

## Line Graphs: Gone Graphing

### Brief Overview:

These lessons will be implemented during the Data Analysis and Statistics unit. After studying and creating line plots and bar graphs, students will be introduced to line graphs. They will utilize various sets of data tables in order to create line graphs that include all of the necessary criteria. Students will also practice making appropriate scales that correspond to specific sets of data. Finally, students will use their knowledge of line graphs to analyze and interpret double line graphs.

### NCTM Content Standard/National Science Education Standard:

Data Displays  
Data Analysis

### Grade/Level:

Grades 4-5

### Duration/Length:

Three days (60 minutes each day)

### Student Outcomes:

Students will:

- Organize and display data in line graphs.
- Interpret and compare data in double line graphs.

### Materials and Resources:

- Harry Potter line graph transparency (RS1-T)
- Chart paper
- Sally's Pencil Box data (RS2-S)
- Pencil Box line graph transparency (RS3-T)
- Pencil Box line graph answer key (RS4-T)
- MovieBuster line graph activity (RS5-S)
- incomplete MovieBuster line graph transparency (RS6-T)
- MovieBuster Journal Prompt (RS7-S)
- The Recycling Project (RS8-S)
- Summer Temperatures in the Bahamas transparency (RS9-T)
- Winter Temperatures in Alaska transparency (RS10-T)

- From Puppy to Dog (RS11-S)
- Home Run! Activity (RS12a-S) (RS12b-S)
- Home Run! Activity answer key (RS13-T)
- Winter Temperatures in Maryland (RS14-T)
- Harry Potter and Captain Underpants double line (RS15-T)
- Harry Potter and Captain Underpants answer key (RS16-T)
- Underwater Olympics double line graph (RS17-S)
- Underwater Olympics answer key (RS18-T)
- Venn Diagram (RS19-S)
- Summative Assessment (RS20-S)
- Summative Assessment Answer Key (RS21-T)

## Development/Procedures:

### Lesson 1 Introduction to Line Graphs

*Preassessment* – Display Harry Potter line graph (RS1-T) as an overhead transparency. Have students observe the graph and ask, based on their previous knowledge of graphs, to list the criteria needed to create a complete line graph. They will list the criteria in their notebooks.

*Launch* – Have students share their lists and record responses on chart paper. Elicit the criteria of a line graph: title, labels,  $x$ -axis (time increments) and  $y$ -axis (appropriate scale), and accurate data.

*Teacher Facilitation* – Distribute Sally’s Pencil Box data (RS2-S) to students. Display blank Pencil Box line graph (RS3-T) on the overhead. Model how to make a line graph using the pencil box data. Use responses from launch and check off the appropriate criteria while constructing the graph. Upon completion, facilitate discussion comparing line graphs to other kinds of graphs. Sample questions:  
 What differences do you see between line graphs and bar graphs?  
 What did you notice about the  $x$ -axis on the Harry Potter and the pencil box graph? Elicit that a line graph shows change over a period of time.

*Student Application* – Put students into pairs. Distribute MovieBuster line graph (RS5-S) activity. Have students work in pairs and use the data to make a line graph. Circulate and monitor student understanding. Make sure the students are working cooperatively and are using all criteria when constructing their line graph.

*Embedded Assessment* – After pairs finish their graphs, display an incomplete MovieBuster line graph on the overhead (RS6-T). Distribute MovieBuster Journal Prompt (RS7-S) and have students complete prompt independently.

*Reteaching* – Pull students into a small group. Distribute The Recycling Project (RS8-S) and complete together with teacher assistance.

*Extension* – Write the following question on the board and have them respond in their notebooks: *Look back at your MovieBuster line graph. Explain why you think the line goes up on Friday and Saturday?*

## **Lesson 2                      Creating Line Graphs Using Appropriate Scales**

*Launch (Preassessment embedded)* – Display Summer Temperatures in the Bahamas data chart and blank line graph transparency (RS9-T). Ask the students to help you to set up the graph using all of the essential criteria. When the students share that a scale is needed, purposely set up the scale incorrectly so that it counts by 1's. This will result in not having enough room for the rest of the data. At this point ask the students how they think this problem could be solved. Elicit that we need to set up the scale so that it is counting by 10's. Discuss with the students that scales often need to be changed according to the data. Fix the incorrect scale. Ask the students where they think the dot should be plotted for numbers that don't correspond exactly with the scale (for example, 75°F or 85°F). Elicit that these numbers should go in between the interval lines. Finish constructing the graph correctly.

*Teacher Facilitation* – Display Winter Temperatures in Alaska (RS10-T) transparency. Using Think-Pair-Share have students discuss what would be the most appropriate scale for this line graph. Using student suggestions, construct a line graph using various scales and discuss what interval is most appropriate. (Note: the most appropriate scale for this graph is intervals of 5). Point out that the scale must have equal intervals. Use Think-Pair-Share and ask students, "Why is it important that the scale have equal intervals?" Elicit that the intervals need to be consistent so that the data can be read correctly.

*Student Application* – Distribute From Puppy to Dog (RS11-S). Have students work individually to create a line graph of Buddy's weight. Circulate and check that students are using an appropriate scale as well as including all the necessary criteria. (Note: the most appropriate scale for this graph is intervals of 2). Upon completion, discuss what scale intervals the students tried:

Which scale intervals didn't work? Why?

Which scale interval was the most appropriate and why?

*Embedded Assessment* – Have students complete Home Run! Activity (RS12a-S).

*Reteaching* – Model another example on a blank graph using the data Winter Temperatures in Maryland (RS14-T) transparency. Purposely make the scale interval too small (intervals of 2) and ask:

What happens if the scale interval is too small? Elicit that you won't have enough room to graph all your data.

Change the scale to make the interval too large (intervals of 10) and ask:

What happens if the scale interval is too large? Elicit that you wouldn't utilize the whole graph and the data will be crunched at the bottom.

Discuss what would be the best interval (intervals of 5) and finish making the line graph with the most appropriate scale.

*Extension* – Have students complete response questions on Home Run! Activity (RS12B-S).

### **Lesson 3                      Interpreting Single and Double Line Graphs**

*Preassessment* – Display Harry Potter line graph transparency (RS15-T). Ask the students to describe what they notice about the overall shape of the line. Possible questions include:

Why do you think the book sales went up so much after the first month?

Why did the sales continue to decline after July?

Sample responses may include:

The sales went up in July because kids were off of school for summer and had more time to read.

The book went on sale at the end of June and there wasn't a full month for people to buy it.

The sales continued to decline after July because most people who really wanted the book would have purchased it when it first came out.

*Launch* – Read aloud the following scenario as you continue to display RS15-T (Make sure you cover up the Captain Underpants data table to avoid confusion): *The author of the series, Captain Underpants, needs your help. He wants to know how his book sales compared with the Harry Potter book sales. What would be the best way to display the data to compare it to the Harry Potter book sales?* Elicit that you need another line on the line graph to make a double line graph. Uncover the Captain Underpants Book Sales data.

*Teacher Facilitation:* Ask the students to help you graph the Captain Underpants Book Sales data. Have them share their observations of the double line graph. Direct the students to look at both lines on the graph. If students have not already noticed, ask them if there is anything confusing about the graph. Elicit that they do not know which line corresponds to which book. Ask them how this problem could be solved. Elicit that we need to make the lines look different so that we can distinguish between the two. This can be accomplished by making the lines two different colors or using a dotted line instead of

a straight one. Use a damp paper towel to erase the line and draw it again in a different color.

