Line Plots: Frogs in Flight

Brief Overview:

Frogs in Flight is intended to teach fifth grade students how to construct and interpret line plots. Students collect data on how far their origami frogs jump by measuring to the nearest inch. A line plot containing a title, label, and scale is constructed based on the frog jumping data. The line plot is used to display, interpret and analyze the data gathered from the investigation. Creating a fun display of frogs, graphs, and data culminates the activity.

NCTM Content Standard/National Science Education Standard:

Data Analysis and Probability
- **Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them**
- **Collect data using observations, surveys, and experiments;**
- **Represent data using tables and graphs such as line plots, bar graphs, and line graphs;**

Grade/Level:

Fifth Grade

Duration/Length:

Three 60-minute periods

Student Outcomes:

Students will:

- **Collect data and construct line plots.**
- **Interpret the line plot data.**

Materials and Resources:
- **Teacher Resources 1-5**
- **Student Resources 1-5**
- **Transparency of Teacher Resources 2 and 4**
- **Card stock or stiff paper**
- **Magnets created from Teacher Resources 1 and 3**
- **Rulers**
- **Masking tape**
- **Internet access**
-

Development/Procedures:

Lesson 1
Pre-Assessment –
- **Have a class discussion about graphs.**
- **Ask the students where they have seen graphs and what types of graphs they have seen. (Note: It might be helpful to bring in graphs that have been in local newspapers or magazines to show students.)**
- **Explain to the class that there are many different kinds of graphs and they have different purposes. Some data is best displayed on a line graph while other data should be shown on a bar graph. (Note: Again, refer to graphs from newspapers.)**
- **Ask the class if they can think of why someone would use a graph to display information. Students could think-pair-share their ideas.**

Launch –

- **Explain to the class that graphs are used to display data or information.**
- **Say: Today you will watch a photo slideshow about frog jumping contest in order to gather data to make a graph.**
- **Go to http://www.frogtown.org/ and scroll to click on the photo gallery. View prior to lesson to determine which photos will be the most appropriate for your class.**

Teacher Facilitation –

- Use the magnet activity, Teacher Resource 1, to introduce graphs with definitions.
  - Place the graphs on the board with tape or magnets.
  - Have students volunteer to match the terms with the graph.
  - After the students complete the matching task, ask them to share what the graph is displaying. (Note: Encourage students to recognize the parts of the graphs by using the title, axes, and labels. Ask students how they interpret the data displays.
- Show the data that you collected at the frog-jumping contest you attended over the summer from Teacher Resource 2.
- Ask the students how the data was collected for the frogs. (They should respond with measuring.)
- Ask the students to identify a graph that would best display the data if they wanted to find the typical length of a frog jump.
  - Guide discussion toward the use of line plots because of the repeating data and the range of distances. If a student suggests a bar graph, explain why that graph would make it difficult to answer a question like *which distance was jumped the most*.
- Students should identify the least and the greatest distance jumped. Place the range of data (5 inches to 22 inches) on the chalkboard and create a large line plot.
  - Use questioning to develop a definition of range. The difference between the greatest and least data values.
  - Leave the data collection sheet on the overhead. Plot 2-3 pieces of the data. Model for the students where you are getting the information and think aloud as you are plotting. (Note: You may use Teacher Resource 3 to display the data using frogs instead of X's to keep the students engaged.)

Student Application –

- Have students come up and place frogs (or X's) to show the data on the large line plot.

- **Ask the class if they think the line plot is complete. They should respond that the line plot needs a title and the x-axis should have a label.**

Embedded Assessment –

- **Continue to question the students about the parts of a graph. This will reinforce the importance of a title, scale, and labels.**
- **Observe the students while creating the large line plot. Make sure they understand where the data is coming from and how it is displayed.**

Reteaching/Extension –

- **If students are struggling use Student Resource 1. Discuss with the students how the X's were plotted and plot some with them prior to the students plotting on their own.**
- **To extend use Student Resource 1. Students can independently complete the line plot. Answers can be found on Teacher Resource 4.**

Lesson 2

Pre-Assessment –

- **Have a group discussion of units of measure. Discuss appropriate measurement tools and units for different measuring tasks.**
- **Ask students to find the inch side of their ruler. Students should then use their ruler to measure their neighbor's index finger to the nearest inch. Allow students time to share results.**

Launch –

- **Remind students of the frog jumping slide show from yesterday. Explain that today we are going to have our own frog-jumping contest.**

- **Reference** http://www.origami-usa.org/models/jumping-frog.pdf **to find an example of how to make an origami frog. Model how to fold the paper to create a jumping frog. It is recommended that you model each fold based on individual student needs.**
- **Allow the students a few minutes to practice jumping with their paper frogs.**

Teacher Facilitation –

- **Use two student helpers to model how to jump the frog, measure the distance of the jump, and record the results. One student will measure and one will record the results as the teacher jumps the frog from behind a start line. A model of Student Resource 2 should be created on the board or overhead listing the teacher's name, name of the frog, and the distance it jumped.**
- **After modeling the data gathering process have students explain the process through questioning.**

Student Application –

- **Students should be divided into groups of 4 to 6 depending on class size. Each group must have a masking tape starting point, ruler, and Student Resource 2 to record their data.**
- **Each student should have an opportunity to jump a frog, measure a distance, and record a result. Students should not measure their own frog's jump.**
- **Once the group data has been collected each student in the group should record their group's data on their individual Student Resource 2 or data sheet.**
- **Discuss students' results. As each child gives its result record it on the chalkboard. Individual students should record the class data under the title Class Frog Jumping Data on Student Resource 2.**

