AP Biology Graphing Practice Packet

Graphing is an important procedure used by scientists to display the data that is collected during a controlled experiment. When a graph is put together incorrectly, it detracts the reader from understanding what you are trying to present. Most graphs have 5 major parts:

1. Title
2. Independent Variable (X-axis)
3. Dependent Variable (Y-axis)
4. Scale for each variable
5. Legend (or Key)

A. **Title:** Depicts what the graph is about. The Title gives the reader an understanding about the graph. A good title is closer to a sentence than a phrase and is usually found at the top of the graph.
B. **Independent Variable:** Variable controlled by the experimenter. The variable that "I" am testing. (I for Independent). Common independent variables include: time, generations, measurements (length, distance), and temperature. This variable goes on the X-axis.
C. **Dependent Variable:** Variable that is affected by the independent variable; what the experimenter measures. Example: How many oxygen bubbles will depend on the depth of the water. This variable goes on the Y-axis.
D. **Scale:** Before you can plot your data points, you must figure out how much each box on your graph paper is worth. Scale doesn't' always have to start at zero, but I must be consistent. If you start off making each box worth 5 cm, each subsequent box must also be 5 cm. Always make sure your scale is labeled with what it is and what the units are.
E. **Legend:** A short description about the graph's data. Most often used to show what different patterns or colors stand for on your graph.

Rules and Tips for Graphing:

1. Always use a pencil to draw your graph. It's easier to fix mistakes (Or use Excel!).
2. Always draw lines with a ruler. Do not freehand. Use at least half of your paper for the graph.
3. Make sure Independent Variable is on the X-axis and Dependent Variable is on the Y-axis.
4. Include all parts:
   a. Title
   b. Axis Labels WITH Units
   c. Legend
5. If you are graphing multiple subjects, use different colored or patterned lines and explain what they are in the legend.
6. Choose an appropriate graph to explain your data. Examples:
   a. LINE: Measuring a change in something over time
   b. BAR: Comparing individuals to each other with only one data point.
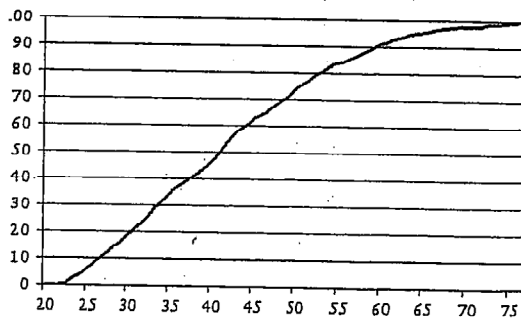   c. PIE: Show percentages that add up to 100%.

Questions:

1. The following graph is a fair to good example. Fill in the table with what is good about the graph and what could use improvement.