Ask the students to observe the graph and look closely at the two lines again. Ask the students the following question: "How would someone else be able to tell which color corresponds to which book?" Next ask them if there is anything we could add to the graph to solve this problem. Elicit that we need a key, then model for them the appropriate way to add a key to a double line graph.

Introduce the important vocabulary word, *trend*. Tell the students that the trend of the data on a graph either increases, decreases, or stays the same.

Use the following sample questions to facilitate a discussion on interpreting the trend of the double line graph:

Describe the trend of the Captain Underpants books sales data. (Possible responses: The number of books sold increased from June to July, stayed the same between July and August, increased from August to September, and decreased from September to October.)  
Between what months did the sales of both books increase?  
Between what months did the sales of both books decrease?  
How many more Harry Potter books were sold in August than Captain Underpants?

*Student Application* - Distribute Underwater Olympics activity (RS17-S). As the students are working, monitor their progress to make sure that they are able to accurately answer the questions by interpreting the double line graph. Also, encourage them to use mathematical vocabulary to explain their answers.

*Embedded Assessment* – Distribute Venn Diagram (RS19-S). Make sure that the students write in the words single and double line graph in the boxes above the Venn Diagram. Students will list the similarities and differences between a line and double line graph in order to compare the two.

*Reteaching* – Pull students into a small group. Review the questions from the Underwater Olympics activity (RS17-S) and have students verbally respond. Give extra support as needed. Have the terms *trend*, *decrease*, *increase*, and *stay the same* posted so they are easily visible. Make sure the students are using this math vocabulary in their oral responses.

*Extension* – Have students log on to the following website and practice creating line graphs:

<http://nces.ed.gov/nceskids/graphing/line.asp>

**Summative Assessment:**

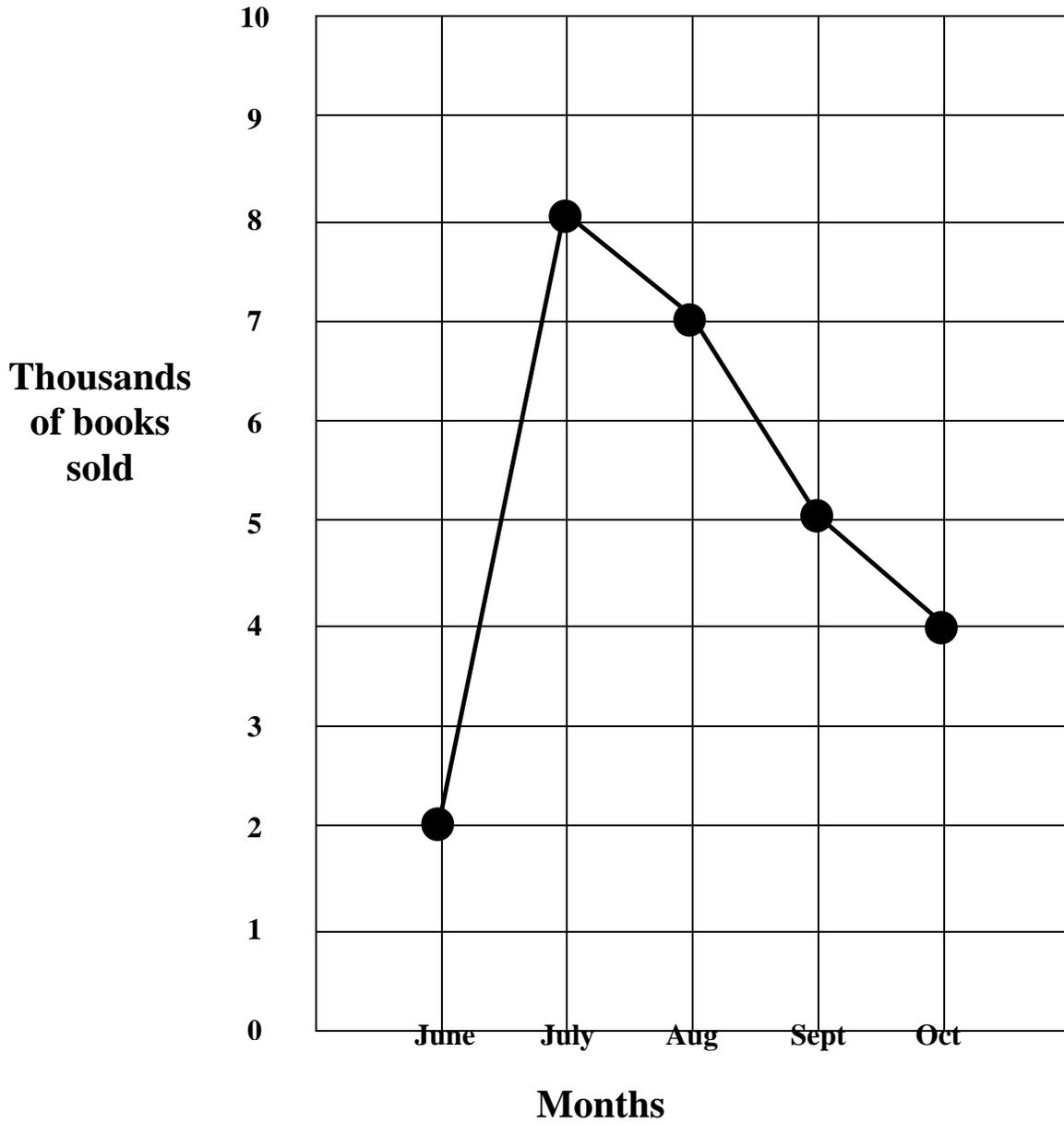
The students will complete the Assessment Activity (RS20-S). They will apply their knowledge of line graphs and the essential criteria by constructing a single line graph and answering interpretation questions. They will then apply their knowledge of double line graphs by answering brief and extended constructed responses.

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# Harry Potter Book Sales in 2003



