LINEAR MODELS

MODEL PROBLEM GUIDELINES

1. Read the problem **CAREFULLY!**
2. Determine your **INDEPENDENT VS. THE DEPENDENT** variable. This is the trickiest part, and the most important part.
3. Use your given information to **WRITE A LINEAR FUNCTION**. This will be easy for you, since you have been writing equations of lines. Start in point slope form, like usual, but your answer should always be in slope-intercept form, unless otherwise stated.

TIPS FOR DETERMINING THE INDEPENDENT AND DEPENDENT VARIABLE:

Remember that **the output depends on the input**. Here are some phrases you may see that give you a hint about the independent vs. dependent variable:

- The output **is a function** of the input.
    - "y" is a function of "x" – Ex) "distance" is a function of "time"
- The output **depends** on the input.
    - "y" depends on "x" – Ex) "price" depends on the "no. of items sold"
- The output **varies linearly** with the input.
    - "y" varies linearly with "x" – Ex) "cost" varies linearly with "time"

THE DRIVING HOME PROBLEM:

"As you drive home from the football game, the number of kilometers you are away from home depends on the number of minutes you have been driving. Suppose that you are 11 km from home when you have been driving for 10 minutes, and 8 km from home when you have been driving for 15 minutes."

What is the independent variable (the input)?

time → the number of minutes you drive

What is the dependent variable (the output)?

distance → the distance you are from home

Define your variables and write down the ordered pairs. Try not to use x and y all the time. Think of other letters that could represent the input and output for that particular problem.

t = time in minutes

d = distance in km from home

(min, km)

(10, 11) (15, 8)

Determine the independent and dependent variable. Then list the ordered pairs.

1. "The number of napkins used in school varies linearly with the number of hot lunche served at the cafeteria. In the first week of school, 1,250 napkins were used when 925 hot lunches were served. In the second week, 1,425 napkins were used when 1,100 hot lunches were served."

   L = # of lunches (ind.)   (925, 1250)

   n = # of napkins (dep.)   (1100, 1425)

2. "A person's shoe size is a function of their height, in inches. A man with a size 10 shoe is 6 ft tall. A woman with a size 6.5 shoe is 5.5 ft tall."

   6ft = 72in   5.5ft = 66in

   h = height in inches   (72, 10)

   s = shoe size   (66, 6.5)

THE DONUT PROBLEM

3. "The price you pay for a box of donuts varies linearly with the number of donuts in the box. For 5 donuts the price is $1.15, and for 11 donuts it is $2.35.

   Define the variables: **Set-up the ordered pairs**

   d = # of donuts   (5, 1.15)

   p = price   (11, 2.35)

   a. Write the particular equation, expressing price in terms of number of donuts.

   Find slope: $\frac{2.35 - 1.15}{11 - 5} = \frac{1.20}{6} = .20$ ← slope!

   This is a unit rate 20¢/1 donut

   $p - 1.15 = .20(d - 5)$ $\boxed{p = .20d + .15}$

   $p - 1.15 = .20d - 1$

   b. Predict the price of a box containing 3 donuts   d = 3 ← plug in

   $p = .20(3) + .15$

   $p = .60 + .15$

   $p = .75$ $\boxed{75¢}$

c. If a box costs $3.15, how many donuts would you expect it to contain?

