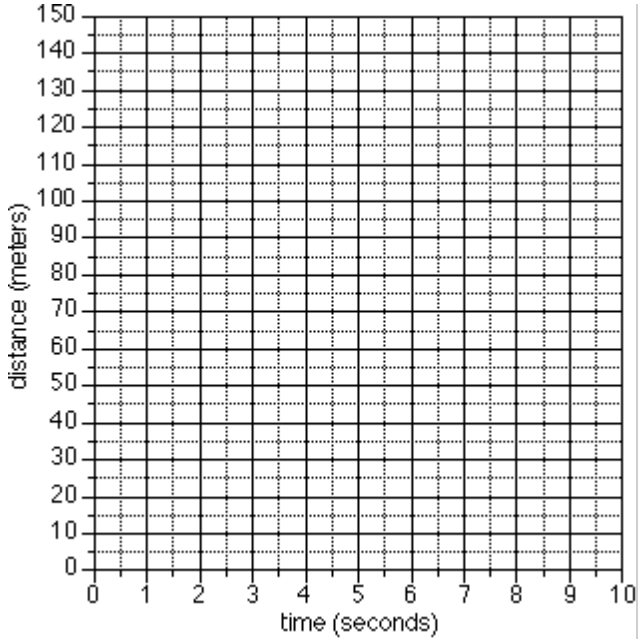


6th In-Class Worksheet Name _____
Graph Practice Teacher _____

Due _____

Making Science Graphs and Interpreting Data

✻Scientific Graphs:

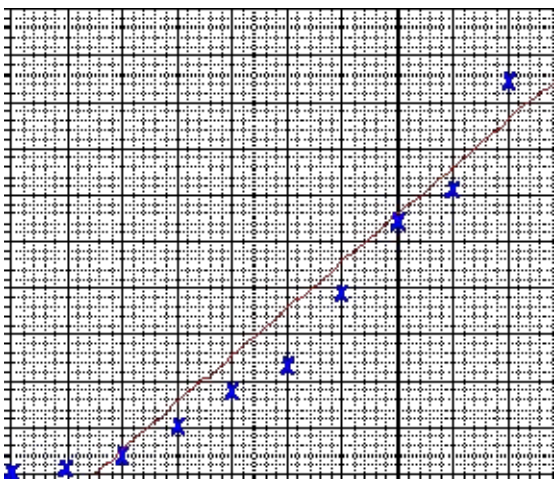
Most scientific graphs are made as **line** graphs. There may be times when other types would be appropriate, but they are rare.

The lines on scientific graphs are usually drawn either **straight** or **curved**. These "smoothed" lines do not have to touch all the data points, but they should at least get close to most of them. They are called **best-fit lines**.

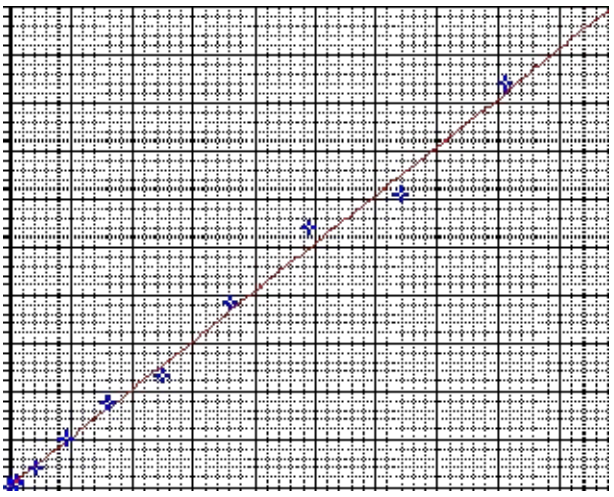
In general, scientific graphs are not drawn in connect-the-dot fashion.

Here are two examples of **best-fit graph** lines.
One is drawn correctly, the other is not.