Embedded Assessment –

- **Use questioning throughout the lesson to assess students understanding of measuring to the nearest inch and data collection strategies.**
- **Observe and assess students' success as they work in groups to measure their frogs' jumps and record data.**

Reteaching/Extension –

- **Work with groups that are experiencing difficulties with measurement of data collection.**
- **Groups that finish early should use Student Resource 3 to draw a picture of their frog and write a caption that relates to its data.**

Notes: Please have students keep their frogs in school to be used as a display celebrating their contest. You will need to make a poster sized line plot of the students' data to be used as a part of this display. Students will make their own line plot in lesson 3. Therefore, the poster should not be shown to them until after the conclusion of lesson 3.

Lesson 3
Pre-Assessment

- **Question students about why graphs are used to display data. (We use them to make information easier to understand or interpret.**
- **Continue to use questioning to assess students' knowledge of gap, mode, and range.**
- **Display Teacher Resource 4 a completed Crab Race Line Plot as an overhead. Review the parts of a line plot using Student Resource 4 as a pinch card. Point to a part of the line plot. Students should pinch the name on the card that corresponds to that part of the line plot that you have designated.**

Launch –

- **Allow students time to decorate their frogs so they can be displayed in the classroom. These frogs will be used to decorate a poster sized line plot of the student's data after the lessons have been completed.**

Teacher Facilitation –

- **Use questioning to interpret Teacher Resource 4. Guide the students through the following questions. You can adjust the questions to meet the needs of students in your group.**
  - **What does each X on the line plot represent? (time it took for one crab to run the race) How do you know? What part of the line plot helps you to quickly identify what the X's represent? (axis label)**
  - **How many crabs ran the race in 28 seconds? (2) How many crabs ran the race in 23 seconds? (0) What do we call a space in the data like 26-27 seconds? (gap)**
  - **What time occurred the most? (22 seconds)** *Elicit the term mode to describe the outcome that occurs the most.*
  - **What is the range of the data? (10 seconds)** *Range was reviewed in Lesson 1.* **How did you find the range? (subtract the lowest value from the highest value)**
  - **How many crabs ran in the race? (12) How did you use the graph to find your answer? (counted the total number of x's) What was the total time it took for all of the crabs to run the race? How did you find your answer?**

Student Application –

- **Direct students to individually use Student Resource 5 to create a line plot using the whole class data from the Frogs in Flight data that was colleted in lesson 2 on Student Resource 2. Remind them to complete the 2 short answer questions and brief constructed response question that accompany the line plot. (Summative Assessment,)**

Embedded Assessment –

- **Assess students through questioning during the teacher facilitation. The summative assessment will also serve as the formal assessment of this lesson.**

Reteaching/Extension –

- **Attach decorated frogs to the poster size copy of the line plot based on the students' frog jumping data.**
- **Hang the completed Student Resource 3 Featured Frogs to celebrate the culmination of the activity.**
- **A stem and leaf plot could be developed to extend this activity.**
- **Use Teacher Resource 1 Line Plot to question students who are struggling with interpreting line plots.**

Summative Assessment:

A summative assessment has been provided for your use. The assessment is Student Resource 5 and should be completed during lesson 3. The assessment requires students to construct and analyze a line plot. Students must also complete a brief constructed response based on the line plot. It is recommended that you turn the fill in the blank questions into selected response. This could not be done in advance because data will vary for different classes. Answers can be found on Teacher Resource 5.

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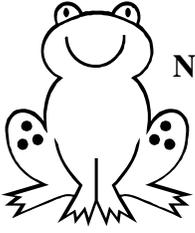
Crabby Claws Crab Races

Directions: **Over the weekend you went to the *Crabby Claws Crab Races* in Baltimore, Maryland. The data below represents the time taken to complete the race. Some of the points have already been plotted for you, complete the line plot and come up with a creative title.**