Crimes Of Robbery
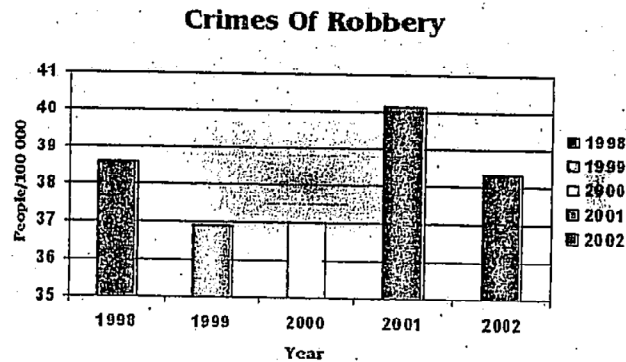
| GOOD	IMPROVE

2. The graph below is not a good graph. What parts are missing?

Experiment #1: Use the following data to create an appropriate graph and answer the questions. (graph paper on next page).
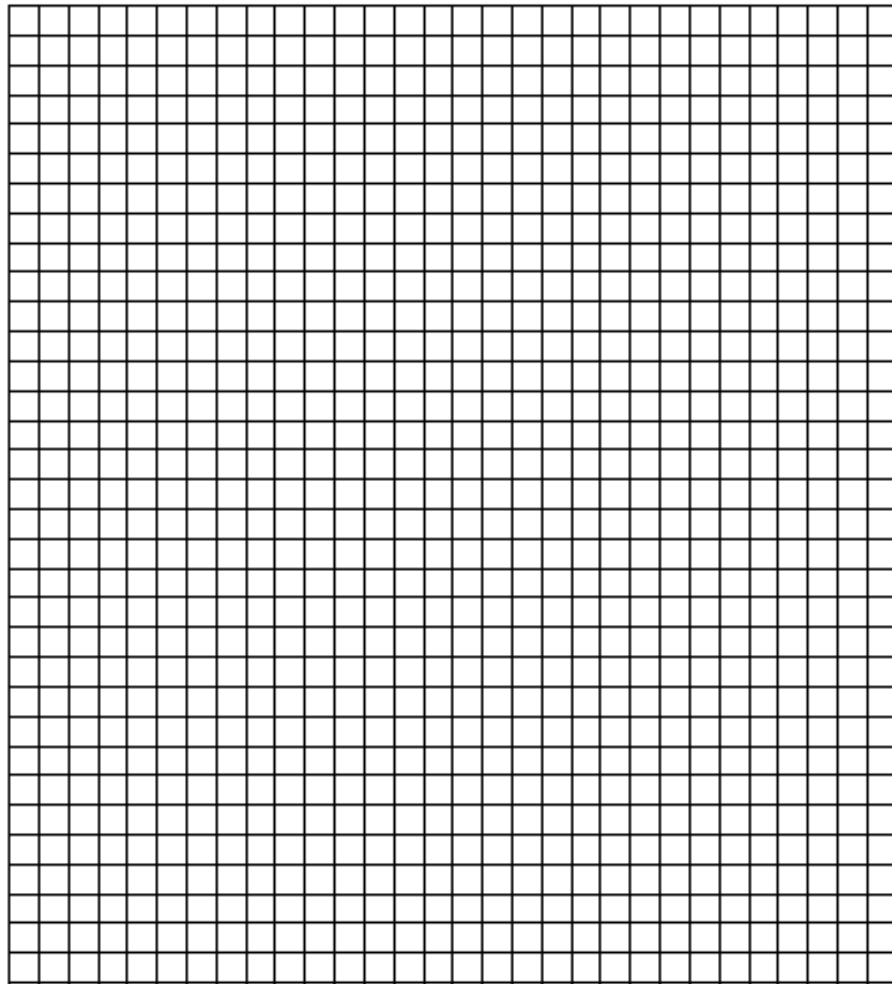
Depth (meters)	Bubbles per minute Plant A	Bubbles per minute Plant B
2	29	21
5	36	27
10	45	40
16	32	50
25	20	34
30	10	20

