Name _Solutions_____

Graphing Review

Introduction
Line graphs compare two variables. Each variable is plotted along an axis. A line graph has a vertical axis and a horizontal axis. For example, if you wanted to graph the height of a ball after you have thrown it, you would put time along the horizontal, or x-axis, and height along the vertical, or y-axis.

Line graphs are important in science for several reasons such as:
- showing specific values of data. If one variable is known, the other can be determined.
- showing trends and relationships in data clearly. They visibly depict how one variable is affected by the other as it increases or decreases.
- allowing the viewer to make predictions within recorded data, called **interpolation**, and to make predictions about data not yet recorded, called **extrapolation**.

Interpolation vs. Extrapolation
Determine which of the examples below is interpolation and which is extrapolation. Explain why.
1. The value of Sarah's car in 2004 was $17,500. _interpolation. 2004 was measured at that time._
2. The value of Sarah's car in 2017 is $1,900. _extrapolation. 2017 hasn't happened yet, it's in the future._

How to Construct a Line Graph:
1. Identify the Variables & Label the Axes
   a. **Independent Variable** – factor that is varied in an experiment and specifically controlled by the experimenter
      i. Label along the x-axis (horizontal) – include units
      ii. Typically found on the left side of a data table
   b. **Dependent Variable** – factor that is measured in an experiment and will change as a result of the independent variable
      i. Label along the y-axis (vertical) – include units
      ii. Typically found on the right side of a data table


Independent vs. Dependent Variable Practice
- A student wanted to observe how changing the temperature of the aquarium water would affect the breathing rate of his goldfish.
  o What is the independent variable? _temperature of the water_
  o What is the dependent variable? _breathing rate_
- A student wanted to determine how tall corn would grow if different types of fertilizer were used.
  o What is the independent variable? _type of fertilizer_
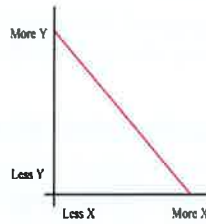 o What is the dependent variable? _height of the corn_

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2. Determine the Graph Scale
   a. Determine the magnitude (numeric value) of each variable
   b. Establish a scale that best fits the range of each variable
   c. Spread the graph to use the MOST available space (use at least ¾ of the graph)
   d. Be consistent throughout each axes' scale
3. Plot the data points
   a. Plot each data value on the graph with a dot
   b. If multiple sets of data are being plotted, use different colored lines and include a key
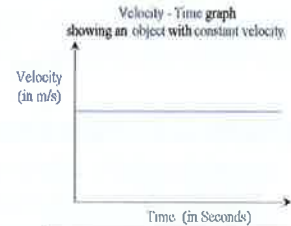
Name_____

4. Draw the Graph
    a. DO NOT connect the dots unless specifically told to do so
    b. Draw one of the following types of graphs:
        i. Best fit Straight Line
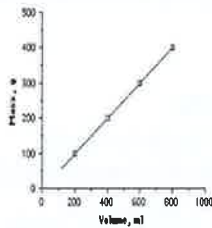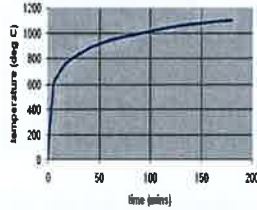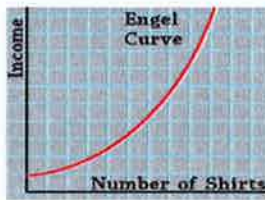

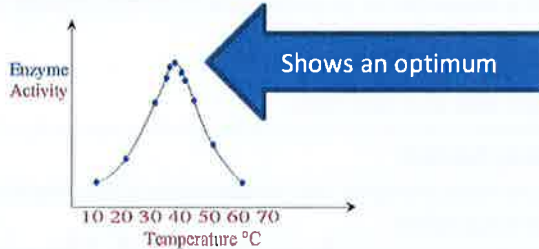| DIRECT RELATIONSHIP -Both variables increase together | INDIRECT RELATIONSHIP -As one variable increases, the other decreases | CONSTANT RELATIONSHIP -Change in one variable has no effect on the other |

        ii. Best fit Curved Line

        iii. Best fit Peak Line

Shows an optimum

5. Title the Graph

    • Include a descriptive title that explains what kind of plot it is, the technique that was used, which substance was measured, and what instrument was used to measure it.
    • IMPORTANT: Titles should not include (or be) "Plot of...", "Graph of...", or "...over a range of data points." - Be concise, but complete.