22	25	30	28	21	20
29	28	22	24	24	22

_____

		X			X			X		X
20	21	22	23	24	25	26	27	28	29	30
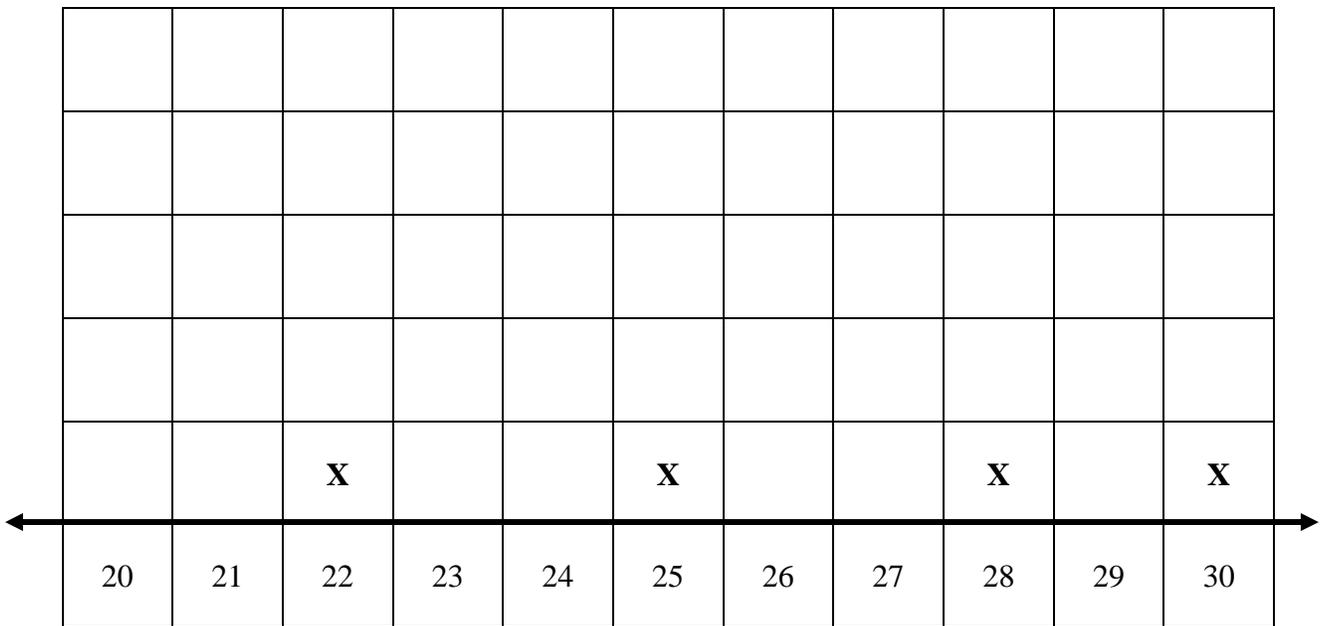
Time in Seconds
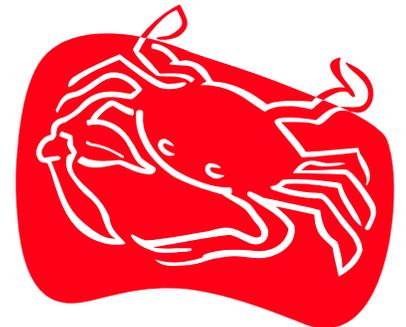
Data Collection for Frogs in Flight

Directions: **Each group member's frog will be taking one jump. Another member will measure the distance from the starting point to the nearest inch. A third member will record the results in the data table. Then rotate responsibilities. Remember everyone needs to copy all of the results from the group onto their data table.**

Group Frog Jumping Data

Frog Jockey	Frog's Name	Distance Jumped (nearest in)

Class Frog Jumping Data

Directions: **In the space below record data for all distances jumped. You should have the same number of data as there are students in your class.**

_____

_____

_____

_____

Name: _____

Featured Frog!