3. What is the dependent variable? Why did you pick that answer?

4. What is the independent variable? Why did you pick that answer?

5. What type of graph would be best for this data? Why did you pick that answer?

6. What title would you give this graph?

7. What information would you include in the legend of the graph?

8. What will you label the X-axis with?

9. What will you label the Y-axis with?
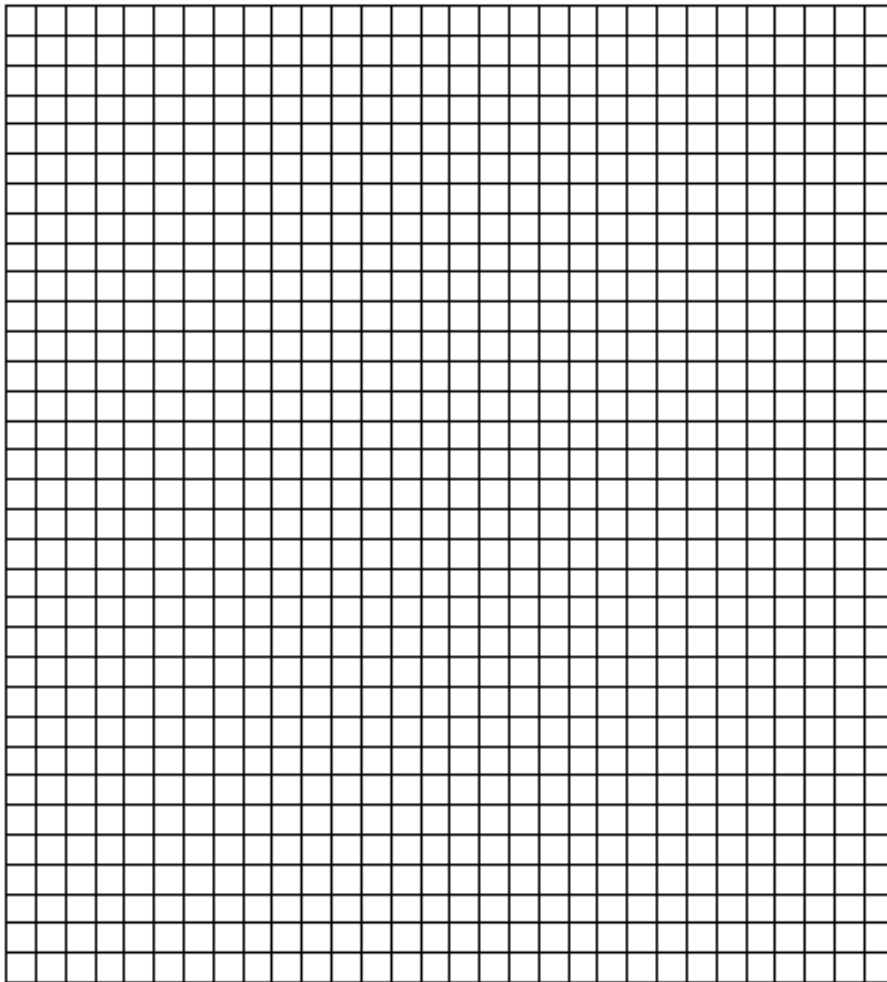
Experiment 2: Use the following data to create an appropriate graph and answer the questions.

| Time after eating (Hours)	Glucose in mg/dL Person A	Glucose in mg/dL Person B
0.5	170	180
1	155	195
1.5	140	230
2	135	245
2.5	140	235
3	135	225
4	130	200

10. Which individual would you potentially diagnose as diabetic?

11. What evidence do you have that supports your answer to #10?

12. IF the time period was extended to 6 hours, what would be the expected blood glucose level for Person A? _____ Person B? _____ (assume they don't eat again).

13. What conclusion can you make about the data and graph for experiment 1?

14. What evidence did you use to support your conclusion?

15. What conclusion can you make about the data and graph for experiment 2?

16. What evidence did you use to support your conclusion?

17. What other type of graph could you have created for experiment 1? For experiment 2?

Interpreting Graphs
In addition to being able to draw a graph based on data collected, you will also need to interpret data given to you in graph form. Answer the following questions based on the graphs presented. NOTE: Most of these are NOT examples of great graphs, they are for interpretation practice only.
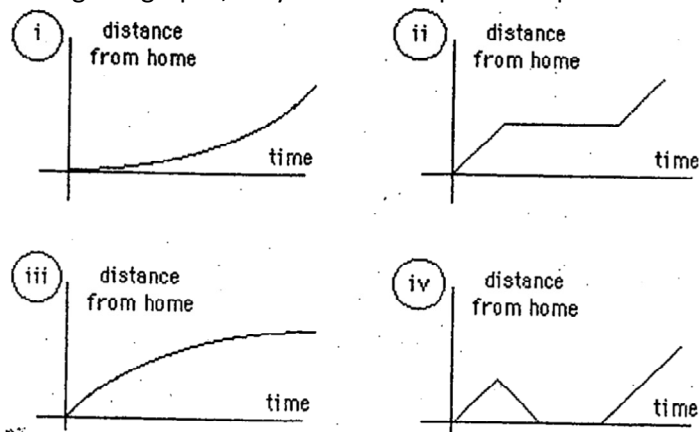

Identify the graph that matches each of the following stories:

18. _____I had just left home when I realized I had forgotten my books so I went back to pick them up.

19. _____Things went fine until I had a flat tire.

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

The graph to the right represents the typical day of a teenager. Answer the questions:

21. _____What percent of the day is spent watching TV?

22. _____How many hours are spend sleeping?

