Unit 6 | Lesson 1

Creating a Scatter Plot

Let's find ways to show patterns in data.

Focus

Goal(s):

1. Understand that a "scatter plot" represents data with two variables and does not represent a function.
2. Create a scatter plot from a table of data, and informally describe (orally and in writing) the trend of the data.
3. Create a table of collected data, and explain (orally) how to organize the data.

Coherence

Today:

Students see the association between the area of the ozone hole and the number of skin cancer cases in Australia. They read data from a table to make predictions (MP2), and then create a scatter plot to visualize patterns in the data to make connections between two quantities (MP7).

Previously:

In Grade 6, students represented the distribution of a single statistical variable using dot plots, histograms, and box plots.

Coming Soon:

In Lesson 3, students classify associations in data (and discover that the area of the ozone hole has started showing signs of recovery).

Standards

- **Addressing:**
  8.SP.A.1
  Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.
- **Building On:**
  - 6.SP.B.4
- **Building Toward:**
  - 8.SP.A.1
  - 8.SP.A.2
  - 8.SP.A.3

Pacing Guide

Suggested Total Lesson Time | ~45 min

Warm-up	Activity 1	Activity 2	Activity 3	Summary	Exit Ticket
5 min	10 min	10 min	10 min	5 min	5 min
Independent	*Pairs*	*Independent*	*Pairs*	*Whole Class*	*Independent*
		8.SP.A.1	*8.SP.A.1*	*8.SP.A.1*	*8.SP.A.1*
	MP2	*MP7*			
Desmos Activity and Presentation Slides					
Slide(s) 1	Slide(s) 2	Slide(s) 3–5	Slide(s) 6	Slide(s) 7-8	Slide(s) 9

Vocabulary

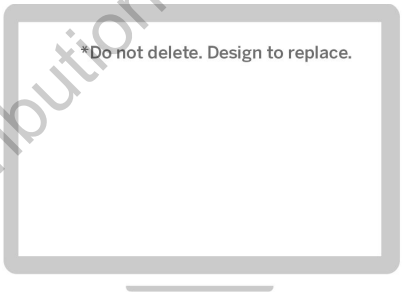
New words

- **Scatter plot**

Materials

- Exit Ticket PDF
- Additional Practice Book

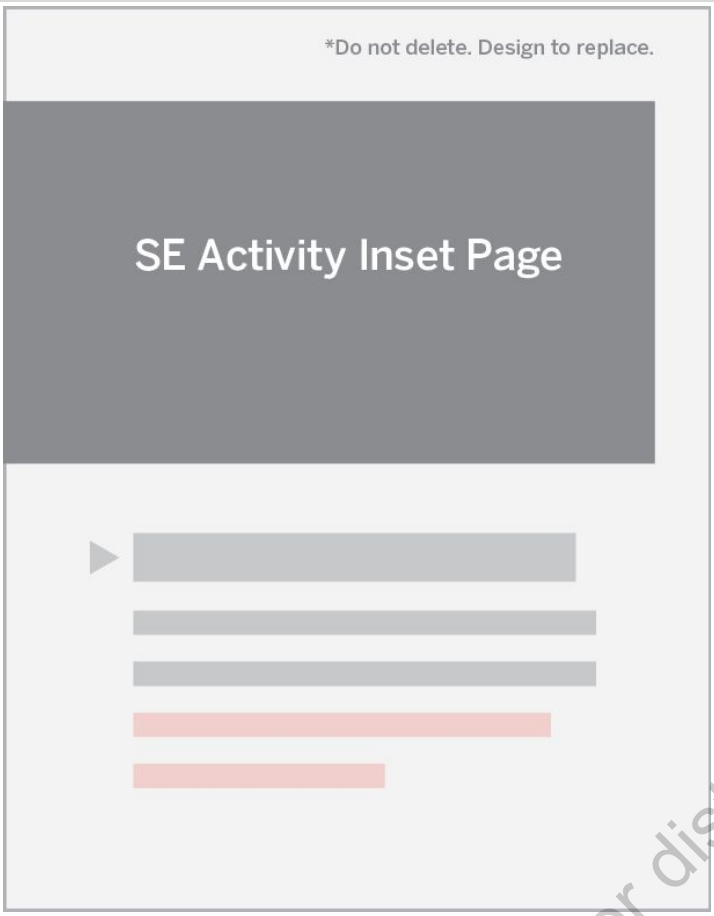
Desmos Digital Classroom



Activity 2: Digital Scatter Plots
Students use the sketch feature to create a scale and plot points on a graph. Teachers can check all students' answers at once by overlaying student screens, checking for accuracy and addressing any concerns immediately.

Warm-up: Notice and Wonder

Students look at infographics showing changes in the ozone hole.



Launch

Give students 1 minute of quiet think time followed by a whole-class discussion. The warm-up should be used to introduce the ozone layer. Say, "Ozone is a gas found in the atmosphere. It protects the Earth from ultraviolet radiation. Here, we see the area of the ozone hole in different years."

Monitor

Help students get started by asking about the changes they see in the images.

Connect

Have students share what they noticed and wondered. Record answers for all to see.