Graphing information can be found in your textbook on p. 815.

Graphing Practice

Practice Problem #1

Background: The thickness of the annual rings indicates what type of environmental situation was occurring the time of the tree's development. A thin ring usually indicates a rough period of development such as lack of water, forest fires, or insect infestation. On the other hand, a thick ring means a prosperous period of development. Use the information from the data table below to create a proper scientific graph and to answer the corresponding questions.

Age of Trees (in years)	Average Thickness of Annual Rings in Forest A (millimeters)	Average Thickness of Annual Rings in Forest B (millimeters)
10	20	24
20	24	28
30	30	35
35	34	38
50	41	45
60	46	51

1. What is the dependent variable? _thickness_
2. What is the independent variable? _Age of trees_
3. What was the average thickness of annual rings for 40 year old trees in Forest A? _(see graph)_ _36 mm_
4. What is it called when you make predictions within given data, such as made in question #3? _interpolation_
5. What was the mean thickness of annual rings for all trees found in Forest B? _(24+28+35+38+45+51 mm)/6 = 37 mm_
6. Based on the data shown, what can be concluded about the comparative health of Forest A & B? _Forest B is healthier because the average thickness of rings is consistently larger_
7. What type of relationship (constant, direct, or indirect) exists between the age of trees and the average thickness of the tree's rings? Explain. _Direct. There is a straight line that can be drawn between the points._

Use PENCIL to make graph!

Avg. Thickness of Annual Rings (mm)