23. What activity takes up the least amount of time?

24. What activity takes up a quarter of the day?

25. What two activities take up 50% of the day?

26. What two activities take up 25% of the day?

17% Talking on telephone

25% Going to school

4% Studying

33% Sleeping

8% Eating

Watching TV
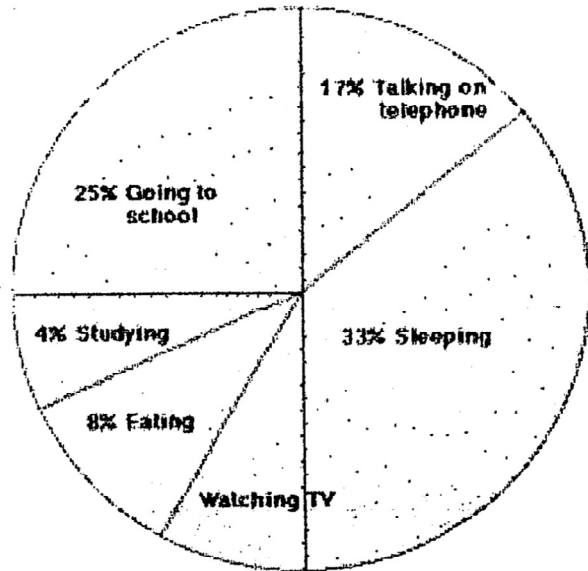
Answer the questions about the graph to the right:

27. How many total miles did the car travel?

28. Describe the motion of the car between hours 5 & 12.

29. What direction is represented by line CD?

30. How many miles were traveled in the first two hours of the trip?

Miles

A Trip By Car

200

150

100

50

E

B

C

D

A

0   5   10   15   20   25

Hours
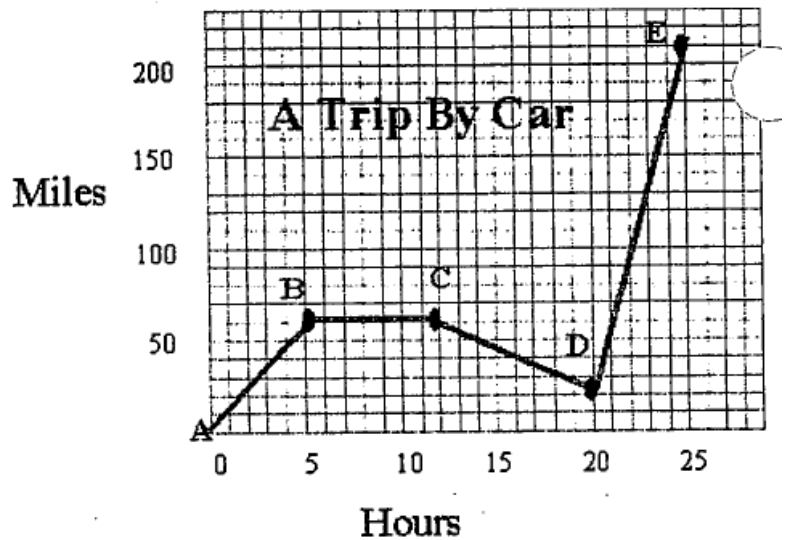
The bar graph to the right represents the declared majors of freshman enrolling at a university. Answer the following questions:

