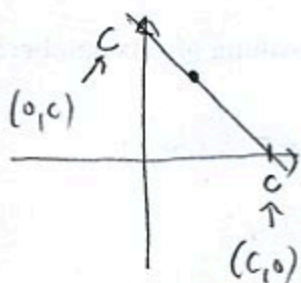1. (6pts) Find the equation of a line whose x- and y-intercepts are the same nonzero number c and which passes through point $(2, 5)$. Draw the graph of the line.

Computing slope using the intercepts:

$(0,c)$

$(c,0)$

$$m = \frac{0-c}{c-0} = \frac{-c}{c} = -1$$

$$y - 5 = -1(x-2)$$
$$y = -x + 2 + 5$$
$$y = -x + 7$$

2. (10pts) Find the equation of the line (in form $y = mx + b$) passing through $(-4, 3)$ that is perpendicular to the line $3x - 4y = 12$. Draw both lines.

$$3x - 4y = 12$$
$$-4y = -3x + 12 \quad | \div (-4)$$
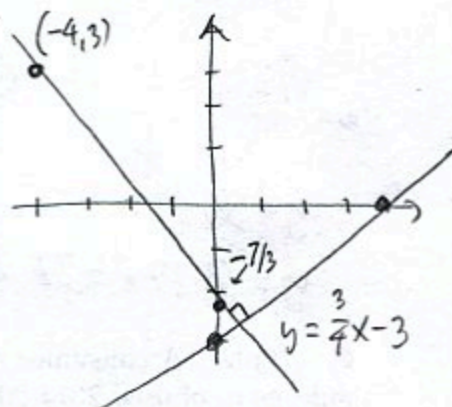$$y = \frac{-3x + 12}{-4}$$
Slope $= \frac{3}{4}$
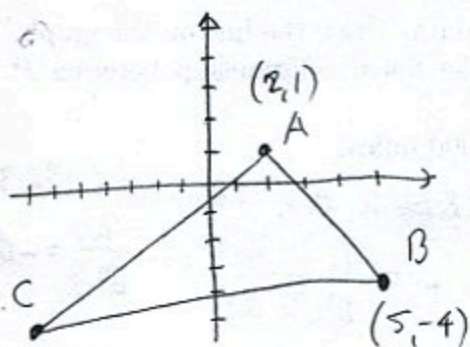$$= \frac{3}{4}x - 3$$

Slope of perp. line: $-\frac{4}{3}$

$$y - 3 = -\frac{4}{3}(x - (-4))$$
$$y = -\frac{4}{3}x - \frac{16}{3} + 3$$
$$y = -\frac{4}{3}x + \frac{7}{3}$$

$(-4,3)$

$-7/3$

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

3. (8pts) Draw the triangle with vertices $A = (2, 1)$, $B = (5, -4)$ and $C = (-7, -5)$.
a) Find the slopes of the sides of the triangle.
b) Use slopes to check if the triangle is a right triangle.

$(2,1)$
A
B
$(5,-4)$
C
$(-7,-5)$

$$m_{AB} = \frac{-4-1}{5-2} = -\frac{5}{3}$$

$$m_{BC} = \frac{-5-(-4)}{-7-5} = \frac{-1}{-12} = \frac{1}{12}$$

$$m_{AC} = \frac{-5-1}{-7-2} = \frac{-6}{-9} = \frac{2}{3}$$

no two slopes are opposite reciprocal, hence no two sides are perpendicular

4. (4pts) According to the Bureau of Transportation Statistics, the the number of passenger vehicles registered in the US was 193,980,000 in 2009, and 187,555,000 in 2014. What is the average rate of change of the number of passenger vehicles registered in the US from 2009 to 2014? What are the units for the average rate of change?

$$\text{avg. rate of change} = \frac{187,555,000 - 193,980,000}{2014 - 2009} = \frac{-6,425,000}{5} = -1,249,000 \text{ cars per year}$$

5. (12pts) The water bill for a family was \$59.83 in a month when it used 10 HCF (hundred cubic feet) of water. In another month, it used 15 HCF and was billed \$75.93.
a) Assuming that the water cost $C(x)$ is a linear function of the amount of water x used (in HCF), 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 a line through
$$ x C$$
$(10, 59.83)$
$(15, 75.93)$

$$m = \frac{75.93 - 59.83}{15 - 10} = \frac{16.10}{5} = 3.22$$

$$y - 59.83 = 3.22(x - 10)$$
$$y = 3.22x - 32.2 + 59.83 = 3.22x + 27.63$$

$C(x) = 3.22x + 27.63$

b) $C(0) = 27.63$
 monthly flat fee

c) Water costs \$3.22 per HCF.

6. (20pts) A consumer is trying to establish a relationship between the sale price P and mileage m of used 2014-2016 Camry SEs. In the table, P is the price of the car in thousands and m is the mileage 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 P and m. 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 m?
e) What price can the consumer expect for a car with 75,000 miles?

m	P
45	15.6
49.5	15.7
76.6	14.6
81.5	13.6
108.3	12.7
108.7	12.4
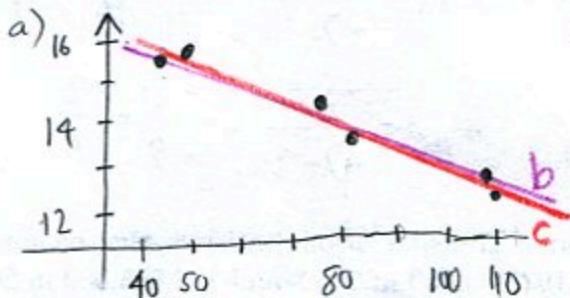
a)
Yes, it looks linear.

b) Use $(45, 15.6)$ and $(108.3, 12.7)$
$$m = \frac{12.7 - 15.6}{108.3 - 45} = -\frac{2.9}{63.3} = -0.0458136$$
$$y - 15.6 = -0.0458136(x - 45)$$
$$y = -0.0458136x + 2.061611 + 15.6$$
$$y = -0.0458136x + 17.661611$$

c) $y = -0.050895x + 18.083385$

d) $r = -0.981121$, close to -1, strong linear relationship -

e) $-0.050895 \cdot 75 + 18.083385 = 14.26626$ About 14,266 dollars