College Algebra — Joysheet 3
MAT 140, Fall 2024 — D. Ivanšić

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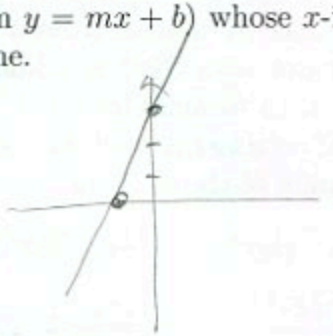
Covers: 1.3, 1.4 *Show all your work!*

1. (5pts) Find the equation of the line (in form $y = mx + b$) whose x-intercept is -1, and whose y-intercept is 3. Draw the graph of the line.

Line passes through $(-1,0)$ and $(0,3)$

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

↑ y-int is 3



2. (10pts) Find the equation of the line (in form $y = mx + b$) passing through $(3, -2)$ that is perpendicular to the line $2x + 3y = 9$. Draw both lines.

$2x+3y=9$

$3y = -2x+9$

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

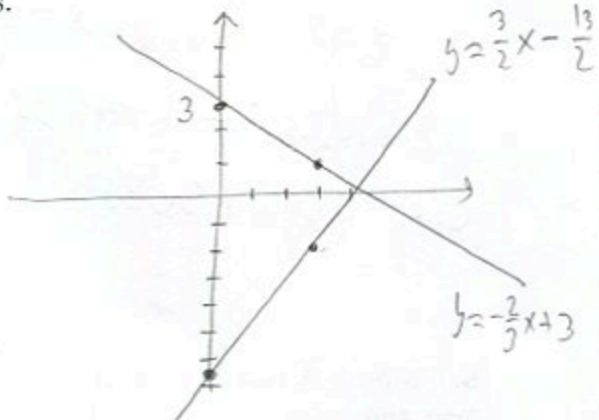
Slope of given line: $-\frac{2}{3}$

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

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

$y+2 = \frac{3}{2}x - \frac{9}{2}$

$y = \frac{3}{2}x - \frac{13}{2}$

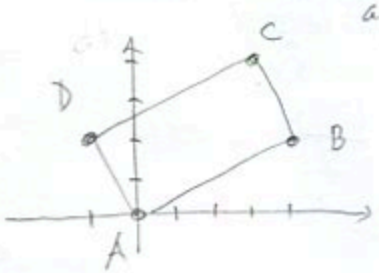


3. (9pts) Draw the quadrilateral with vertices $A = (0,0)$, $B = (4,2)$, $C = (3,4)$ and $D = (-1,2)$ in the coordinate plane.

a) Find the slopes of the sides AB, BC, CD and AD of the quadrilateral.

b) Which pairs of sides, if any, are parallel, and which are perpendicular?

c) Is the quadrilateral a rectangle?



a) $m_{AB} = \frac{2-0}{4-0} = \frac{2}{4} = \frac{1}{2}$

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

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

$m_{AD} = \frac{2-0}{-1-0} = \frac{2}{-1} = -2$

b) AB, CD have same slopes → parallel

AD, BC have same slopes → parallel

slope of AB is opposite reciprocal of BC, AD

slope of CD — — — — of BC, AD

AB is perp. to AD, BC

CD is perp to AD, BC

c) quadrilateral is a rectangle

4. (4pts) On a certain date in 2021 Walmart's stock price was \$46.44, and on the same date in 2024, it was \$67.48. What is the average rate of change of the price of Walmart's stock from 2021 to 2024? What are the units for the average rate of change?

avg rate of chg $= \frac{67.48 - 46.44}{2024 - 2021} = \frac{21.04}{3} = 7.013333$ dollars per year

5. (12pts) The water bill for a household was \$45.35 in a month when it used 25 hundred-gallons of water. In another month, it used 46 hundred-gallons and was billed \$57.11.
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 a line through $(25, 45.35)$ and $(46, 57.11)$

$m = \frac{57.11 - 45.35}{46 - 25} = \frac{11.76}{21} = 0.56$

$y - 45.35 = 0.56(x - 25)$

$y = 0.56x - 14 + 45.35$

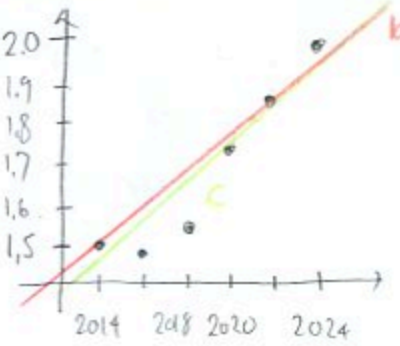
$C(x) = 0.56x + 31.35$

b) $C(0) = 31.35$, is the flat monthly fee, paid even if no water is used

c) Slope is cost per hundred-gallons of water

6. (20pts) A market researcher is considering the average price-per-pound of whole chicken over the years. Below is the data for July prices of the corresponding year. Solve the problems below with accuracy 6 decimal points.
a) Draw the scatterplot of the data. Does the relationship look linear? Yes, it does
b) Use two points in the scatterplot to get an equation of a line that models the relationship between x and P. 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 coefficient of correlation r. How strong is the linear relationship between x and P?
e) What average price-per-pound of whole chicken can we expect in July of 2027?

x	P
2014	1.50
2016	1.45
2018	1.52
2020	1.71
2022	1.88
2024	1.98



b) Use $(2014, 1.5)$ and $(2022, 1.88)$

$m = \frac{1.88 - 1.5}{2022 - 2014} = \frac{0.38}{8} = 0.0475$

$y - 1.5 = 0.0475(x - 2014)$

$y = 0.0475x - 95.665 + 1.5 = 0.0475x - 94.165$

c) $y = 0.055429x - 110.236952$ From calculator

d) $r = 0.943614$ close to 1 strong linear rel.

e) $0.055429 \cdot 2027 - 110.236952$
$= 2.116762$, about \$2.12