Algebra and Trigonometry — Joysheet 4
MAT 150, Fall 2013 — D. Ivanšić

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1. (6pts) Find the equation of the line (in form $y = mx + b$) whose x-intercept is 4, and y-intercept is 7.

Line passes through $(4,0)$ and $(0,7)$

$m = \frac{7-0}{0-4} = -\frac{7}{4}$

$y - 0 = -\frac{7}{4}(x-4)$

$y = -\frac{7}{4}x + 7$

2. (10pts) Find the equation of the line (in form $y = mx + b$) that is perpendicular to the line $4x - 5y = 6$, and passes through point $(-1,3)$. Draw both lines.

$4x - 5y = 6$

$-5y = -4x + 6 \quad | \div(-5)$

$y = \frac{4}{5}x - \frac{6}{5}$

slope is $\frac{4}{5}$

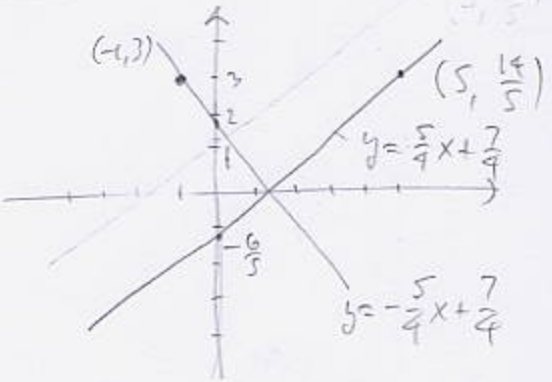
perpendicular line has slope

$-\frac{1}{\frac{4}{5}} = -\frac{5}{4}$

Equation:

$y - 3 = -\frac{5}{4}(x - (-1))$

$y = -\frac{5}{4}x - \frac{5}{4} + 3 = -\frac{5}{4}x + \frac{7}{4}$



3. (10pts) Use slopes of lines to find out whether the quadrangle with vertices (in clockwise order) $A = (-6,-2)$, $B = (-2,3)$, $C = (1,7)$, $D = (-3,2)$ is a parallelogram. (A parallelogram is a quadrangle whose opposite sides are parallel.)

Slope of $AB = \frac{3-(-2)}{-2-(-6)} = \frac{5}{4}$

Slope of $CD = \frac{2-7}{-3-1} = \frac{-5}{-4} = \frac{5}{4}$

} are equal so AB, CD are parallel.

Slope of $BC = \frac{7-3}{1-(-2)} = \frac{4}{3}$

Slope of $AD = \frac{2-(-2)}{-3-(-6)} = \frac{4}{3}$

} are equal, so BC and AD are parallel

It is a parallelogram.

4. (4pts) The number of students enrolled at MSU increased from 10,025 in 2008 to 10,832 in 2013. Find the average rate of change (specify the units) in the number of students from 2008 to 2013.

average rate of change $= \frac{10,832 - 10,025}{2013 - 2008} = \frac{807}{5} = 161.4$ students/year

5. (10pts) Millie's Kitchen bought restaurant equipment whose value after three years was estimated at \$12,550. It expects the equipment to last 12 years, at which time they expect to be able to sell it for \$2,200. For tax purposes, they need to know the estimated value $V(t)$ in every year of operation.

a) Write a formula for $V(t)$, assuming that it is a linear function (that is, the value decreases by the same amount every year).

b) How much did they pay for the equipment when it was new?

c) What is the estimated value of the equipment after 9 years?

a) Need line through $(3, 12{,}550)$ and $(12, 2200)$

$$m = \frac{2200 - 12550}{12 - 3} = \frac{-10{,}350}{9} = -1150$$

$$y - 2200 = -1150(x - 12)$$

$$y = -1150x + 13800 + 2200$$

$$y = -1150x + 16000$$

$V(t) = -1150t + 16000 = 16000 - 1150t$

b) $V(0) = 16000$ value when new.

c) $V(9) = 16000 - 1150 \cdot 9 = 5650$ value after 9 years

6. (20pts) A human resources employee tracks the salary of a manager's position in order to model the relationship between time spent with the company and the salary. The table shows the data, where S is the salary (in thousands), and T is the number of years in employment with the company.

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 T and S. Draw the line on the graph.

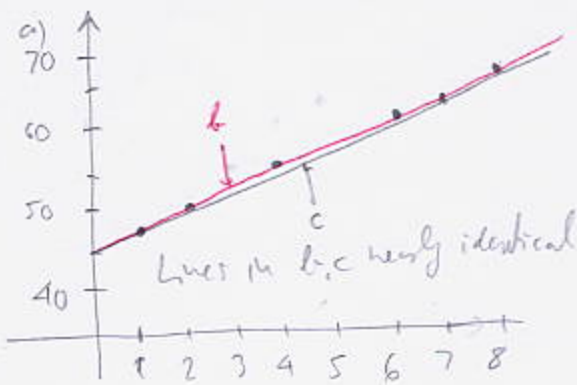
c) Use your calculator to find the "line of best fit" for the data. Draw the line on the graph.

d) Find the coefficient of correlation r. How strong is the linear relationship between T and S?

e) What salary can the manager expect after 11 years with the company?

T	S
1	47.1
2	49.7
4	55.0
6	59.7
7	61.9
8	64.5

a)



Lines nearly identical

Yes, the relationship looks linear

b) Take line through $(2, 49.7)$ and $(8, 64.5)$

$$m = \frac{64.5 - 49.7}{8 - 2} = \frac{14.8}{6} = 2.466667$$

$$y - 49.7 = 2.466(x - 2)$$

$$y = 2.466667x + 44.766667$$

c) $y = 2.469492x + 44.792373$

d) $r = 0.999628$ strongly linear

e) $y(11) = 71.956782$, about \$71,957