Ask, "What do you think makes the area of the ozone holechange?" *(Possible answer: the amount of pollution made by humans.)*

Highlight the color changes. Darker red represents lower levels of ozone. The ozone hole area is increasing over time.

Alternate Warm-up Activity	Differentiated Support	
N/A	**English Language Learners:** N/A	**Students with Disabilities:** N/A

Activity 1: Data Tables

Students read data tables to make a prediction, and look for ways to organize data so they can better see the association between variables.

Launch

Read the prompt aloud with students and answer questions they may have about the context.

Monitor

Help students get started by asking, "In 1983, do you think the ozone level was closer to 5 or 11? How do you know?"

Look for productive strategies:

- **Writing an estimate that is *any* number between adjacent data.** Ask students to make a more precise estimate by comparing which year the question is closer to before writing an estimate for the ozone hole area or the number of skin cancer cases.

Connect

Have students share how they used data in the table to make a prediction. **(MP2)**

Highlight that the ozone hole area and the number of skin cancer cases are from the same years. Since we are looking at the same years, we are able to see how the area and the number of cases might be related.

Ask, "Did anyone find it challenging to make connections based on the table alone?"

Differentiated Support

Students Who Need Help	Students Ready for More	English Language Learners	Students with Disabilities
Limit the data to five rows instead of ten.	N/A	N/A	To support the development of organizational skills, check in with students within the first 2–3 minutes of work time. Look for students who have at least one close estimate using the table. Check to make sure students are in agreement with their matches and that either student can justify the decision.

Activity 2: Creating a Scatter Plot

Students plot data from a table to create and learn about a *scatter plot* and informally recognize associations between variables.

Launch

Tell students they will be plotting points using the data from Activity 1 to look for more patterns.

Monitor

Help students get started by explaining how to plot a point with the coordinates $(5, 11)$.

Look for points of confusion:

- **Not knowing how to create scales for the axes.** Ask students to identify the range of each data set.
- **Reversing the coordinates, and plotting the points as *(number of skin cancer cases, ozone hole area)*.** Write x next to the ozone hole area and y next to the number of skin cancer cases in the table and color code the table titles to the axes labels.

Connect

Display student scatter plots representing the same information as the matching table. **(MP7)**

Have students share their completed scatter plots with their partner and look for any discrepancies.

Highlight that this graph is different from the ones they've seen this year. There are several points scattered on the graph, and it does not represent a function. For example, points $(22, 8444)$ and $(22, 10, 450)$ have the same $x-$ coordinate but different $y-$ coordinates.

Define *scatter plot*. A *scatter plot* is a graphical representation of data. A *scatter plot* is when two numerical variables are graphed by using one variable as the x -coordinate and the other as the y -coordinate. Data pairs are represented as plotted points.

Differentiated Support

Students Who Need Help	Students Ready for More	English Language Learners	Students with Disabilities
Plot the first three points on the graph to model how to create a scatter plot. Have students plot the next seven points.	N/A	N/A	Provide access to tools and assistive technologies, such as graphing software. Some students may benefit from a checklist or a list of steps to be able to use the digital materials or software.

Activity 3: Interpreting a Scatter Plot

After reading data from a table and creating a scatter plot, students look for patterns in the data that might not have been visible in the table.

Launch

Ask students to look at the scatter plot from Activity 2 to answer the questions.

Monitor

Help students get started by asking, "How does the scatter plot help organize data differently than the table does?" *(It creates a visual of the overall patterns.)*

Look for points of confusion:

- **Not recognizing any patterns.** Ask students what happens to the number of skin cancer cases as the ozone hole area increases. In Lesson 3, students will learn about associations more formally.

Connect

Display a scatter plot completed by a student from Activity 2.

Have students share the advantages of representing data using a scatter plot.

Ask, "Based on the data, do you think there is an association between ozone hole area and number of skin cancer cases?" *(Yes, they appear to increase at the same time.)*

Highlight that *scatter plots* help us to investigate possible associations between two attributes. Based on our data, as the ozone hole area increases, the number of skin cancer cases also increases. Moreover, scientists found that the increase in ozone hole area increases the UV rays that actually cause skin cancer.

Differentiated Support

Students Who Need Help	Students Ready for More	English Language Learners	Students with Disabilities
N/A	N/A	*MLR2: Compare and Connect* Help students make connections between the table and the scatter plot with questions such as, "What patterns did you see in the table? What patterns did you see in the scatter plot?" This will help students reason about the ways to create a scatter plot from a table, and to identify patterns using both representations.	Encourage and support opportunities for peer interactions. Invite students to talk about their ideas with a partner before writing them down. Display sentence frames to support students when they explain their reasoning. For example, "One question I *can/cannot* answer from the scatter plot is ___."

Summary

Review and synthesize how to construct a scatter plot and compare it to data organized in a table.

Synthesize

Review vocabulary *scatter plot*

Have students share what a scatter plot is in their own words, and how it interpreting data on a scatter plot compares to interpreting data from a table.

Ask, "How is reading data from a scatter plot different than reading data from a table?"