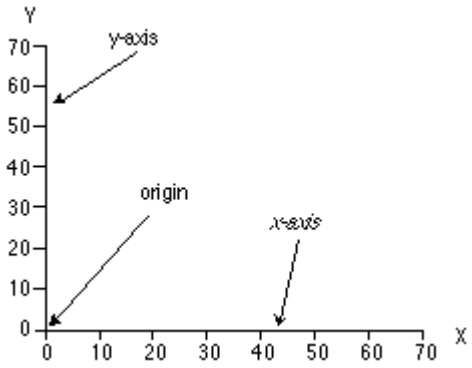
Best-Fit Line #1



Best-Fit Line #2



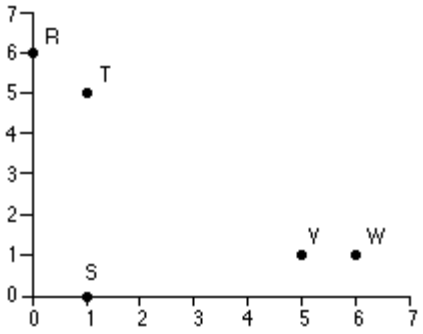
- A graph is a visual representation of a relationship between two variables, *x* and *y*.
- A graph consists of two axes called the *x* (horizontal) and *y* (vertical) axes. These axes correspond to the variables we are relating. In economics we will usually give the axes different names, such as Price and Quantity.
- The point where the two axes intersect is called the *origin.* The origin is also identified as the point (0, 0).



Initial Practice: Points on a Graph

Use the graph below to answer the three questions for this problem.

1. Which point is (0, 6)?
2. What is the *y*-coordinate of point S?
3. What are the coordinates of point T?

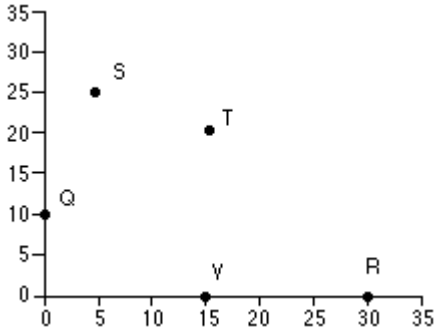


Answers: **1.**
2.
3.

Additional Practice: Points on a Graph

Use the graph below to answer the four questions for this problem.

1. Which point(s) lie on the *x*-axis?
2. What is the *y*-coordinate of point S?
3. What are the coordinates of point Q?
4. What are the coordinates of point T?

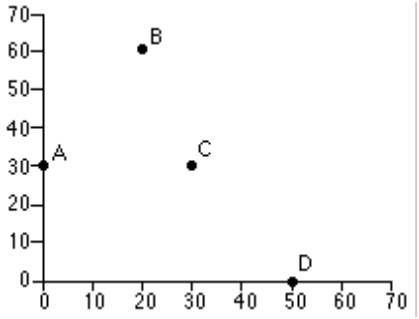


Answers: **1.**
2.
3.
4.

Locating Points on a Graph

Example

1. Which point is on the *y*-axis?
2. Which point is labeled (20, 60)?
3. Which point(s) have a *y*-coordinate of 30?



Answer: **1.**
2.
3.

Variables and Constants

The characteristic or element that remains the same is called a constant. Example: the number of donuts in a dozen is always 12. So, the **number** of donuts in a dozen is a constant.

Other these values can vary (Example: the price of a dozen donuts can change from $2.50 to $3.00). We call these characteristics or elements *variables*. Variable is the term for any characteristic or element that changes. You should be able to determine which characteristics or elements are constants and which are variables.

Practice Example

Which of the following are variables and which are constants?

The temperature outside your house.

This is a _____

The number of square feet in a room 12 feet by 12 feet.

This is a _____

The noise level at a concert.

This is a _____

Which of the following are variables and which are constants?