Age of trees (yr)
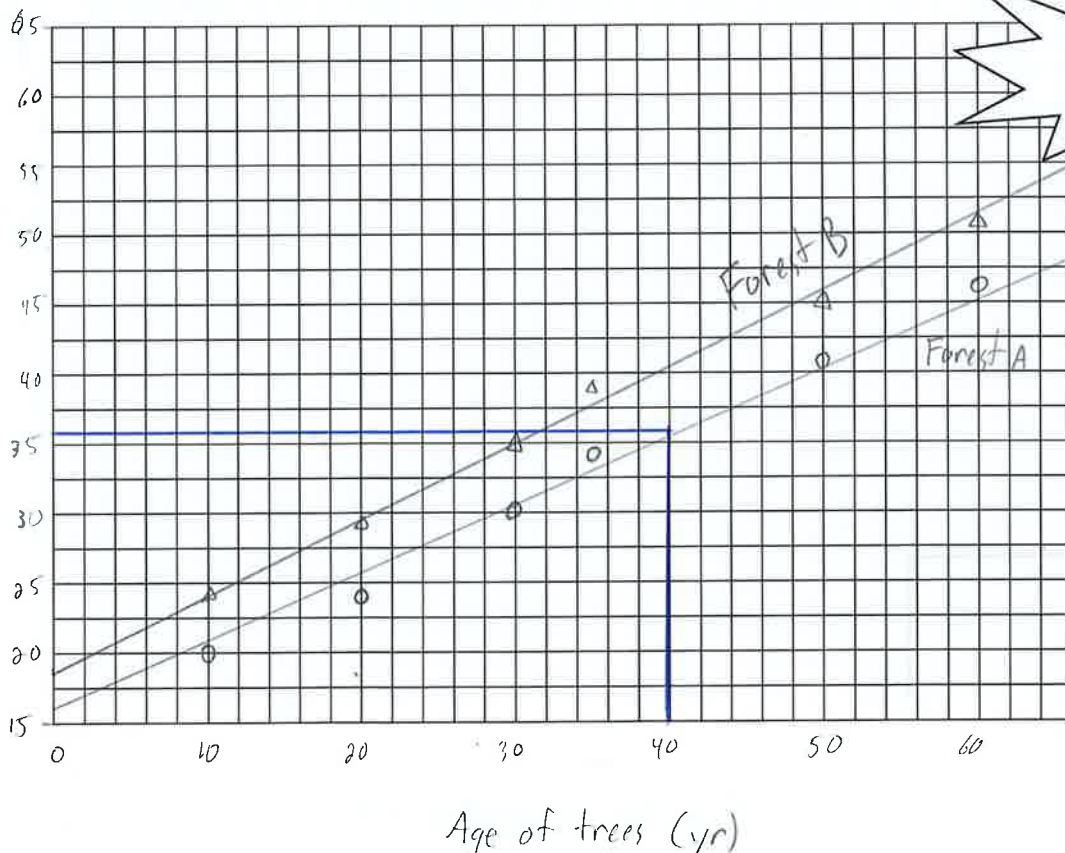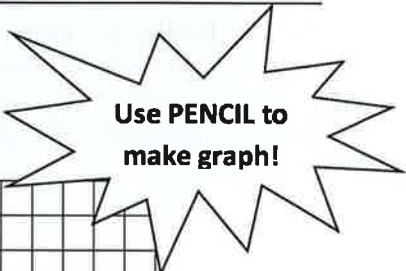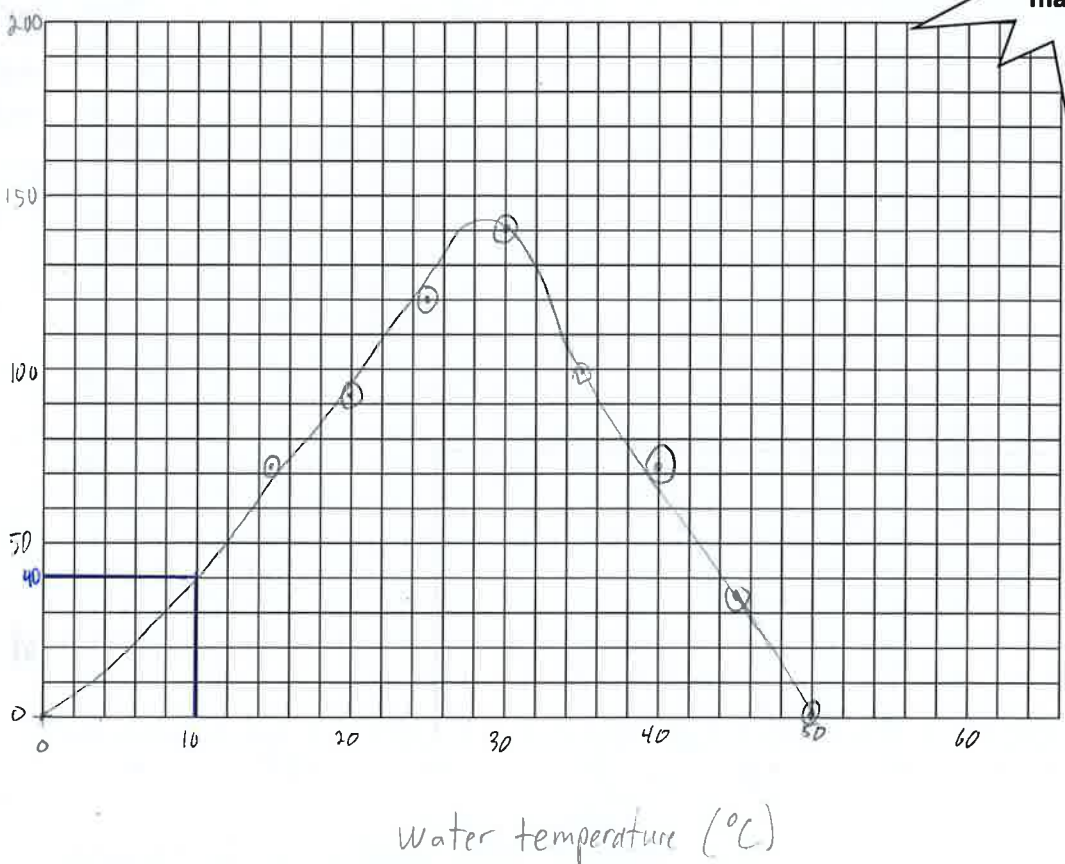
Practice Problem #2

Background: Clams were placed into various temperatures of water. Use the information in the data table below in order to create a proper scientific graph and to answer the corresponding questions.

Water Temperature (°C)	Number of Developing Clams
15	72
20	92
25	120
30	140
35	99
40	72
45	36
50	0

1. What is the dependent variable? _Number of clams_
2. What is the independent variable? _Water temp._
3. What is the optimum temperature for clam development? _29°C_
4. What is the mean number of clams per sample? _(72+92+120+140+99+72+36+0)/8 = 79_
5. Approximately how many clams would be developing in 10 degree Celsius water? _(See graph)_ _40 clams_
6. What is it called when you make predictions about data not yet recorded, such as the prediction we made in question number 5? _extrapolations_