Highlight that a *scatter plot* helps us visualize data and identify any overall trends in data.

Exit Ticket

Students demonstrate their understanding by creating a scatter plot given a table.

Success looks like...

1. Comprehend that a "scatter plot" represents data with two variables and does not represent a function.
2. Create a scatter plot from a table of data, and describe (orally and in writing) the trend of the data.
3. Create a table of collected data, and explain (orally) how to organize the data.

Suggested next steps

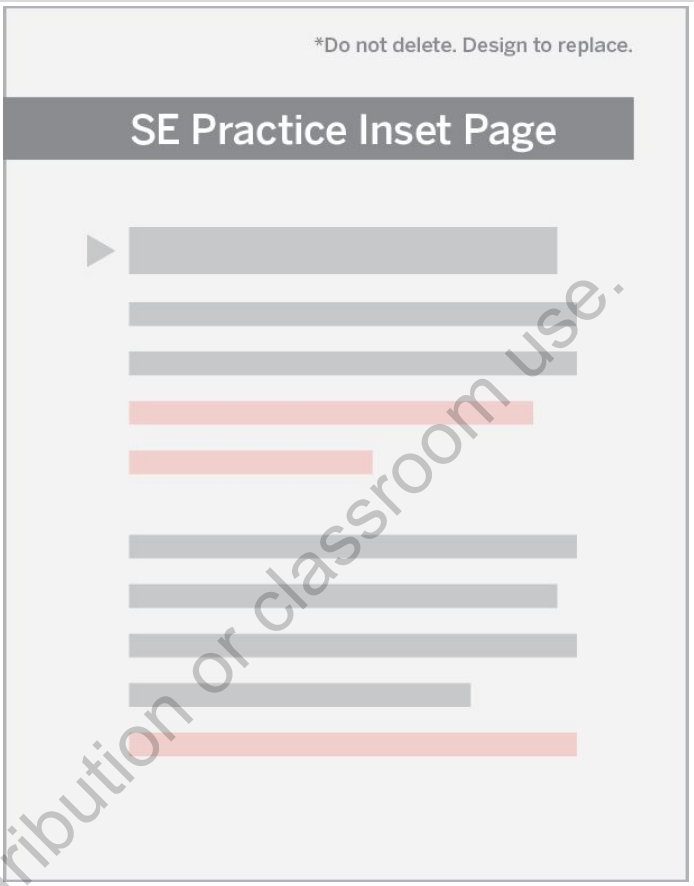
If students write a scale that is not appropriate for the data set, consider:

- Reviewing strategies to create a scale from Activity 2
- Assigning Practice Problem 1

If students reverse the coordinates, plotting the data as *(right hand length, right foot length)*, consider:

- Labeling the table and graph with x and y next to the corresponding variables
- Assigning Practice Problem 1

Practice



Practice Problem Analysis

Problems	Refer to	Standards	DOK
1	Activity 2	8.SP.A.1	*1*
2	Activity 3	8.SP.A.1	*3*
3	Unit 5 Lesson18	8.G.C.9	*2*
4	Unit 6 Lesson 2	8.SP.A.1	*1*

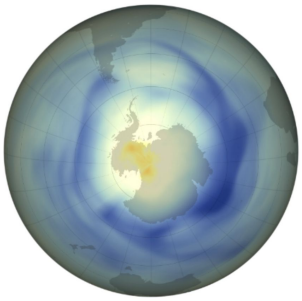
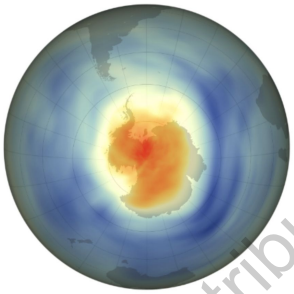
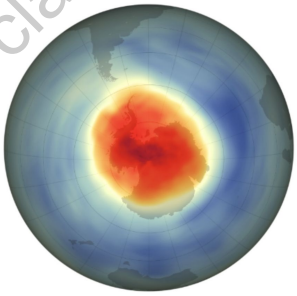
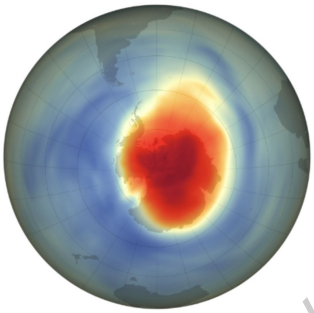
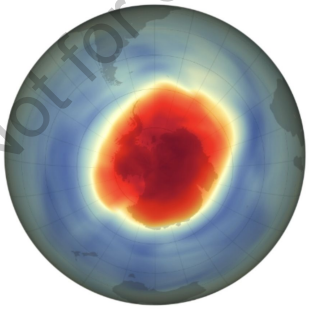
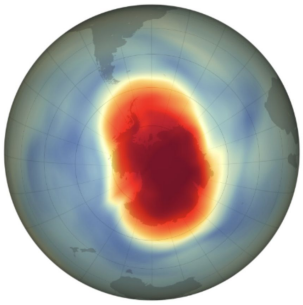
(Space to show the cover for Additional Practice?)