31. What is the total freshman enrollment of the college?

32. What percent of the students are majoring in physics?

33. How many students are majoring in economics?

34. How many more students major in poly sci than in psych?
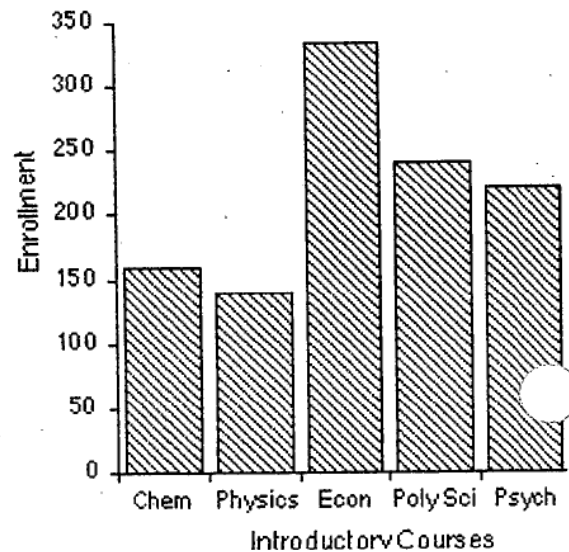
Answer the following questions about the graph below.
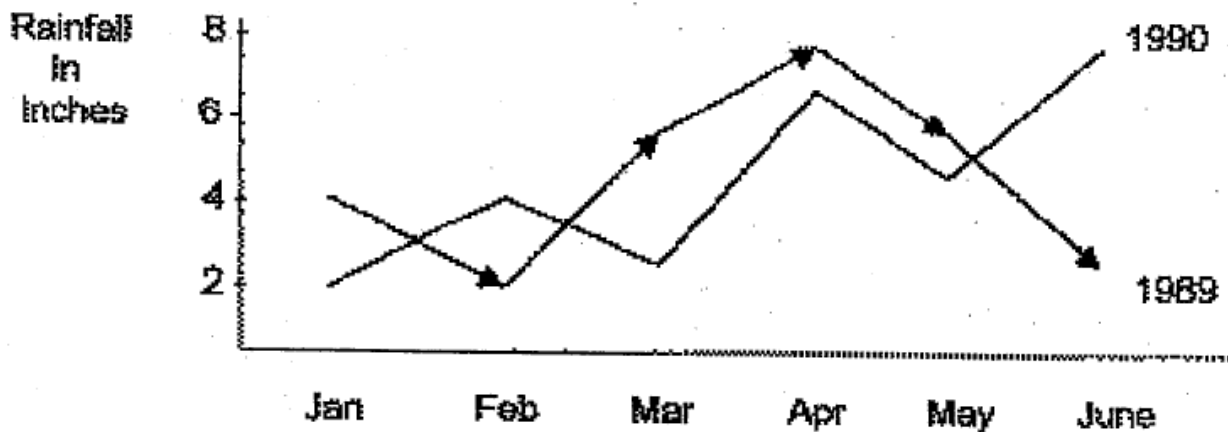
35. How much rain fell in March of 1989?

36. How much more rain fell in Feb of 1990 than in Feb of 1989?

37. Which year had the most rainfall?

38. What is the wettest month on the graph?

LINE GRAPHS:
Line graphs are most often used to show continuous change. Most scientific graphs are lines graphs. Examine the following data:

Population of the United States 1880-1990

Year	Population (Millions)	Year	Population (Millions)
1881	50.2	1940	131.7
1890	62.9	1950	151.3
1900	76	1960	179.2
1910	92	1970	203.2
1920	105.7	1980	226.5
1930	122.8	1990	251.4

In the example given above, both the year and the populations are variables. The factor which is *changed or manipulated*, in this case the year, is called the **independent variable (IV).** The *measured effect* of the IV is called the **dependent variable (DV).** The population is determined by the year; therefore, the population is the dependent variable. Another way to think about the IV and DV is to think about the amount of sleep you get. You know how alert or tired you feel often depends on the number of hours of sleep you got the night before. The amount of sleep is the IV an; your alertness is the DV. Throughout your year of AP Biology, you will be asked to identify variables in many different investigations.

Review "rules and tips for graphing" from front page for how to set up graphs.

