1233.75 \text{ dollars per year}$$

5. (12pts) In a big city, you twice used the same company for a cab ride. On the first occasion, you paid \$10.94 to ride 5 miles. On the second occasion, you paid \$22.77 to ride 12 miles.

- a) Assuming that the cab ride cost $C(x)$ is a linear function of the number of miles ridden x , write a formula for $C(x)$.
 b) What is the cost if you traveled zero miles? What is the meaning of this number?
 c) What is the meaning of the slope in this example?

a) Need a line through $(5, 10.94)$ and $(12, 22.77)$ b) $C(0) = 2.49$

$$m = \frac{22.77 - 10.94}{12 - 5} = \frac{11.83}{7} = 1.69$$

is start-up cost, the amount it costs just to enter the cab,

$$y - 10.94 = 1.69(x - 5)$$

c) Slope is cost per mile traveled

$$y = 1.69x - 8.45 + 10.94$$

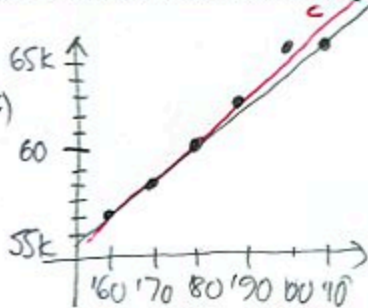
$$y = 1.69x + 2.49$$

$$C(x) = 1.69x + 2.49$$

6. (20pts) A statistician is trying to establish a relationship between McCracken county's population P and year t . In the table, P is McCracken county's population and t is the year. 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 t . 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 P and t ?
 e) What population can the statistician expect in year 2020?

t	P
1960	57,306
1970	58,281
1980	61,310
1990	62,879
2000	65,514
2010	65,565



It looks linear

b) Use first and last points, $m = \frac{65,565 - 57,306}{2010 - 1960}$

$$= \frac{8259}{50} = 165.18$$

$$y - 57,306 = 165.18(x - 1960)$$

$$y = 165.18x - 266,446.8$$

c) $y = 184.465714x - 304,355.2762$

d) $r = 0.980406$ - close to 1, so strong linear relationship

e) $184.465714 \cdot 2020 - 304,355.2762 = 68,265.467$ Expect to see population of about 68,265.