Creating a Scatter Plot

Let's find ways to show patterns in data.

Warm-up: Notice and Wonder

The images show the hole in the ozone over Antarctica in the Southern Hemisphere. The size and shape of the hole are monitored yearly.

October 16, 1980 	October 3, 1984 	October 7, 1989 
October 11, 1992 	October 6, 1998 	October 6, 2006 

1. What do you notice?

2. What do you wonder?

Activity 1: Data Tables

NASA records the area of the ozone hole between September and October every year. The Australian government records the number of new cases of melanoma, a type of skin cancer, in Australia.

The tables show the data they collected from 1982 to 2008.

Year	Ozone hole area (millions of sq. km)
1982	5
1986	11
1988	10
1991	19
1997	22
2001	25
2005	24
2006	27
2007	22
2008	25

Year	Number of skin cancer cases in Australia
1982	3,541
1986	4,712
1988	6,013
1991	5,970
1997	8,444
2001	9,000
2005	10,832
2006	10,427
2007	10,450
2008	11,135

1. Use the tables to estimate the missing values for the ozone hole area and number of skin cancer cases.

a. In 1983 the ozone hole area was about _____million sq. km, and the number of skin cancer cases was about _____.

b. In 2000 the ozone hole area was about _____ million sq. km and the number of skin cancer cases was about _____.

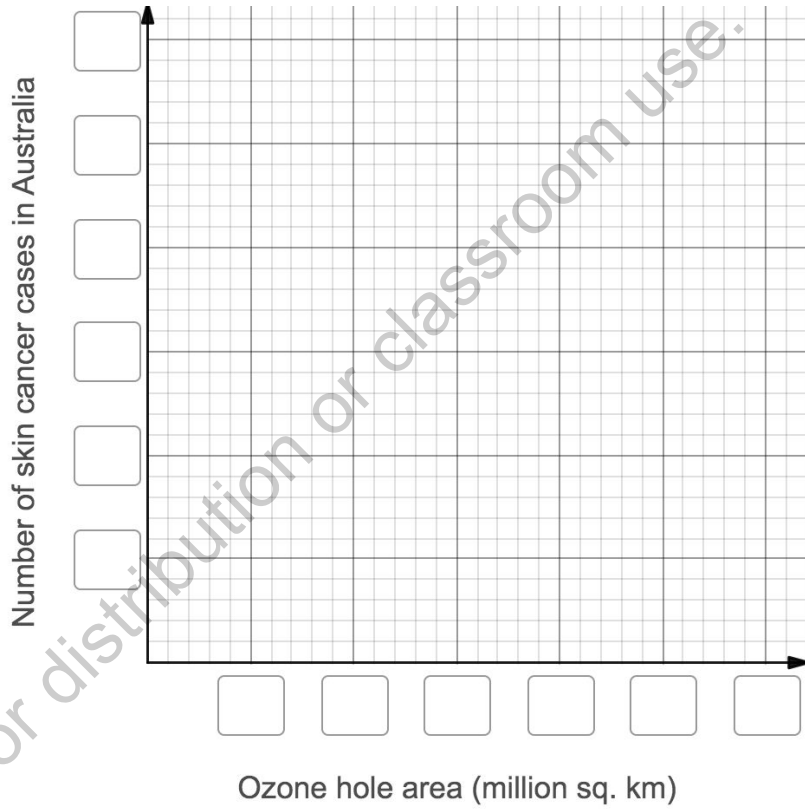
2. **How can you organize the measurements from the table so any patterns are easier to see?**

Activity 2: Creating a Scatter Plot

The table shows the change in the ozone hole area and skin cancer in Australia over several years.

Create a scale for the data, and then plot each point to represent both the ozone hole area and the number of skin cancer cases for each year listed.

Year	Ozone hole area (millions of sq. km)	Number of skin cancer cases in Australia
1982	5	3,541
1986	11	4,712
1988	10	6,013
1991	19	5,970
1997	22	8,444
2001	25	9,000
2005	24	10,832
2006	27	10,427
2007	22	10,450
2008	25	11,135



Activity 3: Interpreting a Scatter Plot

Use the table and scatter plot from Activity 2 to answer the following questions.

1. Describe how the scatter plot matches the table.

2. What patterns, if any, do you see in the data when it is organized as a scatter plot?

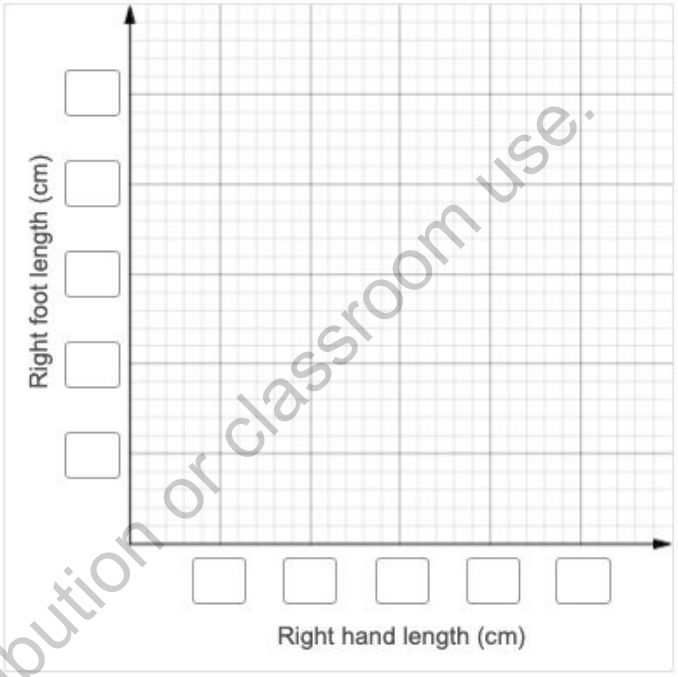
3. How is reading data from a table *similar* to reading data in a scatter plot?