Price of a gallon of gas. _____

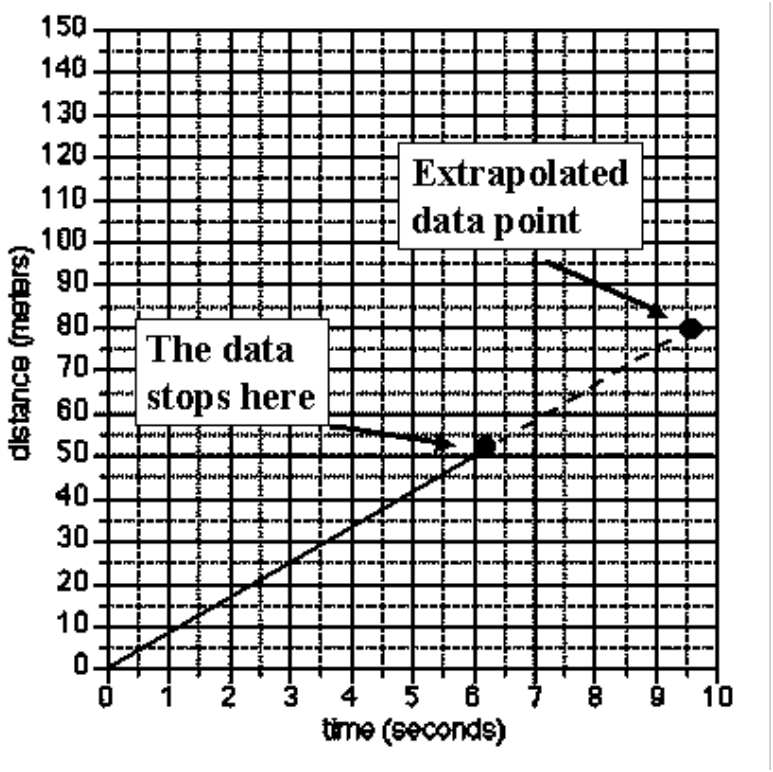
Number of inches in a foot. _____

Number of leaves on a tree. _____

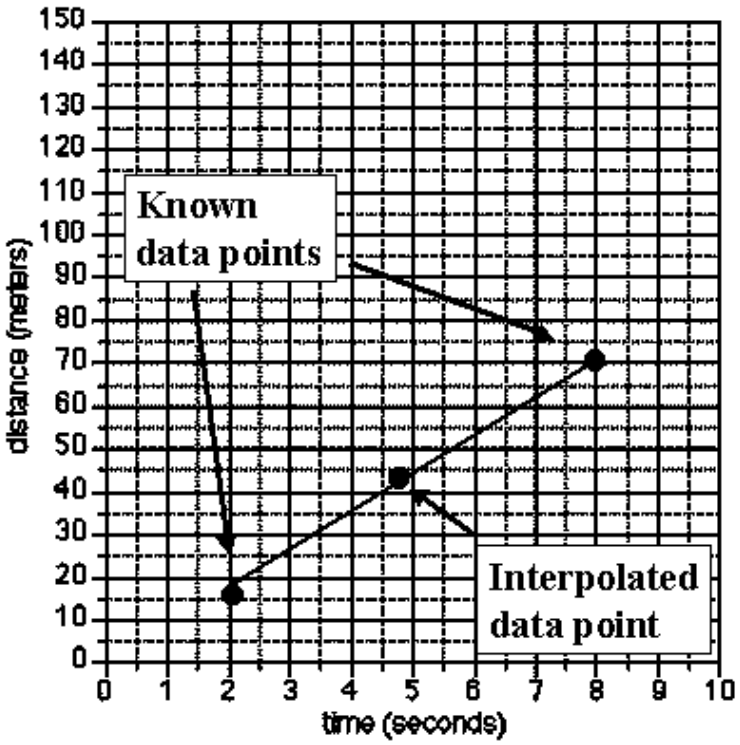
Capacity of the gas tank of your car. _____

Graphs are a useful tool in science. The visual characteristics of a graph make trends in data easy to see. One of the most valuable uses for graphs is to "predict" data that is not measured on the graph.

- **Extrapolate:** extending the graph, along the same slope, above or below measured data.



- **Interpolate:** predicting data between two measured points on the graph.



How To Construct a Line Graph On Paper

Step	What To Do	How To Do It
1	**Identify the variables**	a. **Independent Variable -** (Controlled by the experimenter) • Goes on the X axis (horizontal) • Should be on the left side of a data table. b. **Dependent Variable -** (Changes with the independent variable) • Goes on the Y axis (vertical) • Should be on the right side of a data table.
2	**To determine the variable range.**	a. Subtract the lowest data value from the highest data value. b. Do each variable separately.