# Sally's Pencil Box

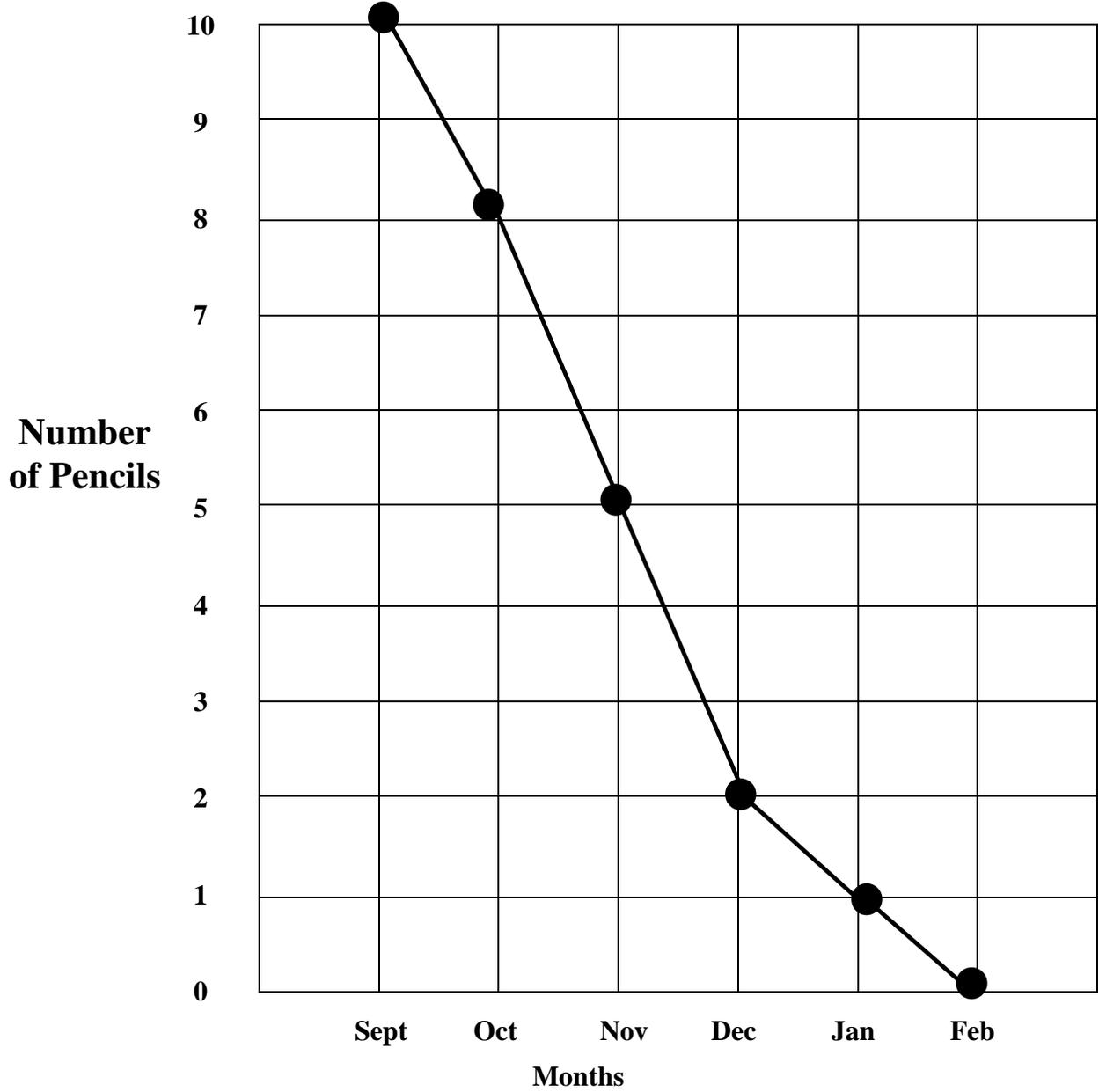


<b>Month</b>	<b>Number of Pencils in Sally's Pencil Box</b>
September	10
October	8
November	5
December	2
January	1
February	0


<b>Month</b>	<b>Number of Pencils in Sally's Pencil Box</b>
September	10
October	8
November	5
December	2
January	1
February	0

- Title
- Labels
- x-axis (time increments)
- y-axis (scale)
- Accurate data

Sally's Pencil Box



- Title
- Labels
- x*-axis (time increments)
- y*-axis (scale)
- Accurate data

Name: \_\_\_\_\_

# MovieBusters

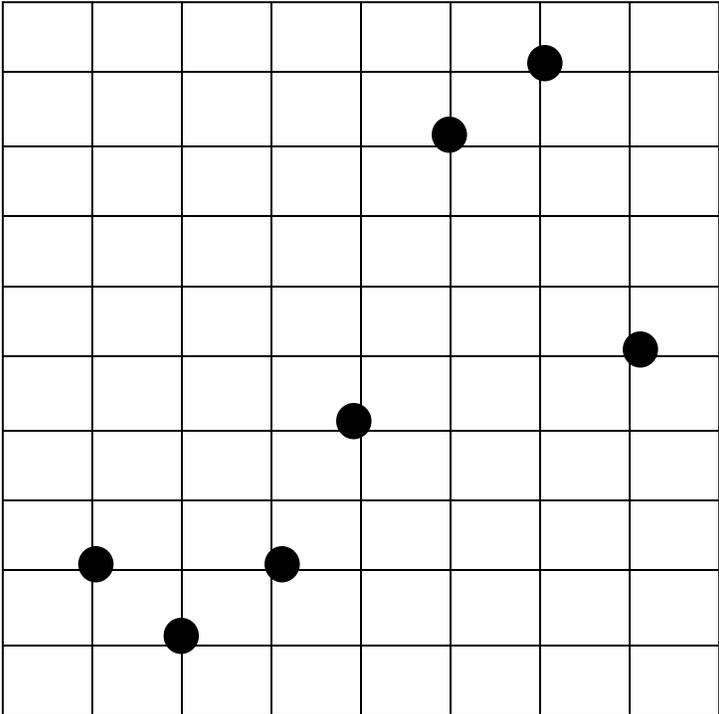


Directions: *MovieBusters* keeps data on the number of DVDs rented during each week. Use the data table below to make a line graph of the number of DVDs sold last week. Remember to check off the criteria as you include them in your graph.


<b>Day</b>	<b>Hundreds of DVDs Rented</b>
Monday	2
Tuesday	1
Wednesday	2
Thursday	4
Friday	8
Saturday	9
Sunday	5

- Title
- Labels
- x-axis  
(time increments)
- y-axis

**Hundreds  
of DVDs**



**Days**

<b>Day</b>	<b>Hundreds of DVDs Rented</b>
Monday	2
Tuesday	1
Wednesday	2
Thursday	4
Friday	8
Saturday	9
Sunday	5

Name: \_\_\_\_\_



## ***MovieBuster* Journal Prompt**

Look at the graph on the overhead. Your teacher has gotten very tired and left some important criteria out of the graph. Explain what needs to be added to the graph and why it should be included.

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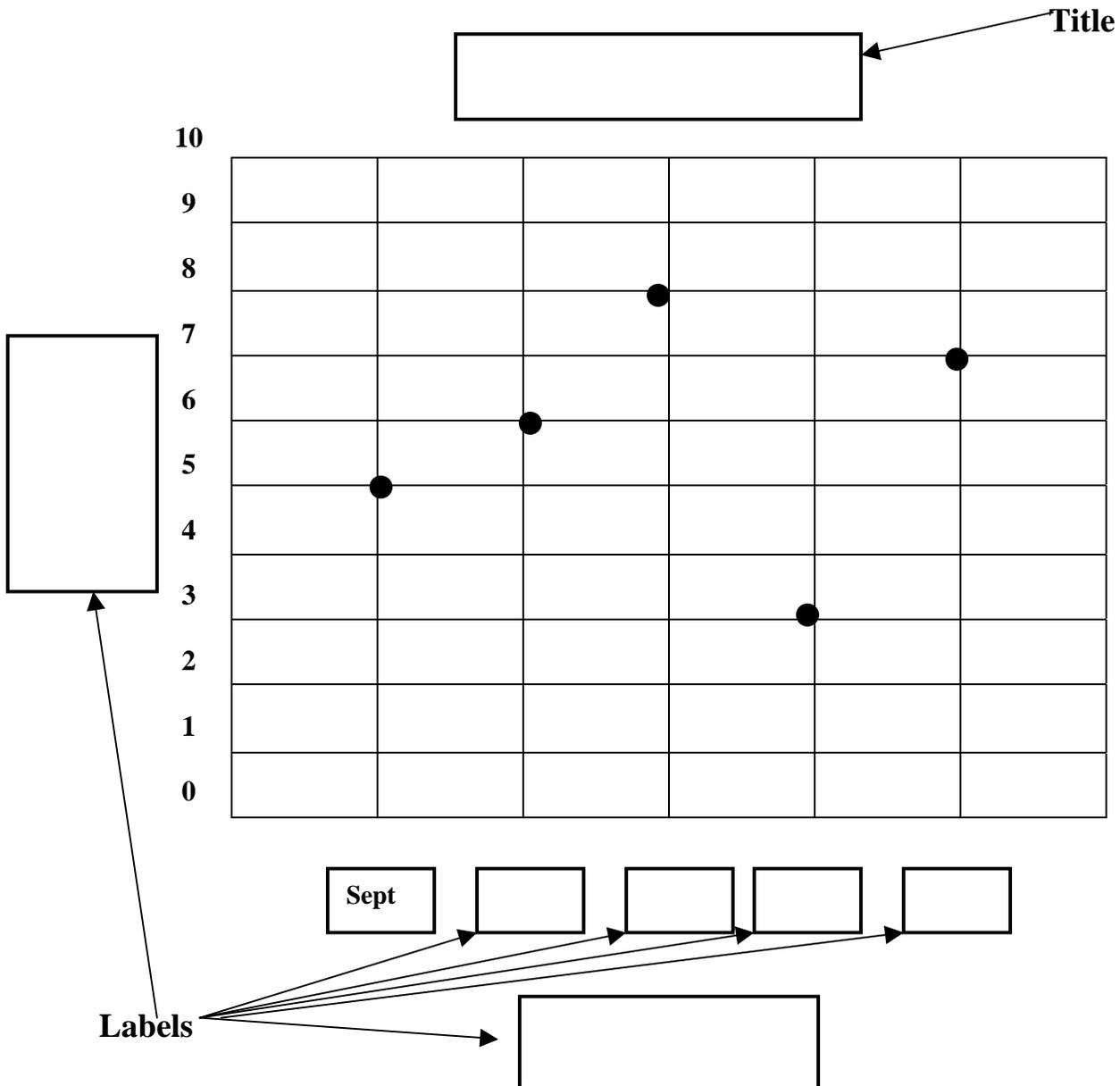
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Name: \_\_\_\_\_