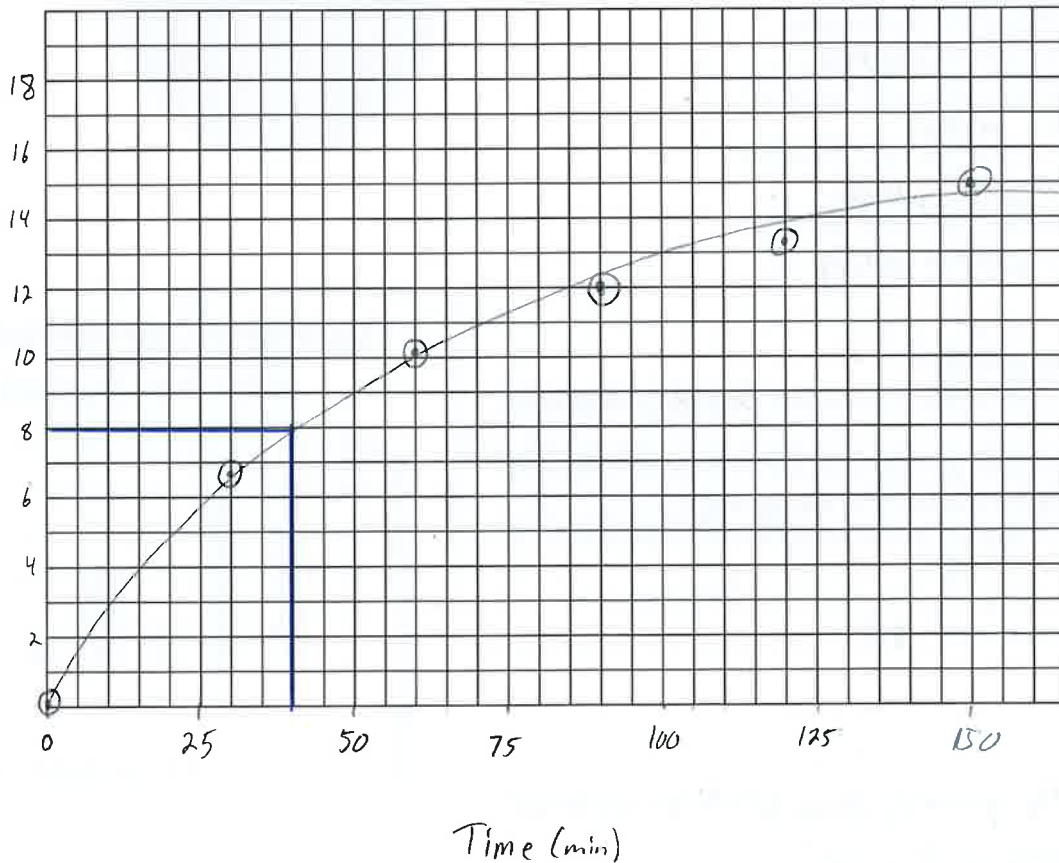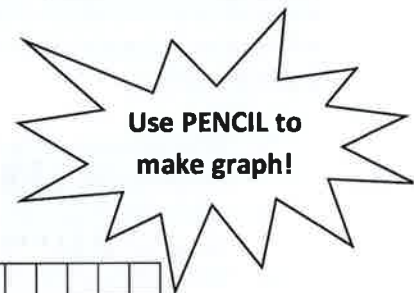**Use PENCIL to make graph!**

Number of Clams

Water temperature (°C)

Practice Problem #3

Background: Natalie sets out to run 15 kilometers. Every 30 minutes she checked her pedometer to determine how far she had run. Use the data below to create a proper scientific graph and to answer the corresponding questions.

Time (minutes)	Total Distance (km)
0	0
30	6.8
60	10.1
90	12
120	13.3
150	15

1. What is the dependent variable? _Total distance_
2. What is the independent variable? _Time_
3. How many kilometers had Natalie run after 40 minutes? _(see graph)_ _8 km_
4. What was Natalie's average speed (in kilometers per hour) over the course of her run? _6.0 Km/hr_
   Use the formula Speed = Distance / Time

$$speed = \frac{distance}{time}$$

$$= \frac{15 \ km}{150 \ m/n} \times \frac{60 \ m/n}{1 \ hr}$$

$$= 6 \ ^{km}/_{hr}$$

Use PENCIL to make graph!