Directions: **Congratulations! A local reporter would like to put a picture of your frog in the newspaper. Illustrate your frog in the frame provided. Write a caption below the picture that includes the distance your frog jumped and your frog's name.**
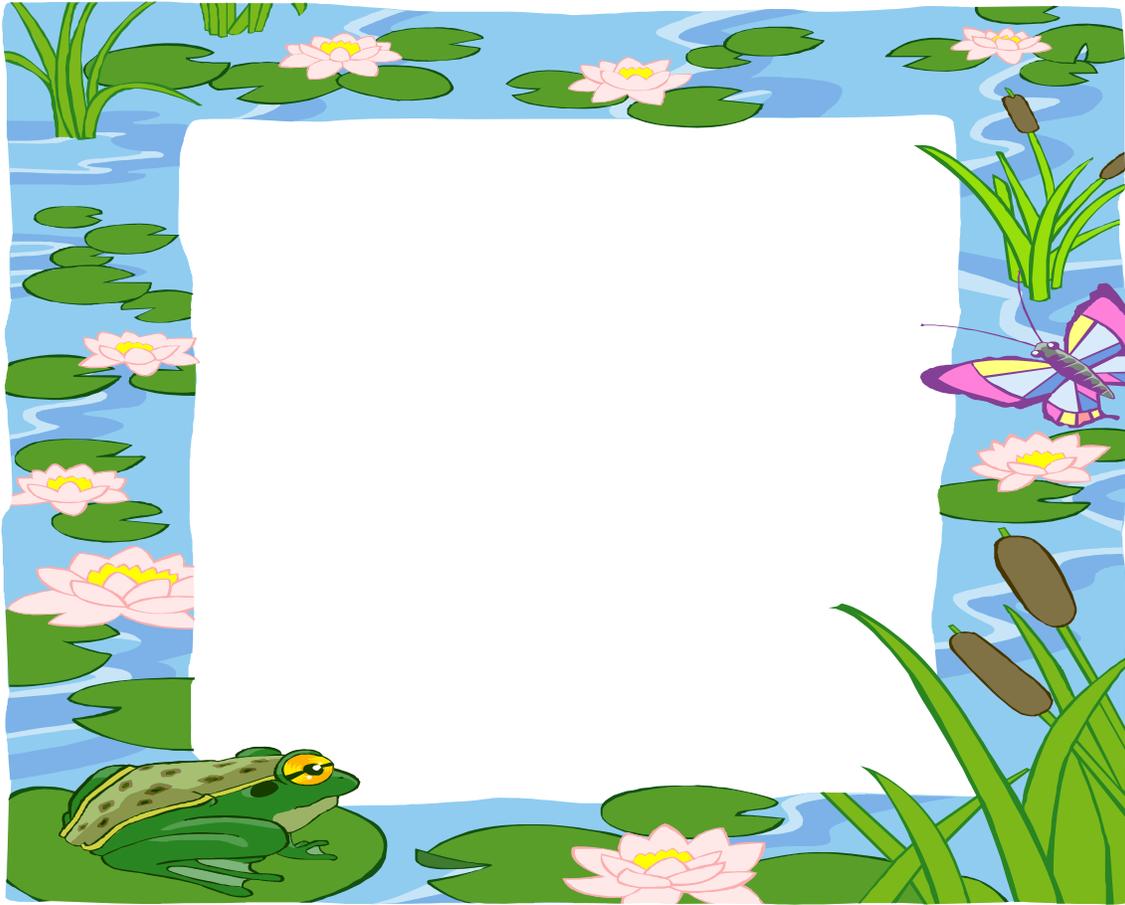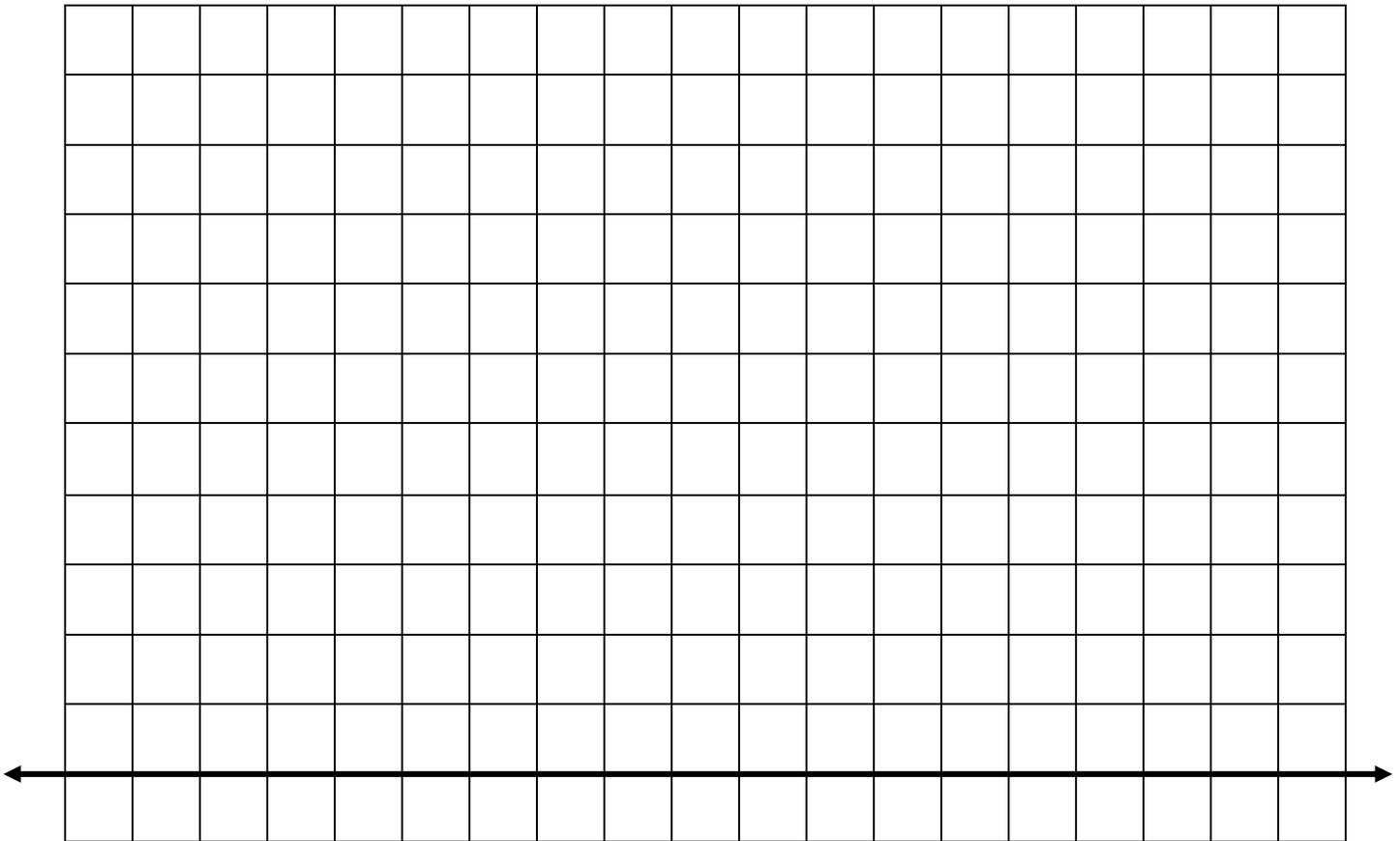

_____

_____

_____

_____

_____

Title	Label
Scale	Data

Title	Label
Scale	Data

Frogs in Flight Assessment
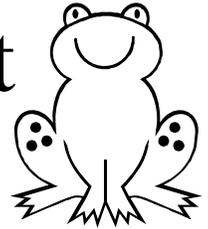
1. Use the data from Student Resource 2 in order to complete the line plot.

2. What is the range of the data?

   _____

3. What is the mode of the data?

   _____

4. Many frogs participated in the *Frogs in Flight* jumping contest.

Part A
How many frogs participated in the contest?

_____

Part B
Use what you know about line plots to explain why your answer is correct.

Use number and/or words in your explanation.