3	**To determine the scale of the graph.**	**a.** Determine a scale, (**The numerical value for each square**), that best fits the **range of each variable.** b. Spread the graph to use MOST of the available space.
4	**Number and label each axis.**	• This tells what data the lines on your graph represent. Label both the **x and y axis**.
5	**Plot the data points.**	a. Plot each data value on the graph with a dot. b. You can put the data number by the dot, if it does not clutter your graph.
6	**Draw the graph.**	a. Draw a curve or a line that best fits the data points. b. Most graphs of experimental data are not drawn as "connect-the-dots".
7	**Title the graph.**	a. Your title should clearly tell what the graph is about. b. If your graph has more than one set of data, provide a "key" to identify the different lines.

Graphing Practice – Problem 1

Age of the tree in years	Average thickness of the annual rings in cm. Forest A	Average thickness of the annual rings in cm. Forest B
10	2.0	2.2
20	2.2	2.5
30	3.5	3.6
40	3.0	3.8
50	4.5	4.0
60	4.3	4.5

A. The thickness of the annual rings indicates what type of environment was occurring at the time of its development. A thin ring usually indicates a lack of water, forest fires, or a major insect infestation. A thick ring indicates just the opposite.
B. Make a line graph of the data.
C. What is the dependent variable?
D. What is the independent variable?
E. What was the average thickness of the annual rings of 40 year old trees in Forest A? in Forest B?
F. Based on this data, what can you conclude about Forest A and Forest B?

Back

The dependent variable is _____

The independent variable is _____

The average thickness of annual rings of **40-year old** trees in

Forest A was _____.

Forest B was _____.

What does this tell you about conditions in Forest A and Forest B when the trees were 40-years old?

Graphing Practice - Problem 2

pH of water	Number of tadpoles
8.0	45
7.5	69
7.0	78
6.5	88
6.0	43
5.5	23

A. Make a line graph of the data.
B. What is the dependent variable?
C. What is the independent variable?
D. What is the average number of tadpoles collected per sample?
E. What is the optimum water pH for tadpole development?
F. Between what two pH readings is there the greatest change in tadpole number?
G. How many tadpoles would we expect to find in water with a pH reading of 5.0?

Back

The dependent variable is _____

The independent variable is _____

The average number of tadpoles collected per sample is _____

Between pH _____ and pH _____ is the greatest change in tadpole number.

If the water's pH was 5.0, you would expect to find _____of tadpoles.

Graphing Practice - Problem 3

Amount of ethylene in ml/m^2	Wine sap Apples: Days to Maturity	Golden Apples: Days to Maturity	Gala Apples: Days to Maturity
10	14	14	15
15	12	12	13
20	11	9	10
25	10	7	9
30	8	7	8
35	8	7	7

A. Ethylene is a plant hormone that causes fruit to mature. The data above concerns the amount of time it takes for fruit to mature from the time of the first application of ethylene by spraying a field of trees.
B. Make a line graph of the data.
C. Make a key for the different kinds of apples being graphed.
D. What is the dependent variable?
E. What is the independent variable?

Back

The dependent variable is _____

The independent variable is _____

Graphing Practice - Problem 4

Water Temperature in ^{o}C	Number of developing clams
15	75
20	90
25	120
30	140
35	75
40	40
45	15
50	0

A. A clam farmer has been keeping records of the water temperature and the number of clams developing from fertilized eggs. The data is recorded above.
B. Make a line graph of the data.
C. What is the dependent variable?
D. What is the independent variable?
E. What is the optimum temperature for clam development?

Back

The dependent variable is _____

The independent variable is _____

The optimum temperature for clam development is _____

Graphing Practice – Problem 5

Time (seconds)	Distance (meters)
0	0
1	2
2	8
3	18
4	32
5	50
6	72
7	98
8	128
9	162
10	200

A. Graph the data.

Graphing Practice – Problem 6

The volume of a gas decreases as the temperature of the gas decreases. A sample of gas was collected at 100 degrees Celsius and then cooled. The changes in the volume of the sample are shown below.

TEMPERATURE (^{o}C)	VOLUME (ml)
100	317
80	297
60	288
40	278
30	252
20	243
10	236
0	233
-10	227
-30	202

A. Graph the data.