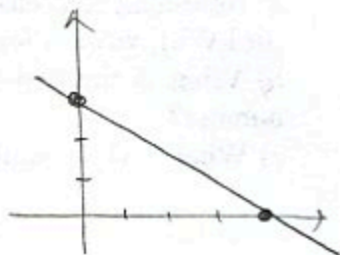**1.** (5pts) Find the equation of the line (in form $y = mx + b$) whose x-intercept is 4 and y-intercept is 3. Draw the graph of the line.

Line through $(4,0)$ and $(0,3)$

$$m = \frac{3-0}{0-4} = \frac{3}{-4} = -\frac{3}{4}$$

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

↑ since we know the y-int

2. (10pts) Find the equation of the line (in form $y = mx + b$) passing through $(1, -5)$ that is perpendicular to the line $5x + 3y = 12$. Draw both lines.

Given line: Slope of perp. line is $\frac{3}{5}$

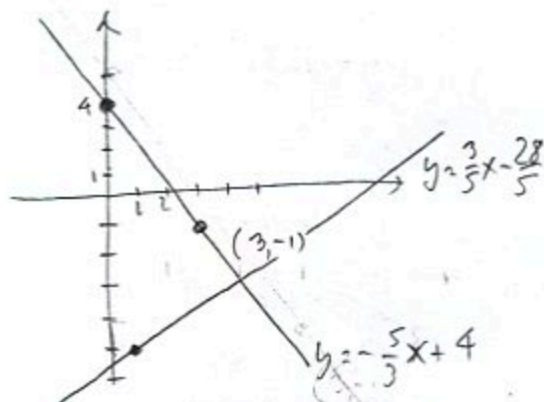$$5x + 3y = 12$$
$$3y = -5x + 12 \quad |\div 3$$
$$y = -\frac{5}{3}x + 4$$
slope $= -\frac{5}{3}$

$$y - (-5) = \frac{3}{5}(x - 1)$$
$$y + 5 = \frac{3}{5}x - \frac{3}{5}$$
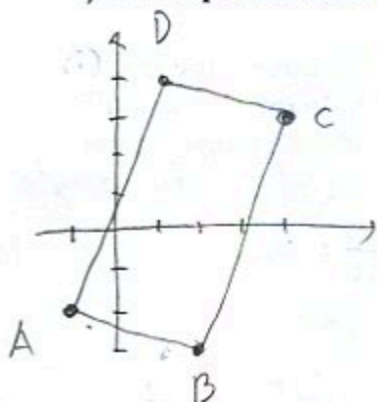$$y = \frac{3}{5}x - 5 - \frac{3}{5}$$
$$y = \frac{3}{5}x - \frac{28}{5}$$

$y = \frac{3}{5}x - \frac{28}{5}$

$(3, -1)$

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

3. (9pts) Draw the quadrilateral with vertices $A = (-1, -2)$, $B = (2, -3)$, $C = (4, 3)$ and $D = (1, 4)$.
a) Find the slopes of the sides of the quadrilateral.
b) Use slopes to check if the quadrilateral is a parallelogram (opposing sides parallel).
c) If the quadrilateral is a parallelogram, use slopes again to check if it is a rectangle.

a) $m_{AB} = \dfrac{-3-(-2)}{2-(-1)} = \dfrac{-1}{3} = -\dfrac{1}{3}$

$m_{BC} = \dfrac{3-(-3)}{4-2} = \dfrac{6}{2} = 3$

$m_{CD} = \dfrac{4-3}{1-4} = \dfrac{1}{-3} = -\dfrac{1}{3}$

$m_{AD} = \dfrac{4-(-2)}{1-(-1)} = \dfrac{6}{2} = 3$

b) It is a parallelogram because AB and CD } have same slopes, BC and AD so are parallel

c) It is a rectangle because slopes of AB and BC AD and CD are opposite reciprocal, therefore perpendicular

4. (4pts) According to government data, the price (on average) of a pound of chicken breast was \$4.71 in August of 2022, and \$4.41 in April of 2023. What is the average rate of change of the price of a pound of chicken breast from August 2022 to April 2023? (Time is measured in months here.) What are the units for the average rate of change?

August to April is 8 months

avg. rate of price change $= \dfrac{4.41 - 4.71}{8} = -\dfrac{0.30}{8} = -0.0375$ dollars per month

5. (12pts) The electric bill for a household was \$125.28 in a month when it used 850 kWh (kilowatt-hours) of electricity. In another month, it used 1640 kWh and was billed \$227.98.
a) Assuming that 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 a line through $(850, 125.28), (1640, 227.98)$

$$m = \frac{227.98 - 125.28}{1640 - 850} = \frac{102.7}{790} = 0.13$$

b) $C(0) = 14.78$
It is the flat monthly fee

$y - 125.28 = 0.13(x - 850)$

$y - 125.28 = 0.13x + 0.13 \cdot 850$

$y = 0.13x - 110.5 + 125.28$

$y = 0.13x + 14.78$

$C(x) = 0.13x + 14.78$

c) Slope is 0.13.
It means electricity cost is 0.13 dollars per kWh

6. (20pts) An entomologist is trying to establish a connection between how quickly a certain species of a cricket chirps and the temperature. In the table, T is the temperature recorded in °F when a cricket was observed chirping x times in 15 seconds. 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 x 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 coefficient of correlation r. How strong is the linear relationship between x and T?
e) If we observe a cricket chirping 31 times in 15 seconds, what is the estimated temperature?

x	T
13	55
20	57
26	62
36	72
37	76
38	74

a)
looks linear
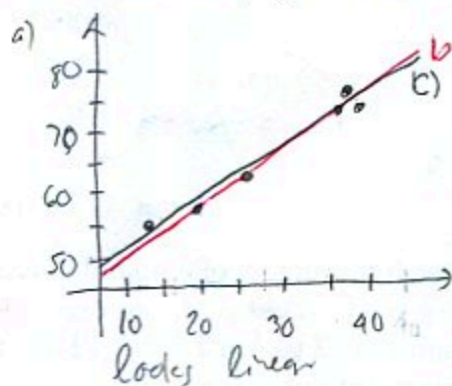
b) Use $(20,57)$ and $(36,72)$, For example
$$m = \frac{72-57}{36-20} = \frac{15}{16} = 0.9375$$

$y - 57 = 0.9375(x - 20)$

$y = 0.9375x - 18.75 + 57$

$y = 0.9375x + 38.25$

c) $y = 0.861663x + 41.586228$

d) $r = 0.976947$ close to 1
so strong linear relationship

e) plug $x = 15$ into c)
$0.861663 \cdot 15 + 41.586228 = 68.297767$
about 68°F.