_____

_____

_____

_____

_____

Name: _____

Matching Graphs Activity

Directions: **Cut and separate the graphs from the vocabulary word. Place the graphs on the chalkboard and have students volunteer to come up and match the term with the graph.**

Bar Graph

Fifth Graders' Favorite Snacks

Number of Students

12	
10	
8	
6	
4	
2	
0	

Cookies   Ice Cream   Popcorn   Fruit

Snacks
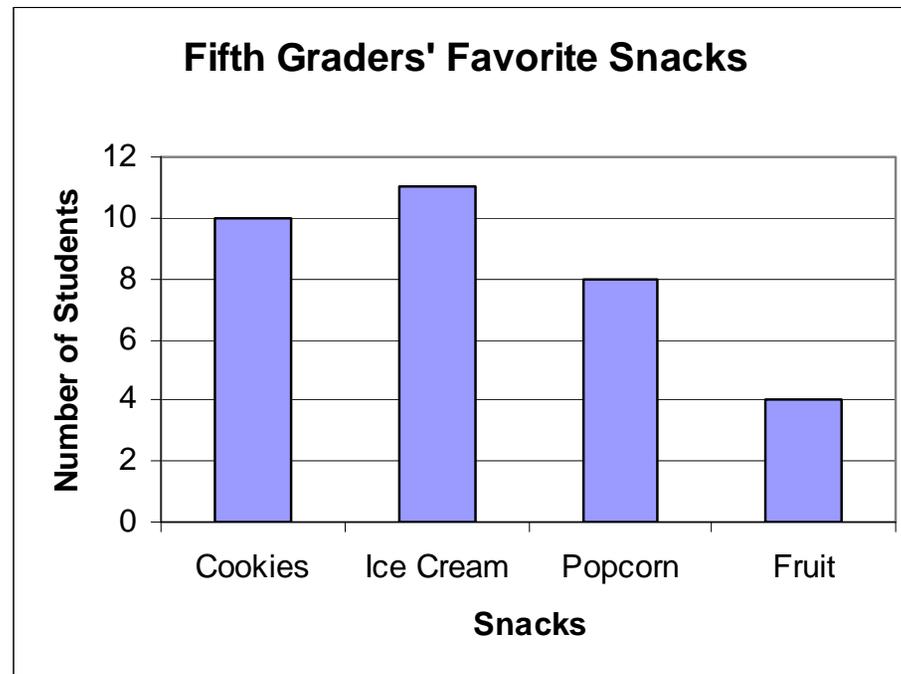
Pictograph

Number of Candy Bars Grade Levels Sold for the School Fundraiser

Grade Levels	Number of Candy Bars Sold
First	🍫 🍫 🍫 🍫 🍫 🍫 🍫
Second	🍫 🍫 🍫 🍫 🍫 🍫
Third	🍫 🍫 🍫 🍫 🍫 🍫 🍫 🍫
Fourth	🍫 🍫 🍫 🍫
Fifth	🍫 🍫 🍫

Key: 🍫 = 50 Candy Bars

Line Graph

Ice Cream Sandwiches Sold in the Cafeteria

Number of Ice Cream Sandwiches (y-axis: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20)

Days of the Week (x-axis: Monday, Tuesday, Wednesday, Thursday, Friday)