4. How is reading data from a table *different* from reading data in a scatter plot?

Exit Ticket

The table shows length measurements of right hand and right foot for five people. Create a scale for the data. Then plot the data values to create a scatter plot.

	Andre	Clare	Diego	Han	Mai
Length of right hand (cm)	19	21	17	18	19
Length of right foot (cm)	27	30	23	24	26



Self-Assess

a. I know a scatter plot is a graphic representation of data.
b. I can create a scatter plot to represent data that has two paired variables.

Key: ***(No content needed here, already in the design template)***

1. I'm lost
2. I don't really get it
3. I'm starting to get it
4. I got it
5. I could teach it

Summary

It's easy to run your eyes down a table of numbers or a bunch of graphs and not feel very much. But numbers give us direction. They can tell us stories about where we are, and where we still need to go.

Here, we'll be looking at one such story–a story told through data about how our actions matter.

It is a story with billions of characters–heroes and villains, winners and losers. It's a race against time, and in the balance, the fate of an entire planet.

This is the story of our ozone layer, a dense shield of gas in the upper reaches of the stratosphere that protects us from the sun's radiation. It is a story of how that shield weakened and cracked, and what it took to put it back together.

In these next lessons we'll tell this story through representations like scatter plots–that is, **graphs that show the values of two different variables on coordinate planes**–to see how the different pieces of that story fit together, and what we had to do to pull our planet back from the brink.

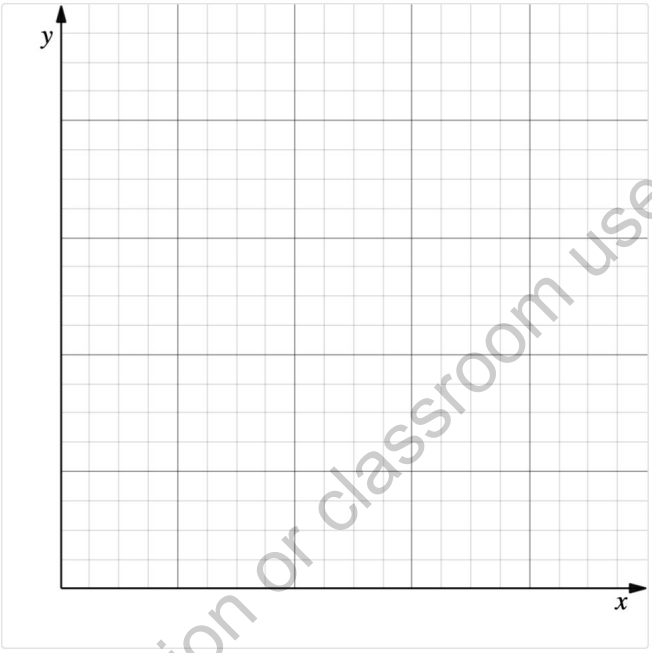
Welcome to Unit 6

My Notes:

Practice

1. Use the table to create a scale for the graph, and then plot the values to construct a scatter plot.

x	y
2	3
5	5
4	2
8	3
6	3
3	5
1	6
4	4



2. When do you think it is better to use a table to represent data? When do you think it is better to use a scatter plot?

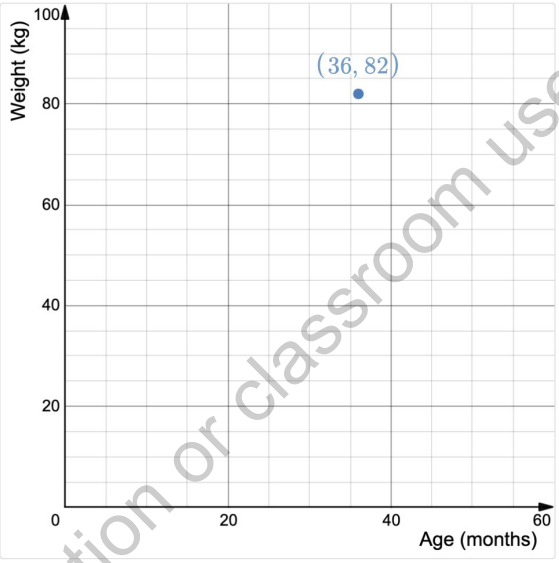
Practice (continued)

3. A cylinder has a radius of 4 cm and a height of 5 cm. What is the volume of the cylinder?

4. **The age and weight of a giant panda is recorded on the graph.**

a. What does the point on the graph tell you about the panda?