# The Recycling Project



Directions: The third \_\_\_\_\_ graders at your school made line graphs showing how many pounds of paper they recycled during the first five months of school. Below is an example of a student's graph, but it is incomplete. Help the student complete the graph by filling in the missing information.



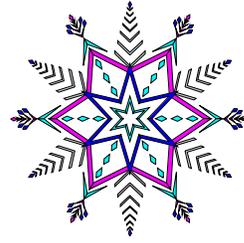
# Summer Temperatures in the Bahamas




Month	Average Temperature (°F)
May	75
June	80
July	85
August	90
September	85

- Title
- Labels
- x-axis (time increments)
- y-axis (scale)
- Accurate data

# Winter Temperatures in Alaska




Month	Average Temperature (°F)
November	40
December	25
January	15
February	20
March	30

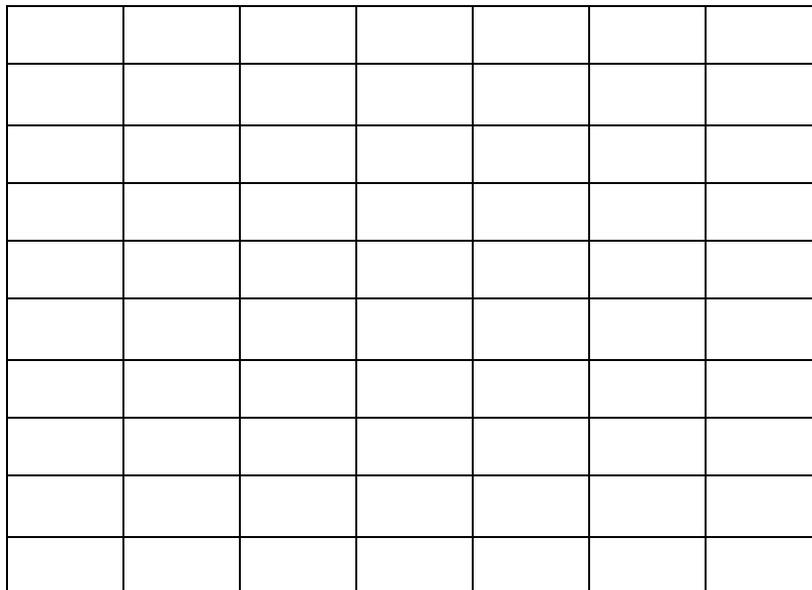
- Title
- Labels
- x-axis (time increments)
- y-axis (scale)
- Accurate data

Name: \_\_\_\_\_

## From Puppy To Dog



Directions: Buddy the dog just turned five years old. Buddy's vet has been tracking his weight since birth. Use the data below to create a line graph showing Buddy's weight through the years. Remember to include all the criteria of a line graph and use an appropriate scale.



<b>Age (years)</b>	<b>Weight (pounds)</b>
Birth	2
1	10
2	16
3	18
4	18
5	20

- Title
- Labels
- x-axis (time increments)
- y-axis (scale)
- Accurate data

Name: \_\_\_\_\_

# Home Run!



Directions: Use the data below to graph the number of home runs Slugger McGee has hit the past 6 seasons. Remember to include all the criteria of a line graph and use an appropriate scale. Then, answer the question on the next page.


<b>Season</b>	<b>Number of Home Runs</b>
1999	15
2000	25
2001	35
2002	5
2003	40
2004	40

Part A

What happened to the line in 2002?

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Part B

Using words and/or numbers explain why you think this happened?

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Name: \_\_\_\_\_

Directions: Use your completed line graph to answer the following questions.

1. Describe what happened to the line in Slugger McGee's six seasons. Did it increase, decrease, or both?

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2. Predict how many home runs Slugger McGee will hit in 2005. Explain your answer using information from your graph.

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3. If Slugger McGee plays baseball for another 10 seasons, do you think the line will continue to increase? Explain why or why not.

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12a

*Below are sample responses. Accept all reasonable answers.*

Part A

What happened to the line in 2002?

***The line went down a lot in 2002. This means he didn't hit very many home runs.***

Part B

Using words and/or numbers explain why you think this happened?

*Slugger probably only hit 5 home runs because he was hurt, he was unable to participate in many games, or there was a baseball strike.*

12b

1. Describe what happened to the line in Slugger McGee's six seasons. Did it increase, decrease, or both?

*The line went up from 1999 to 2001. The line went down sharply in 2002 and then went back up again in 2003. The line leveled off in 2004.*

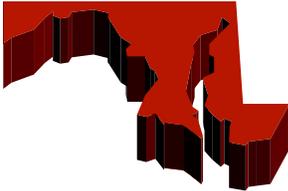
2. Predict how many home runs Slugger McGee will hit in 2005. Explain your answer using information from your graph.

*I think Slugger McGee will hit about 45 home runs. According to the graph, almost every season he hit more and more home runs and I believe he will continue to hit even more.*

3. If Slugger McGee plays baseball for another 10 seasons, do you think the line will continue to increase? Explain why or why not.