Using line graphs to make predictions:
To predict what the population of the US was in the year 2000, you will need to go beyond the data points on the graph. This is called **extrapolation**. We can also use graph to find data point between two sets of plotted data pairs. For example, we can read the graph to determine that the population of the United States in 1905 was approximately 84 million people. Determining data points between two sets of data pairs is called **interpolating**.
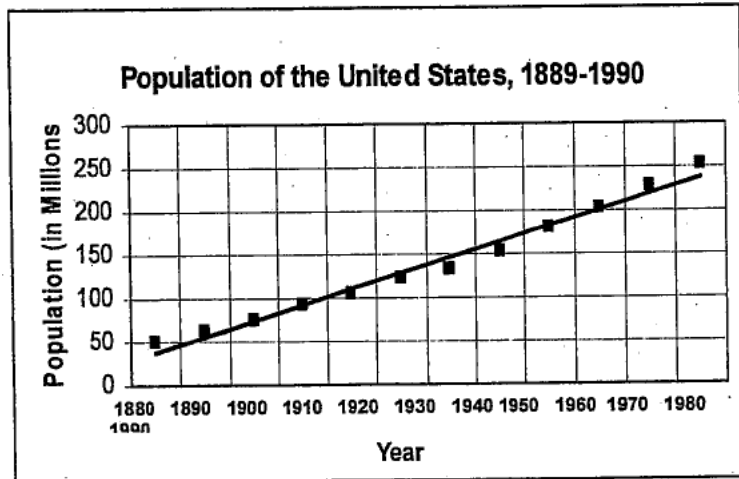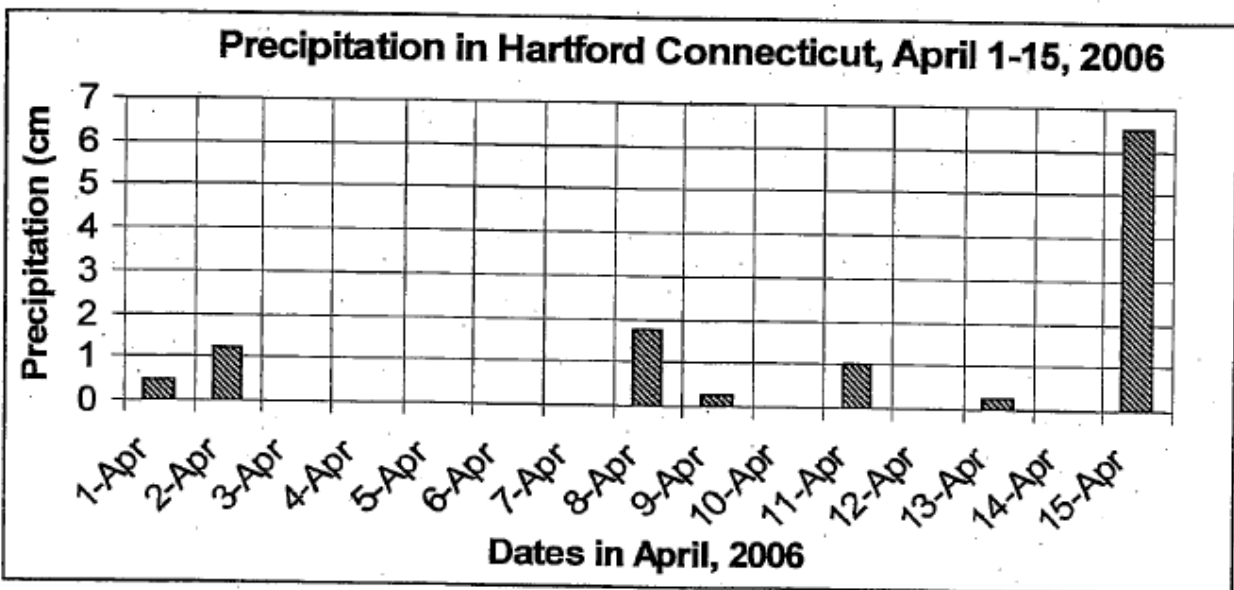

Bar Graphs:
Bar graphs should be used for data that are not continuous. It is a good indicator fo trends if the data are taken of a sufficiently long period of time.

Examples of when to use bar graphs: When comparing different groups. When trying to measure **large** changes over time.

Practice:

Look at the line graph on the previous page called, "Population of the United States 1889-1990."

1. Predict what the population of the United States will be in 2010. _____

2. Determine the approximate population of the United States in:

   1935: _____   1945: _____   1985: _____

3. What was the approximate population of the Untied States in 1970? _____

4. What will be the approximate population in 2020? _____

5. Why would you use a bar graph instead of a line graph?

Precipitation in Hartford Connecticut, April 1-15, 2006

6. According to the bar graph above of precipitation in Harford, CT, how many centimeters of rain fell in Hartford on April 11?