$p = 3.15 \leftarrow$ plug in

$3.15 = .20d + .15$

$3 = .20d$

$d = 15$

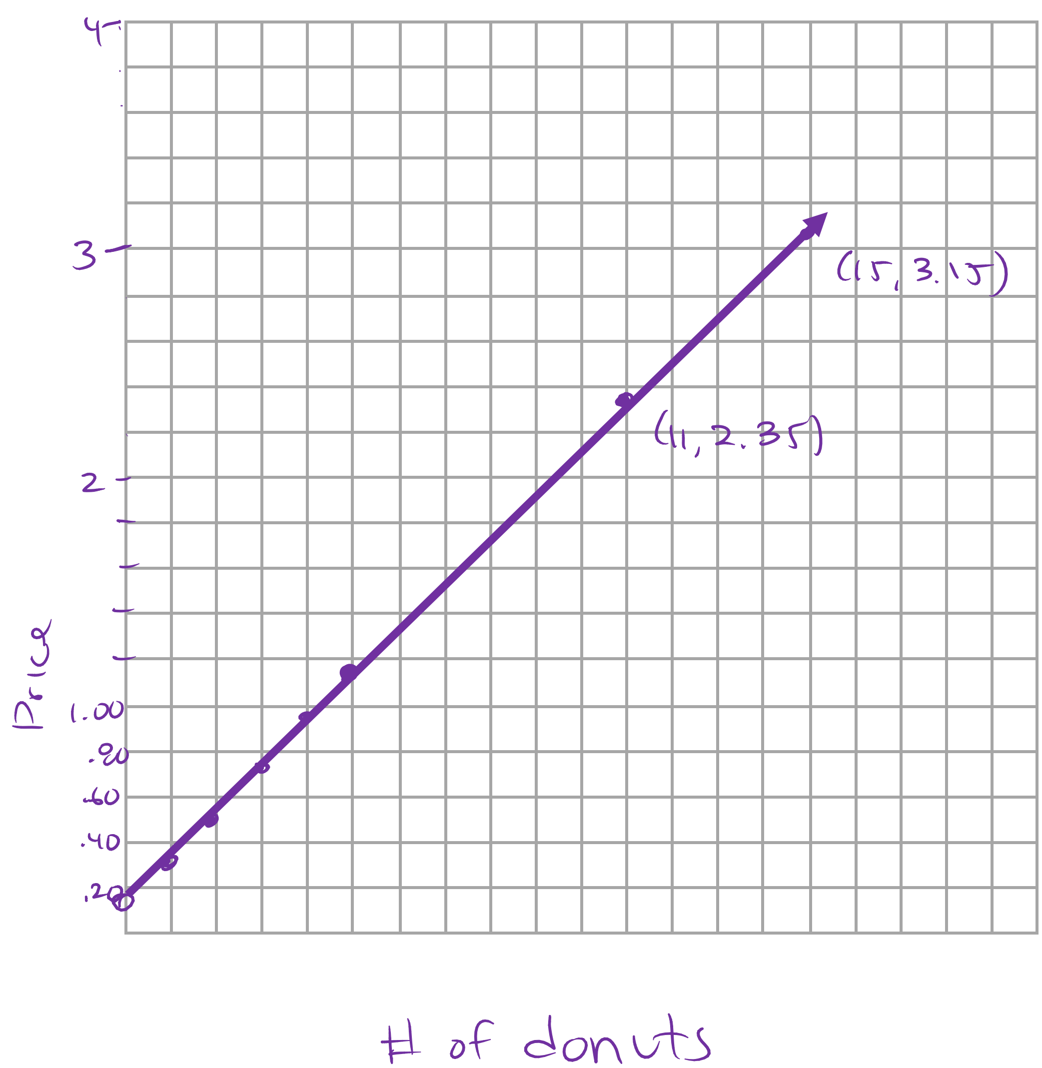
$\boxed{\text{15 donuts}}$

d. Tell the real-world meanings of the slope and the price-intercept.

Slope: $\frac{\$.20}{1 \text{ donut}}$ You pay an additional 20¢ per donut.

p-intercept: (0, .15) A fee for the box.

e. Sketch a graph of this linear function.



RULES FOR GRAPHING

1) The graph must be at least a half sheet of paper. The larger the graph the prettier they are.
2) Label your axes and include the units!
3) Show a scale for each axis. They do not have to be the same.
4) Place some effort into your graphs!

(15, 3.15)

(0, .15)

(5, 1.15)

(11, 2.35)

20 − 5