*I think the line will continue to increase for a few more years but not for all 10 seasons. Slugger will get older and it will start getting harder for him to hit so many home runs.*

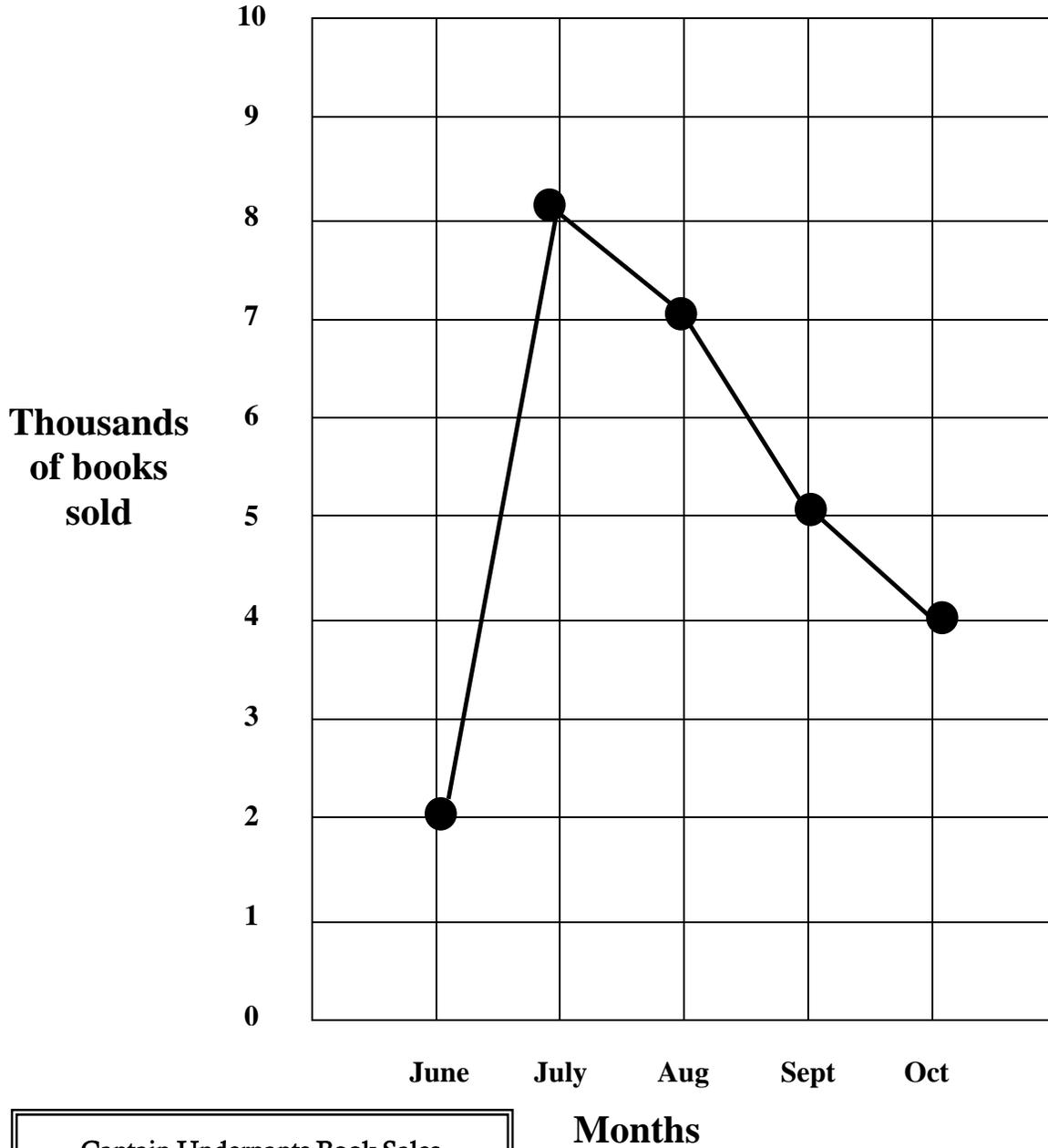
# Winter Temperatures in Maryland




<b>Month</b>	<b>Average Temperature (°F)</b>
December	40
January	35
February	30
March	45