Number of Hotdogs Eaten at a Hotdog Eating Contest
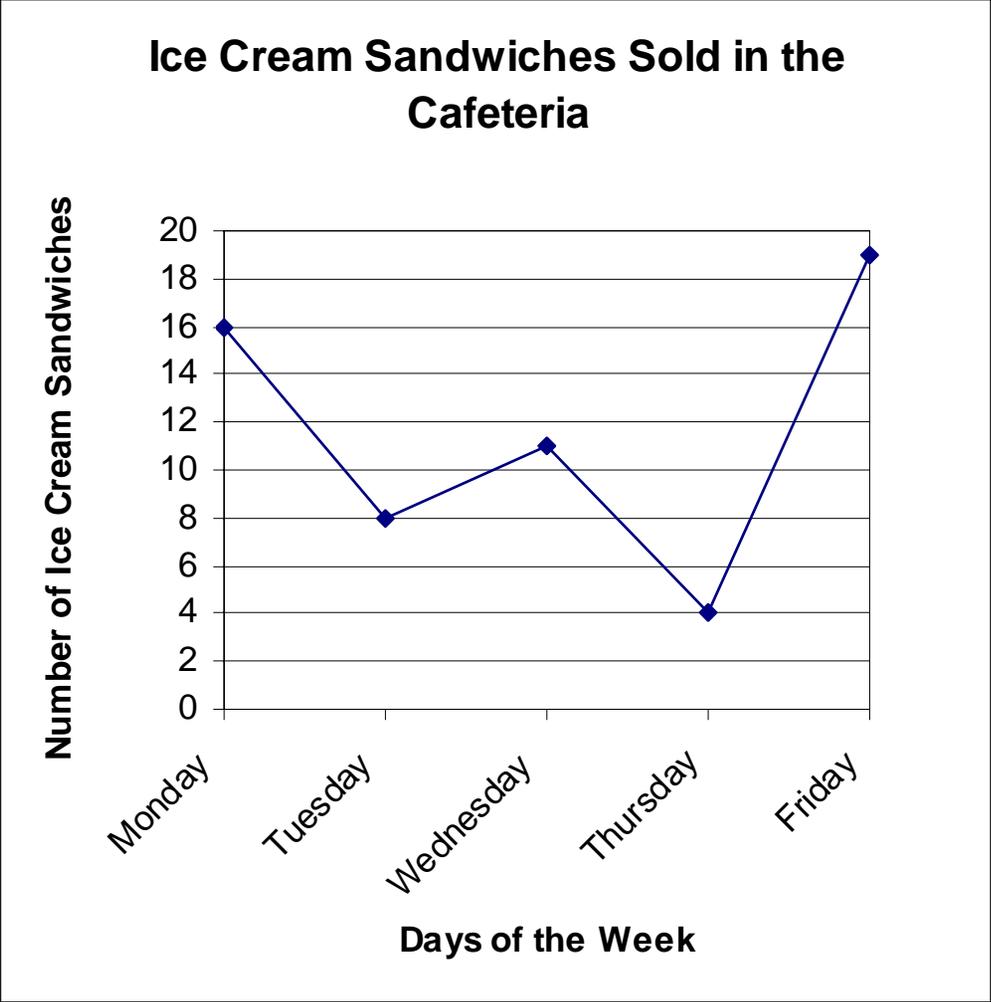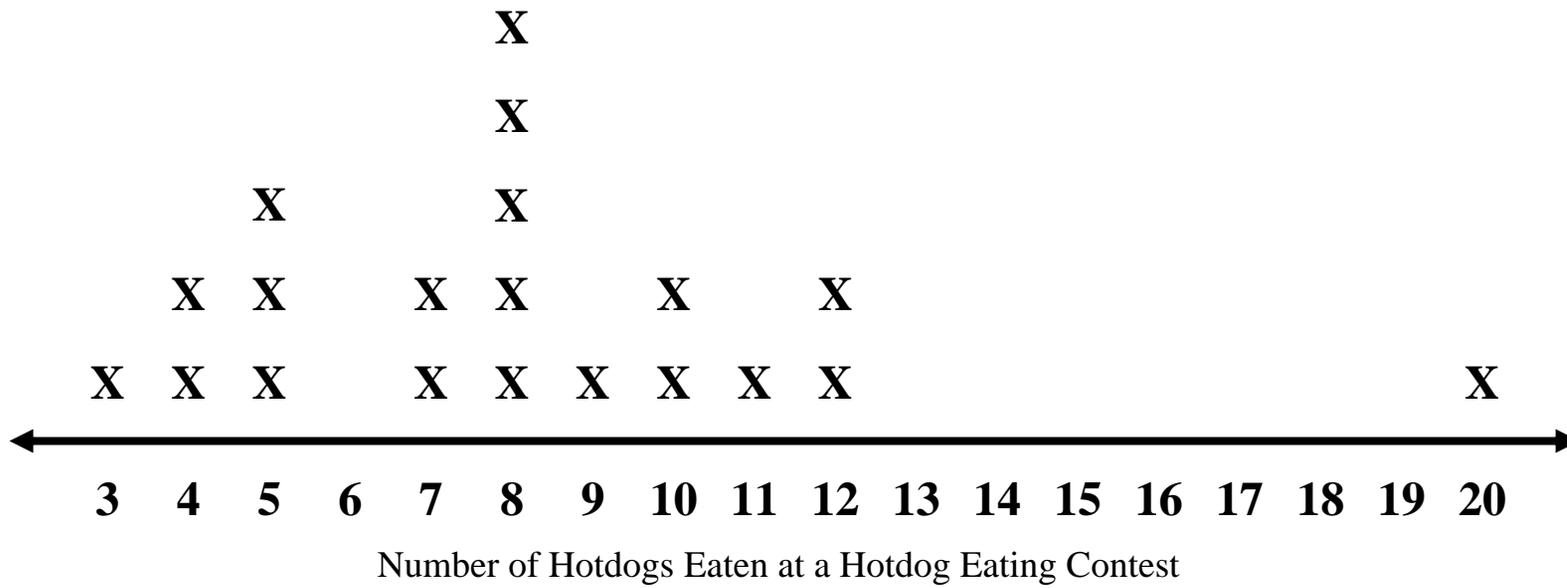
Leaping Lillies Frog Jumping Results

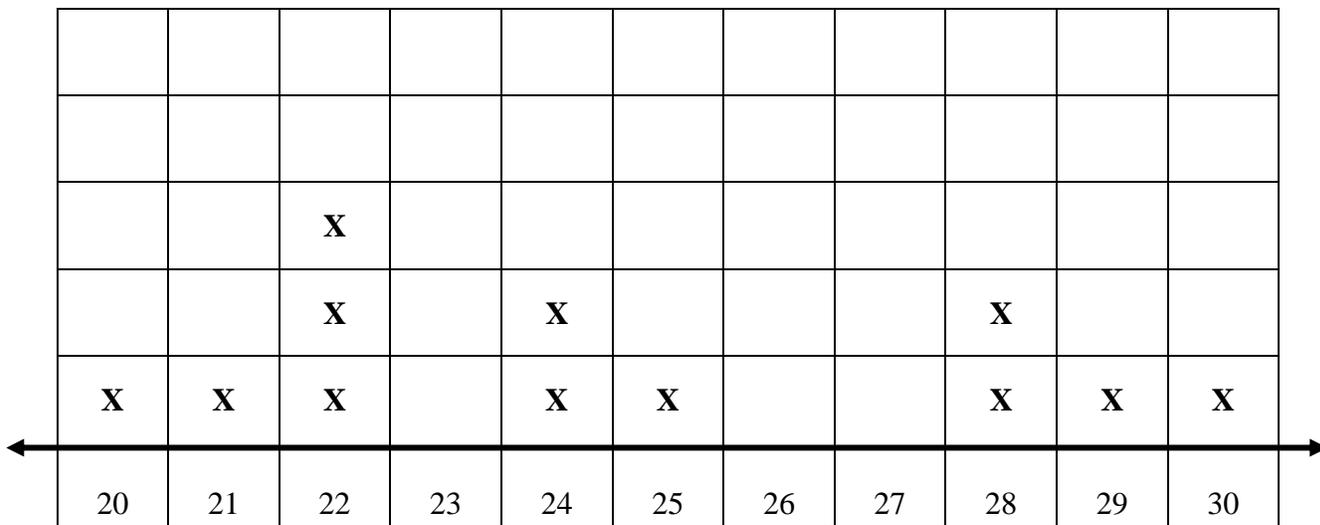| Frog's Name	Distance Jumped in Feet
Einstein	**17**
Phil	**17**
Prince Soggy Bottom	**20**
Velcro	**14**
Angus	**17**
Darwin	**7**
Frogzilla	**12**
Jumping Jimmy	**5**
Pesto	**14**
Hercules	**13**
Jumping Jack	**16**
Long John Silver	**12**
Neutron	**15**
Fearless Freddy	**15**
Penelope	**22**
Kermit	**15**
Skippy	**14**
Popcorn	**15**
Jade	**9**
Springer	**17**