7. Are you able to see any trends in this data set? If so, what is the trend? If not, why not?

8. Can a bar graph show a trend, even if the data are not continuous? Explain.

9. Can the bar graph be used to predict precipitation in Harford on April 20? Why or why not?

10. In 1989, the US Department of the Interior reported that were 360 endangered species of plants and animals in the United States. These endangered organisms included 32 species of mammals, 61 species of birds, 8 species of reptiles, 5 species of amphibians, 45 species of fishes, 3 species of snails, 32 species of clams, 8 species of crustaceans, 10 species of insects, 3 species of spiders, and 153 species of plants. Construct a bar graph of the total number of endangered plants and animals in 1989.
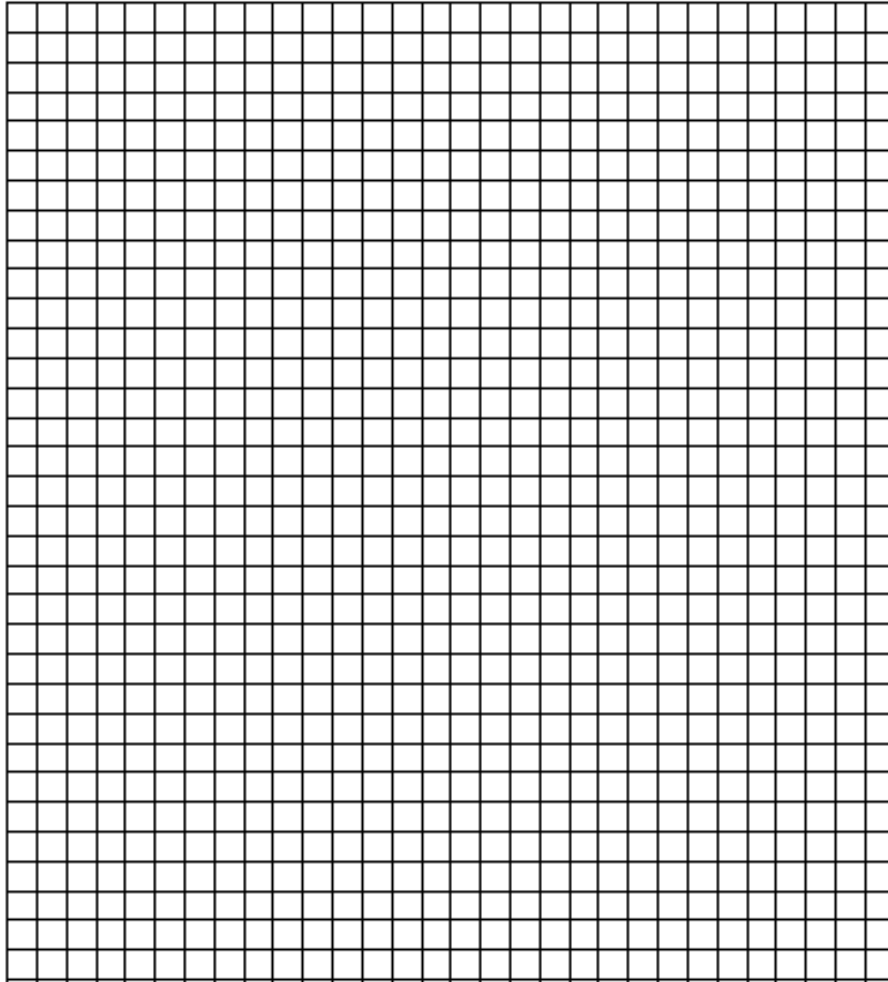
11. After an outbreak of influenza, a student gathered data on the number of students who became ill, until she became sick on the 14th day of her study. The information she gathered is shown below. Create a line graph of the data below.

Date (Feb., 1996)	Number of ill Students
1	12
2	18
3	30
4	49
5	115
6	127
7	125
8	107
9	108
10	115
11	117
12	95
13	60
14	52

Questions:

12. On what day were most students ill?

13. During which period of time did the most students become ill?

14. What was the greatest number of students who were ill on any one day?

15. Estimate the total number of students who were ill on the 15th day.