- Title
- Labels
- x*-axis (time increments)
- y*-axis (scale)
- Accurate data

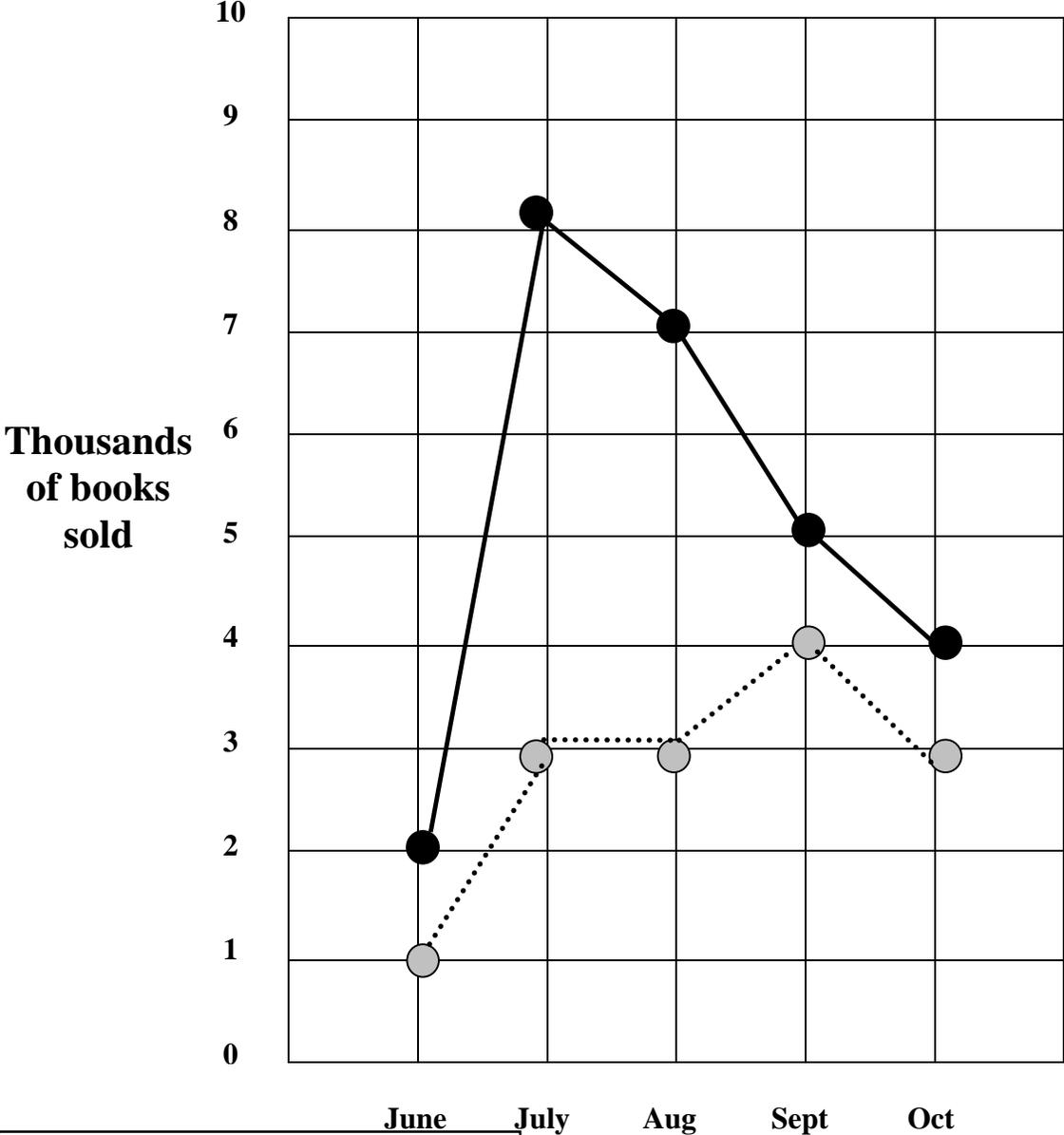
# Harry Potter Book Sales in 2003



Captain Underpants Book Sales

Month	Thousands of books sold
June	1
July	3
August	3
September	4
October	3

# Harry Potter Book Sales in 2003



**June      July      Aug      Sept      Oct**

**Months**

Month	Thousands of books sold
June	1
July	3
August	3
September	4
October	3

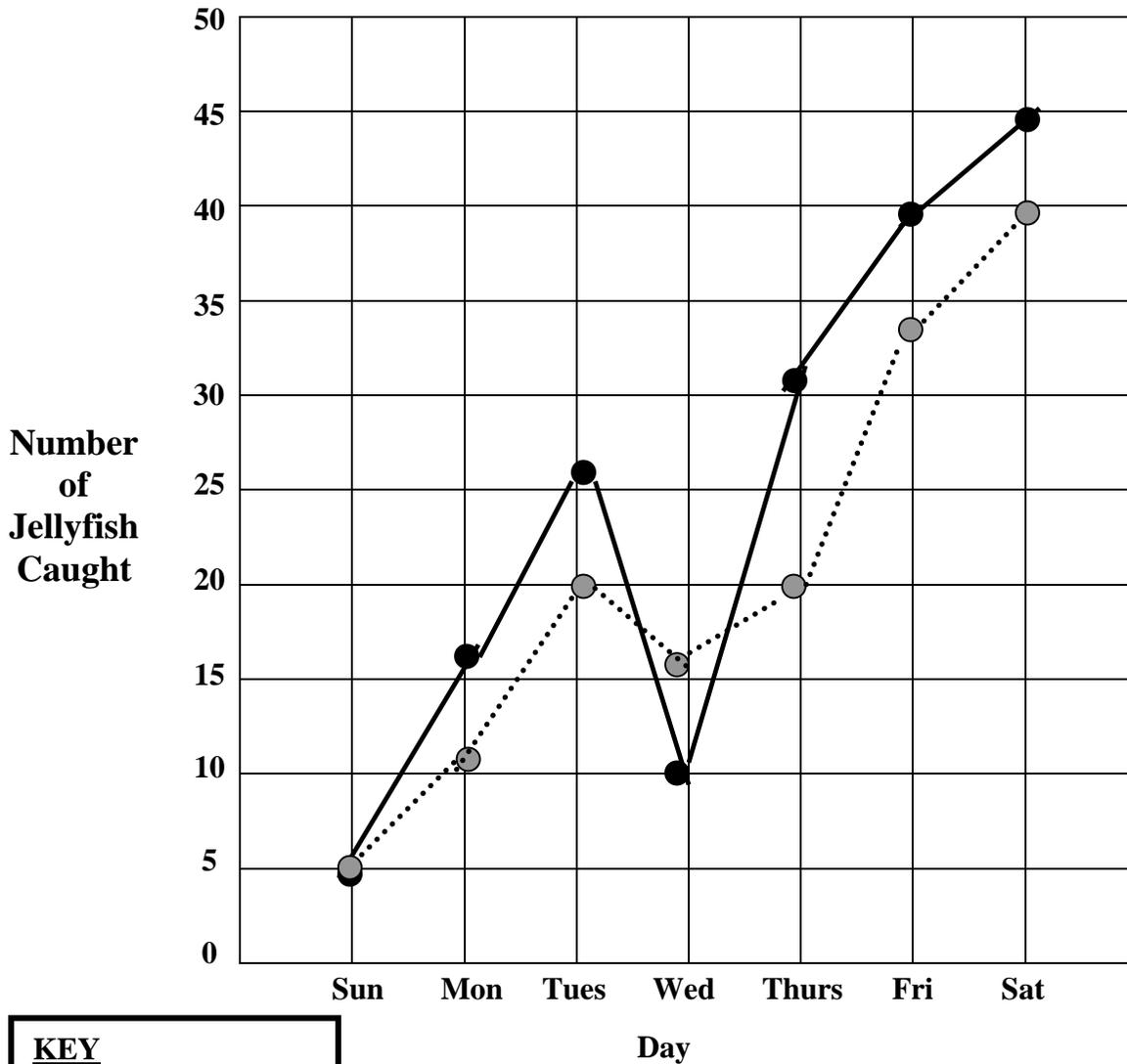
<u>KEY</u>	
Harry Potter	—————
Captain Underpants	.....

# Underwater Olympics



Directions: Spongebob Squarepants and Patrick Starfish are participating in the jellyfish catching competition in the Underwater Olympics. Last week, they both practiced and kept track of how many jellyfish they caught each day. Use the double line graph to answer the questions on the next page.

## Jellyfish Catching Practice



**KEY**

Spongebob Squarepants \_\_\_\_\_

Patrick Starfish .....

1. Describe the trend in the data for Spongebob.

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**2.**

Part A

On which day did the data show a decrease for Spongebob and Patrick?

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Part B

Using words and/or numbers, give some possible reasons this occurred?

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3. Overall, who was the better jellyfish catcher? Using information from the graph explain how you know this.

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4. About how many jellyfish did Patrick catch on Friday? How do you know?

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*Below are sample answers. Accept all reasonable responses.*

1. Describe the trend in the data for Spongebob.

*The data for Spongebob increased from Sunday to Tuesday. He didn't catch as many jellyfish on Wednesday but he improved on Thursday through Saturday.*

2. Part A

On which day did the data show a decrease for Spongebob and Patrick?

*Wednesday*

Part B

Using words and/or numbers give some possible reasons this occurred?

*Maybe the reason Patrick only caught 15 jellyfish and Spongebob only caught 10 was that there weren't as many jellyfish around to catch on Wednesday.*

3. Overall, who was the better jellyfish catcher? Using information from the graph explain how you know this.

*Spongebob was better at catching jellyfish. He caught more jellyfish than Patrick 5 of the 7 days.*