Frog Templates
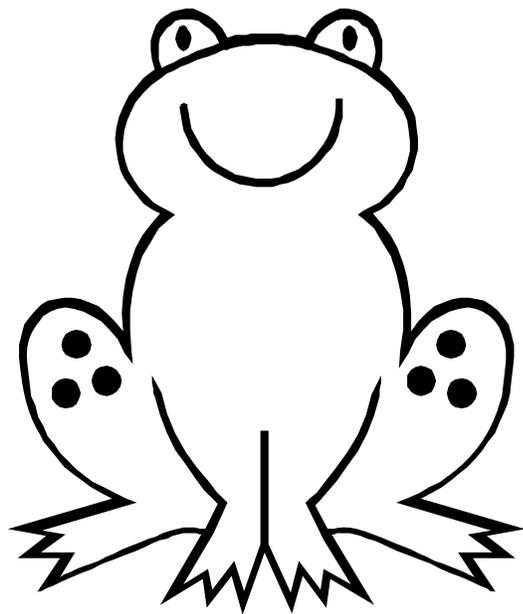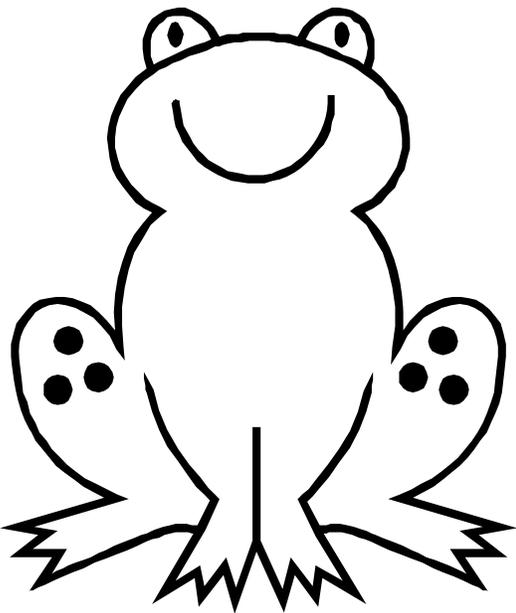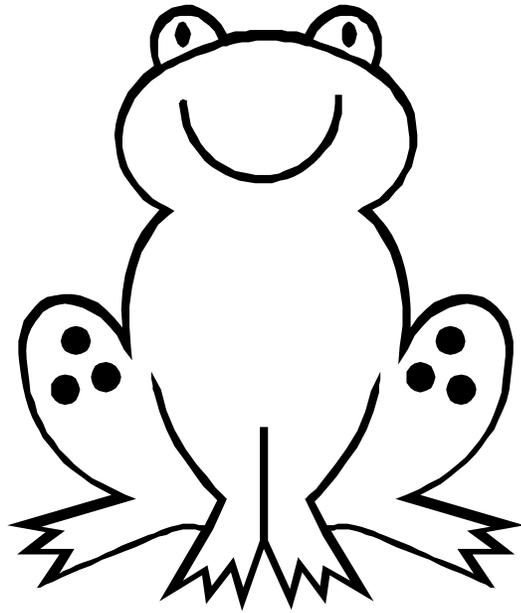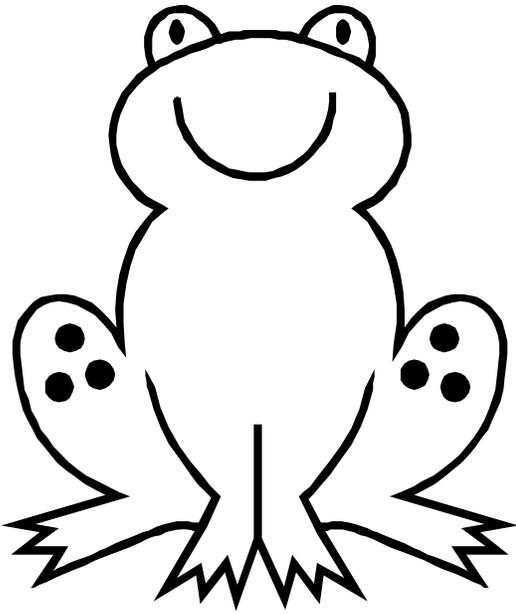
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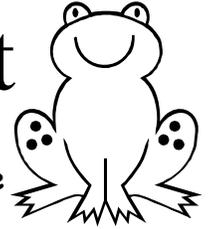
22	25	30	28	21	20
29	28	22	24	24	22