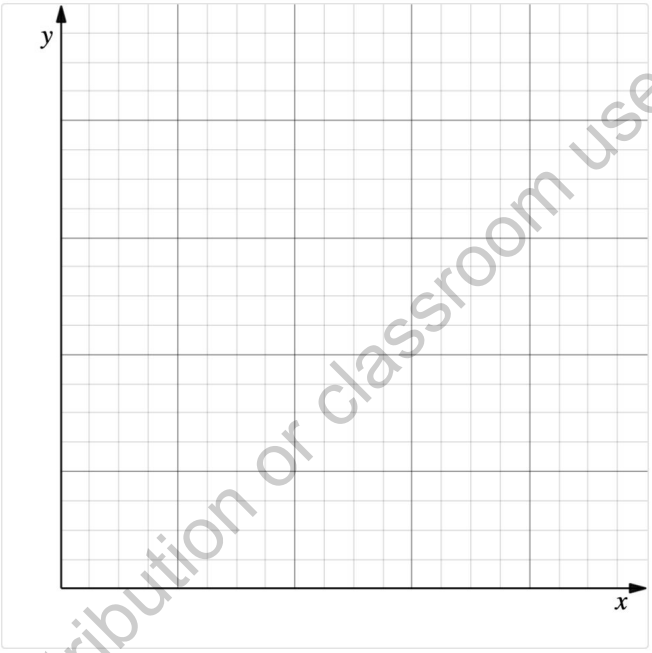
b. Plot a point that represents a giant panda that is 24 months old and weighs 50 kg.



Practice

1. Use the table to create a scale for the graph, and then plot the values to construct a scatter plot.

x	y
2	3
5	5
4	2
8	3
6	3
3	5
1	6
4	4



2. When do you think it is better to use a table to represent data? When do you think it is better to use a scatter plot?

Practice (continued)

3. A cylinder has a radius of 4 cm and a height of 5 cm. What is the volume of the cylinder?

4. **The age and weight of a giant panda is recorded on the graph.**

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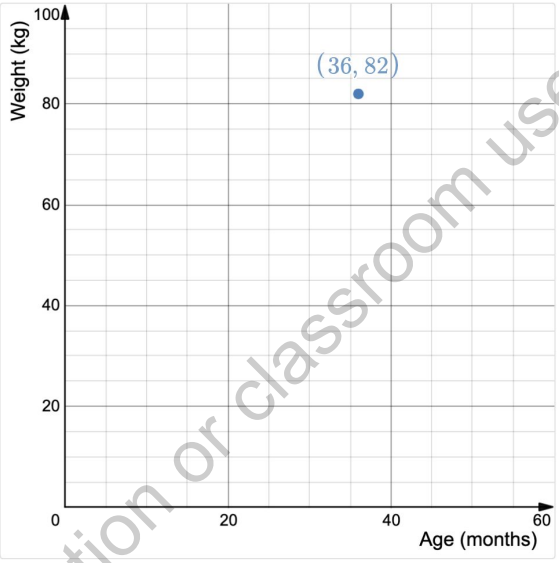


Unit 6 | Lesson 2

Interpreting Points on a Scatter Plot

Let's investigate points in a scatter plot.

Focus

Goal(s):

1. Coordinate (orally and in writing) data in a table and points on a scatter plot.
2. Describe (orally) the trend of the data, and use the trend to predict unknown values.
3. Interpret (orally and in writing) a point on a scatter plot in context.

Coherence

Today:

Students interpret and compare a point in a scatter plot in context (MP2). Students add points to a scatter plot given information about an individual in the population.

Previously:

In Grade 5, students represented real world problems by graphing points in the first quadrant and interpreted the value of points given context of situation. So far in this unit, students have focused on plotting and organizing data.

Coming Soon:

In Lesson 4 students will create and assess a linear model to judge the closeness of data points to a line. In Lesson 5, students will use the linear model to solve problems given context.

Standards

- **Addressing:**
  8.SP.A.1
  Construct and interpret scatter plots for bivariate measurement data to investigate patterns of associate between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.
- **Building On:**
  - 5.G.A.2
- **Building Toward:**
  - 8.SP.A.3

Pacing Guide

Suggested Total Lesson Time | ~45 min

Warm-up	Activity 1	Activity 2	Activity 3	Summary	Exit Ticket
5 min	10 min	8 min	10 min	5 min	7 min
Independent	*Pairs*	*Pairs*	*Pairs*	*Whole Class*	*Independent*
5.G.A.2	*8.SP.8.1*	*8.SP.8.1*	*8.SP.A.1*	*8.SP.A.1*	*8.SP.A.1*
MP2	*MP2*		*MP2*		
Desmos Activity and Presentation Slides					
Slide(s) 1	Slide(s) 2	Slide(s) 3	Slide(s) 4–5	Slide(s) 6	Slide(s) 7