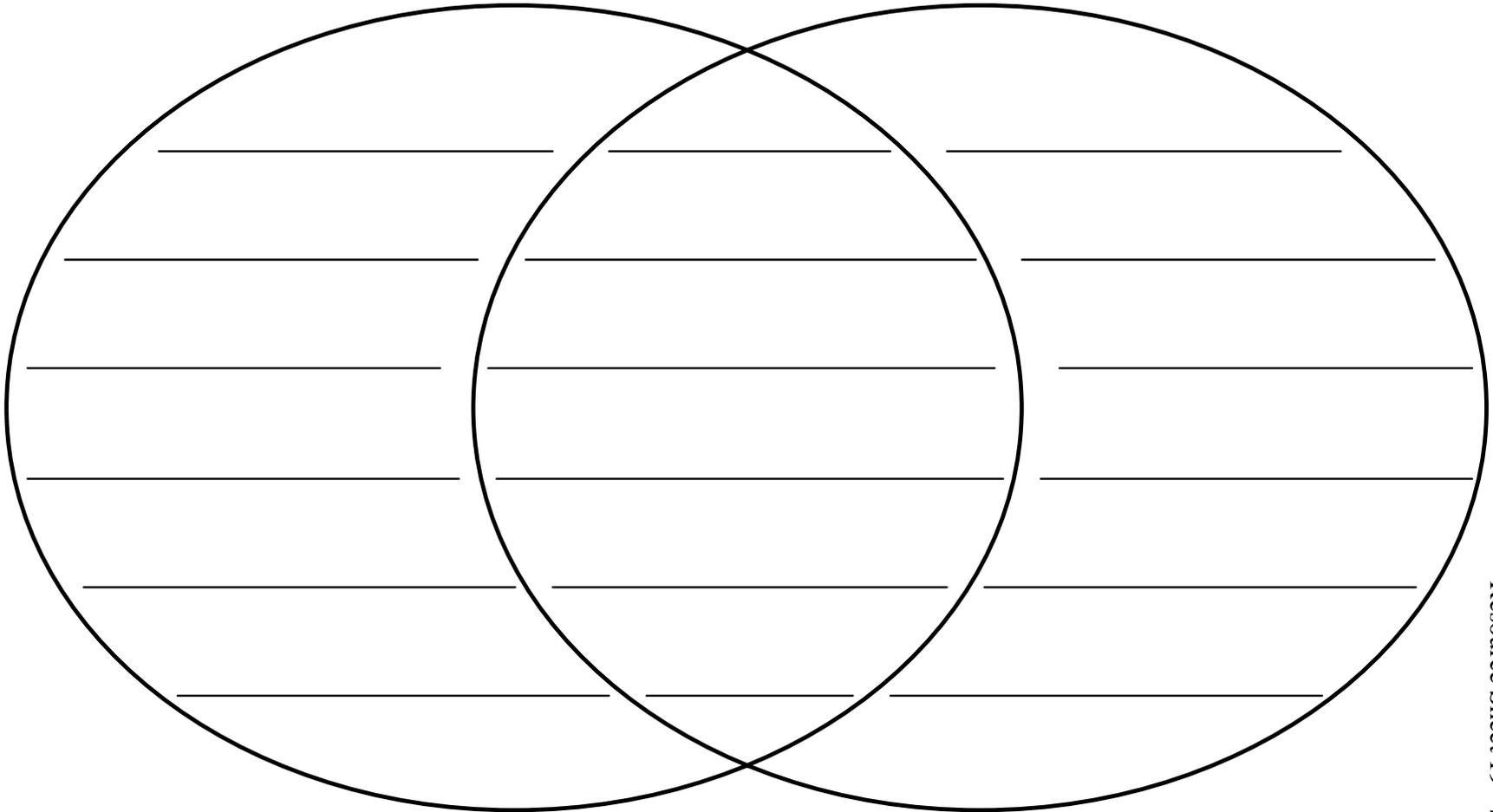
4. About how many jellyfish did Patrick catch on Friday? How do you know?

*Patrick caught about 33 jellyfish on Friday. I know this because the dot for Patrick on Friday is between 30 and 35.*

Name: \_\_\_\_\_

Single Line Graph

Double Line Graph





Directions: Use the data from the line graph you created to answer the following question.

Part A

What is the trend of the data from May to August?

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Part B

Using words and /or numbers explain why you think this trend occurred.

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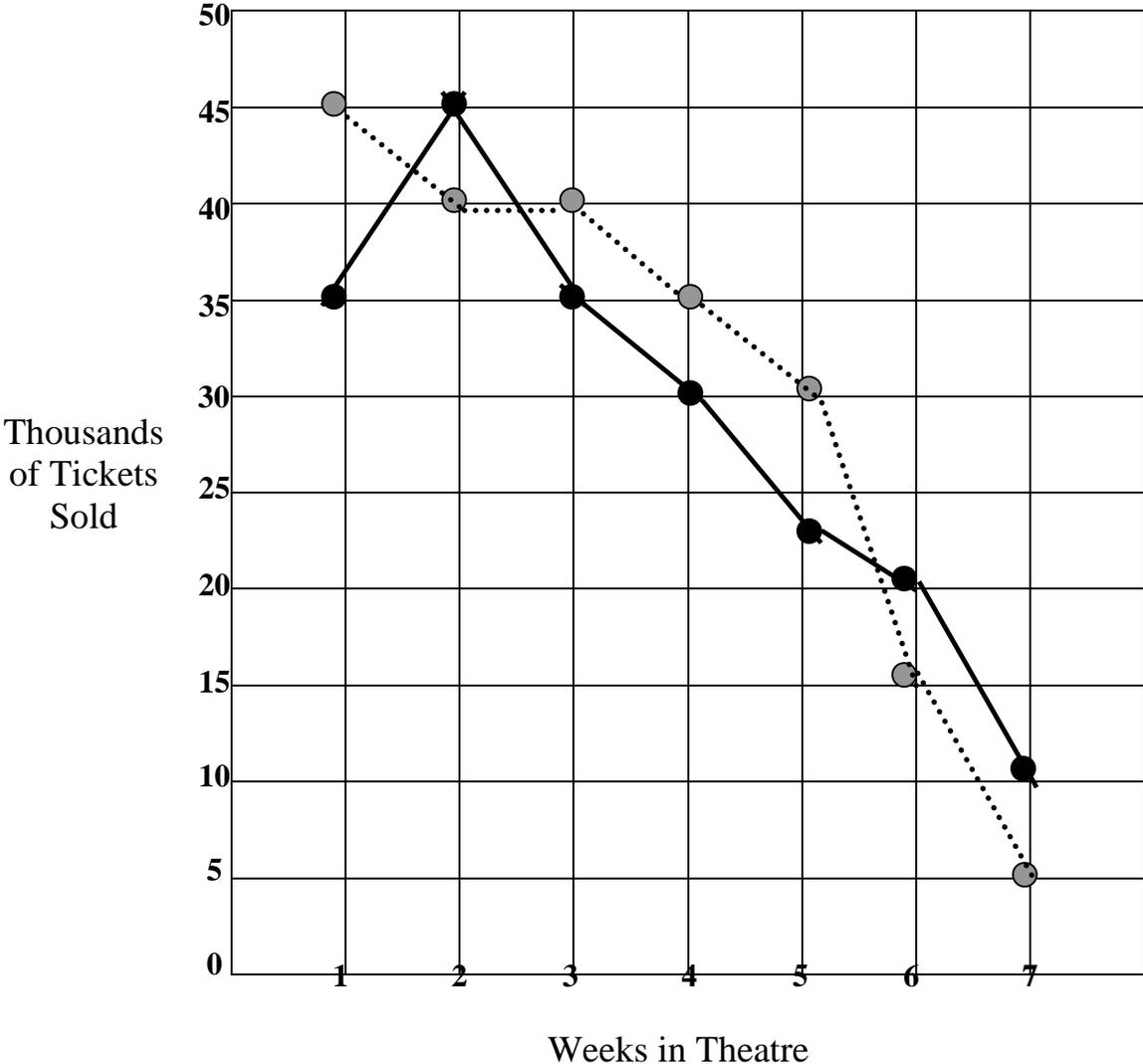
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Directions: Use the line graph below to answer the questions on the next page.

Movie Ticket Sales



**KEY**

Revenge of the Dogs .....  
The Cookie Caper \_\_\_\_\_



1. How many thousands of tickets were sold for *Revenge of the Dogs* in week 2?

- Ⓐ 45
- Ⓑ 40
- Ⓒ 35
- Ⓓ 8

2. How many more thousands of tickets were sold for *Revenge of the Dogs* than *Cookie Caper* in week 5?

- Ⓐ 5
- Ⓑ 30
- Ⓒ 23
- Ⓓ 7

3. Part A

What is the overall trend of the data for *Revenge of the Dogs*?

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Part B

Using words and/or numbers explain why you think this trend occurred.