Crabby Claws Crab Races Results
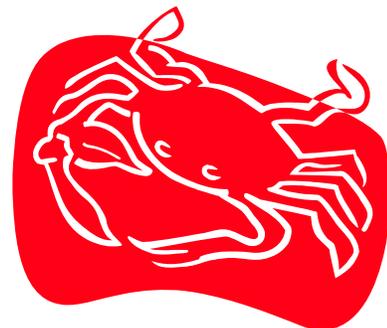
		X								
		X		X				X		
X	X	X		X	X			X	X	X
20	21	22	23	24	25	26	27	28	29	30

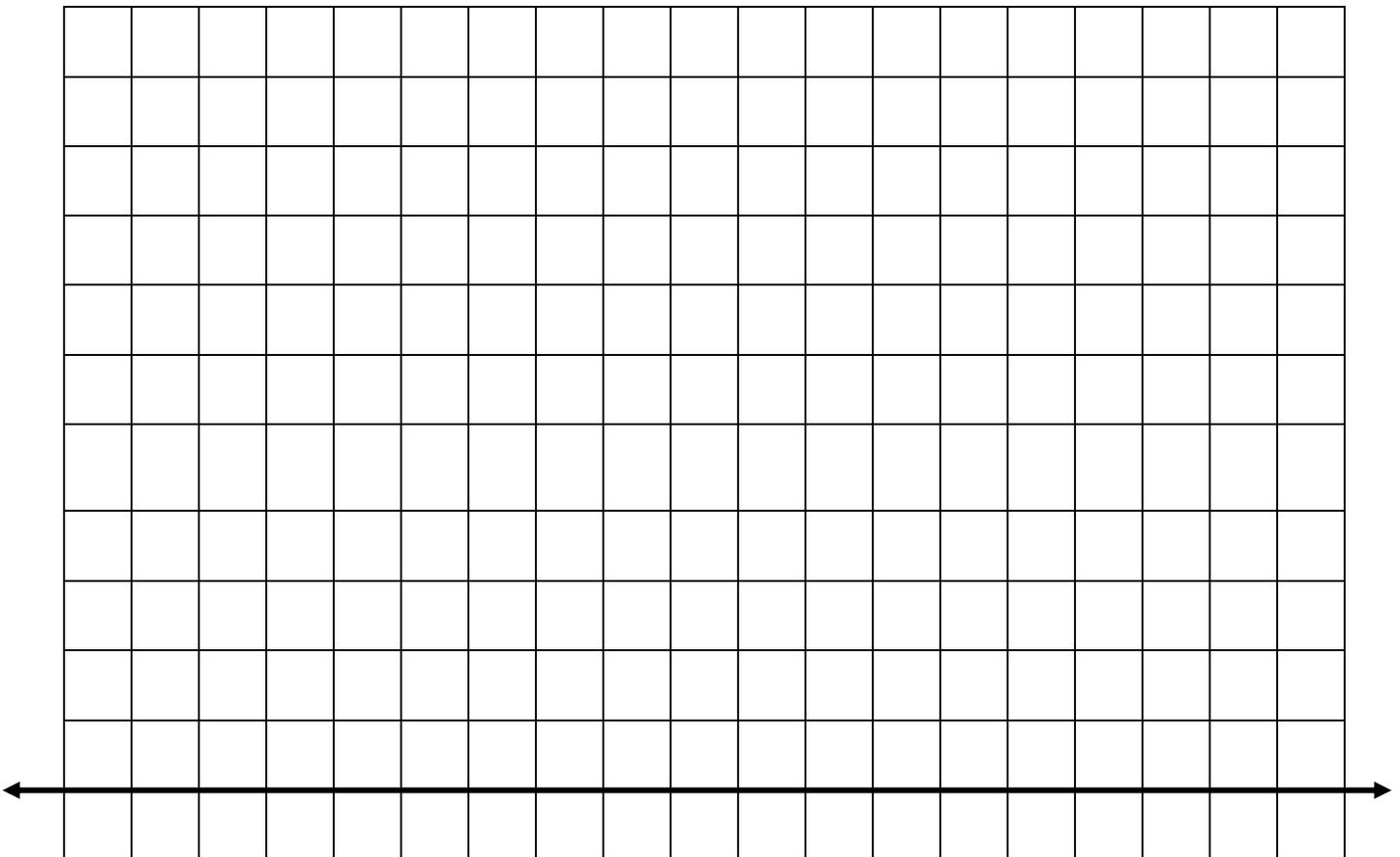Time in Seconds

Frogs in Flight Assessment

1. Use the data from Student Resource 2 in order to complete the line plot.

Title: **1 point**
This is an example of a sample answer. Your students may have

...ight Jumping Results

Data: **1 point**
Students must enter the data correctly

Distances Jumped

Label: **1 point**
This is an example of a sample answer. Your students have

Range: **1 point**
Students need to subtract the smallest data value from the largest data value.

2. What is the range of the data?

3. What is the mode of the data?

4. Many frogs participated in the *Frogs in Flight* jumping contest.

Part A
How many frogs participated in the contest?

Part B
Use what you know about line plots to explain why your answer is correct.

Use number and/or words in your explanation.