Time (min)
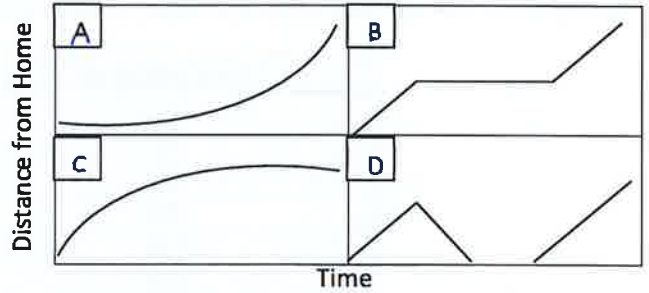
Practice #4

Background: Match each story on the left with the graph it represents on the right. Each graph compares the distance a car is from home compared to time.

D 1. I had just left home when I realized I had forgotten my books, so I went back to pick them up.

C 2. The battery on my electric car started to run down.

B 3. Things went fine until I had a flat tire.

A 4. I started out calmly, but sped up when I realized I was going to be late.


Practice Problem #5

Background: The pie chart shows the approximate percentages teenagers spend doing various activities in a day. Use the information in the pie chart to answer the questions below.

Teenage Actitivies in a Day

1. What percent of the day is spent watching TV? _13%_
2. How many hours are spent sleeping? _$0.33 \times 24 = 8hr$_
3. What activity takes up the least amount of time? _Studying_
4. What activity takes up a quarter of the day? _School_
5. What two activities take up 50% of the day? _sleep + phone_
6. What two activities take up 25% of the day? _phone + eating_
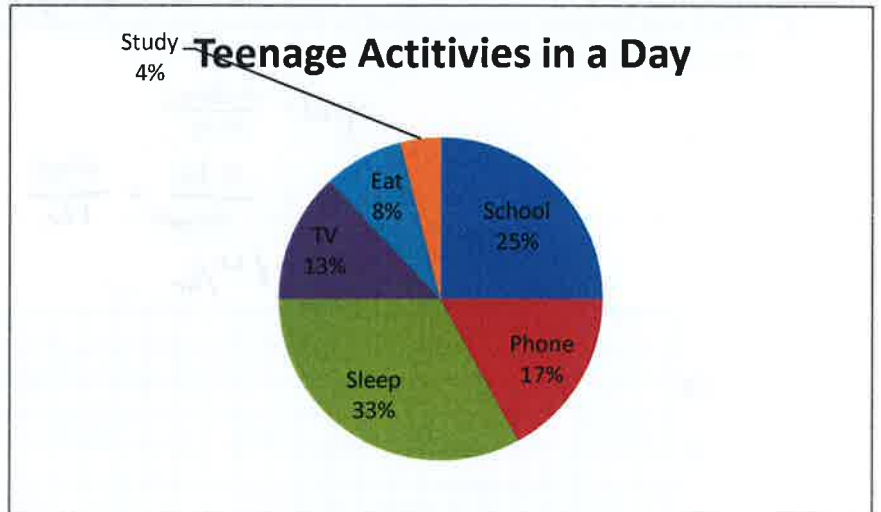
Practice Problem #6

1. What is the dependent variable? _Quantity demanded_

2. Does the price per bushel always increase with demand? _Question is asked the wrong way!_

3. What is the quantity demanded when the price is $5 per bushel? _10_

4. What is the price per bushel when the quantity demanded is 80? _$2_

Quantity Demanded vs. Price Per Bushel
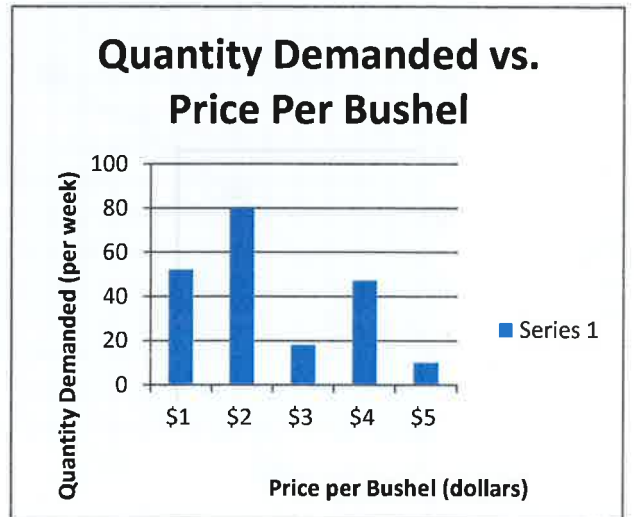
→ Does the quantity demanded always increase/ decrease with price?

No, the quantity changes both up and down as the price per bushel increases. (no pattern).