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Name: \_\_\_\_\_

### Line Graph Assessment

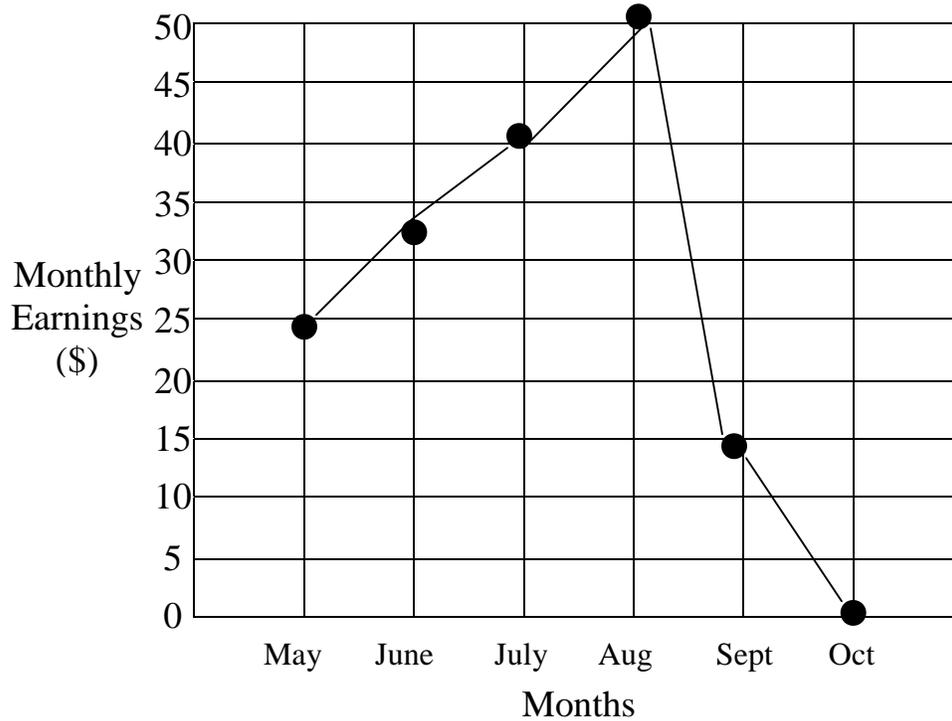
Directions: Use the data from the table to create a line graph.  
Remember to include all the criteria and use an appropriate scale.

Lemonade Stand Sales

Month	Monthly Earnings (\$)
May	\$25
June	\$32
July	\$40
August	\$50
September	\$15
October	\$0



Lemonade Stand Sales



Directions: Use the data from the line graph you created to answer the following question.

*Below are just sample responses. Accept all reasonable responses*

Part A

What is the trend of the data from May to August?

*The data showed an increase which means the sales went up.*

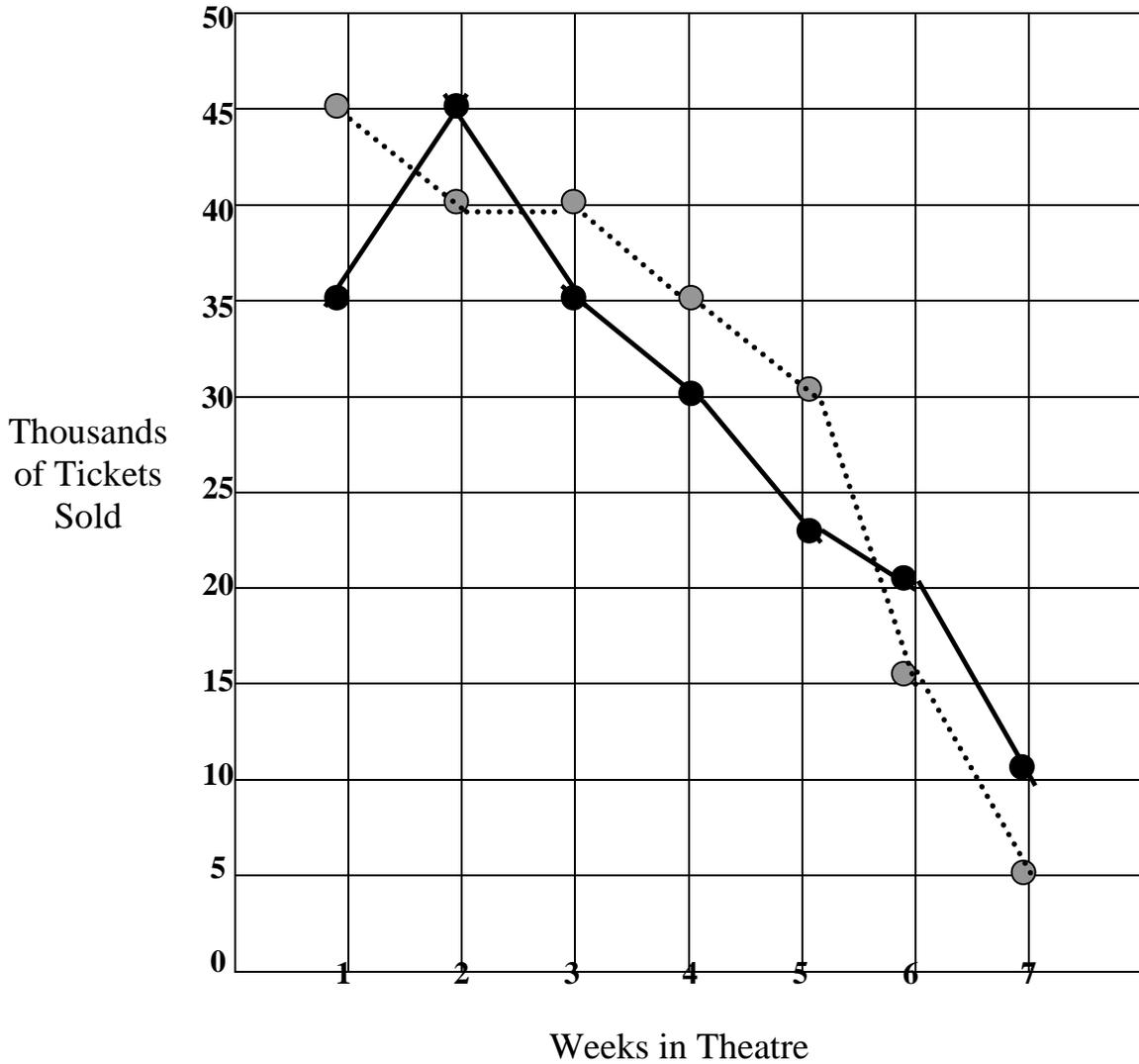
Part B

Using words and/or numbers explain why you think this trend occurred.

*The weather got hotter so more people wanted to buy lemonade.*

Directions: Use the line graph below to answer the questions on the next page.

Movie Ticket Sales



**KEY**

Revenge of the Dogs .....  
The Cookie Caper \_\_\_\_\_



1. How many thousands of tickets were sold for *Revenge of the Dogs* in week 2?

Ⓐ 45

Ⓑ **40**

Ⓒ 35

Ⓓ 8

2. How many more thousands of tickets were sold for *Revenge of the Dogs* than *Cookie Caper* in week 5?

Ⓐ 5

Ⓑ 30

Ⓒ 23

Ⓓ **7**

3. Part A

What is the overall trend of the data for *Revenge of the Dogs*?

*The data showed a decrease which means the movie sold fewer and fewer tickets.*

Part B

Using words and/or numbers explain why you think this trend occurred.

*More people see the movie the longer it is out in the theatre. Therefore, by the seventh week most people who wanted to see the movie have already seen it and not as many people would be buying tickets.*