Vocabulary

Review

- **Scatter plot**

Materials

- Exit Ticket PDF
- Additional Practice Book

Desmos Digital Classroom

Activity 1: Changing Krill

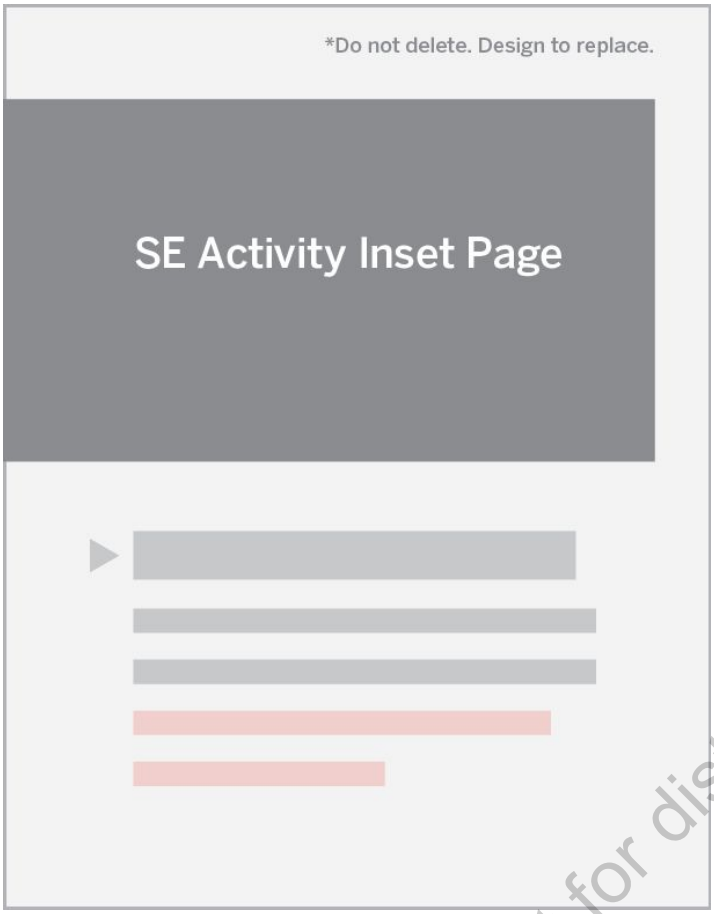
Students manipulate a point on a graph to see how its placement changes a krill's eye distance and height.

Activity 2: Interactive Graphs

Given a table or description, students move points on a coordinate graph. Teachers can overlay student answers to give immediate feedback.

Warm-up: Notice and Wonder

Students observe patterns to make connections between the placement of points and the effects on the krill's height and eye distance.



Launch

Give students one minute of quiet think time followed by a whole-class discussion.

Monitor

Help students get started by asking, "How does the krill's eye distance change when the point moves further to the right on the graph?" or "How does the krill's height change when the point moves higher up on the graph?"

Look for points of confusion:

- **Relating point placement to krill placement on graph**. Point out that the label on the y-axis represents krill's height and the label on the x-axis represents the krill's eye distance.

Connect

Ask, "How does the krill's height and eye distance change based on the graph?"

Have students share what they notice about the placement of the point and krill's height and eye distance.

Highlight how the point movement changes the krill's features. If the point is higher, the krill's height changes. If the point is further right, the krill's eye distance changes. (MP2)

Alternate Warm-up Activity

For students who need additional support with plotting a coordinate of points (from Lesson 1 Practice Problem 4):

Provide a blank graph with labeled axes. Write (x, y) on their paper and have them plot and label the following points:

A: $(5, 2)$, B: $(2, 5)$ C: $(1, 3)$, D: $(3, 1)$

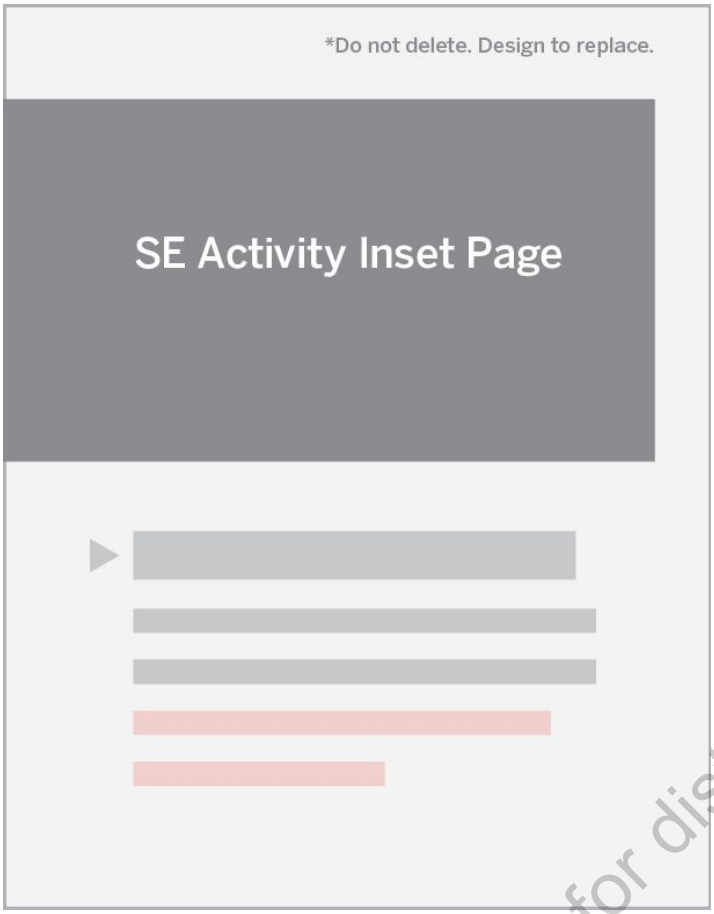
Differentiated Support

English Language Learners
N/A

Students with Disabilities
N/A

Activity 1: Matching Krill

Students analyze the placement of a point on a graph to see how it changes the krill's eye distance and height.



Launch

Have students pair up and discuss each krill and point before writing an answer.

Monitor

Help students get started by asking, "Which krill do you think the two higher points represent?"

Look for points of confusion:

- **Having difficulty supporting their answer.** Have students reread axes and relate it to point placement.

Look for productive strategies:

- **Knowing where to place krill based on height, but not eye distance.** Ask students to compare the eye distances of the krill, then look at the x-axis. Ask if a closer eye distance would be plotted left or right horizontally.

Connect

Ask, "How did you decide which point corresponded with each krill?" (MP2)

Have students share their methods used to place each krill, such as the height of the orange and green krill corresponding with the two higher points and points closer to the y-axis have a smaller eye distance.

Highlight the same vertical distance means same height and same horizontal distance means same eye distance.

Differentiated Support

Students Who Need Help	Students Ready For More	English Language Learners	Students with Disabilities
Only display the orange and green krill with points A a B on the graph.	Have students add another krill that has a different eye distance and is taller than all the krills.	*MLR1: Stronger and Clearer* Use this routine to give students a structured opportunity to revise and refine their response. Ask students to meet a partner for feedback.(e.g., How do you know where the tallest krill's point is placed?)	Demonstrate and encourage students to use color coding and annotations to highlight connections between representations in a problem. For example, ask students to use different colors to represent the krill height/eye distance in the graph and table.

Activity 2: Adding a Point

Students connect points in a scatter plot with data in a table to see the connection between exact data values and placement of values on a graph.

Launch

Introduce this activity by telling students that you are curious to see how the graph can help us notice and compare the features of four different krills.

Monitor

Help students get started by asking what information they know about the red krill based on the table.

Look for points of confusion:

- **Unsure where to place Red.** Tell them to look at the table. Ask, "Which krill has the same eye distance as the red krill? Which krill has the same height as the red krill?"
- **Having difficulty organizing information.** Write the coordinates next to each krill.
- **Placing the red and green krill on vertically instead of horizontally.** Emphasize the axis labels. Since Red and Green both have eye distance of eight mm, they should both have the same horizontal distance.

Connect

Have students share their process such as what data points they used in the table and how they correspond to the horizontal or vertical position in the graph.

Ask, "How did you decide where to plot a point for the red krill?" "What does the same x-value represent? What does the same y-value represent?"

Highlight Red and Green's equal eye distance as corresponding points should be the same vertically. Red and Purple's equal height as corresponding points should be the same horizontally.

Differentiated Support

Students Who Need Help	Students Ready For More	English Language Learners	Students with Disabilities
Simplify the table and graph by removing Blue and Orange data.	N/A	*MLR8: Discussion Supports.* Use sentence starters to help make a connection between point placement and krill features: The red krill has the same eye distance as ____, so ____ is the same. The red krill has the same height as ____, so ____ is the same.	For part one, help students organize information Ask, "Which krill has the same height?" Then ask, "What does that mean?" Lastly ask, where would the point fall along the x-axis?" Repeat questioning with the krill eye distance.

Activity 3: What's the Point?

Students explain the meaning of a point in the context of the problem to compare one data value to the entire data set.

Launch

Tell students that in addition to an image or a table, we can also use a written description to add points to a scatter plot.

Monitor

Help students get started by asking, "Where are the points that represent the shortest eye distance?" and "How do we write an ordered pair as coordinates?"

Look for points of confusion:

- **Unsure what the point $(0, 27)$ represents.** Emphasize that eye distance represents the first number and height represents the second number in the coordinate of points.

Look for productive strategies:

- **Writing a number without units.** Ask students what units the height and eye distance are measured. Then tell them to record this with their answer.
- **Can think of multiple places to plot a point for Question 2.** Since there are multiple answers, ask students to highlight a region of the graph that can represent the answer.

Connect

Have students share what strategies students used to determine where to place the red krill.

Highlight the meaning of zero eye distance.

Ask, "Can there be multiple points that represent the red krill? Why or why not?" *(yes)*

Differentiated Support

Students Who Need Help	Students Ready For More	English Language Learners	Students with Disabilities
N/A	Have students create their own challenge by placing at least 5 points on a new graph. Have students switch graphs ask each other questions such as, "Which krill is the tallest/shortest?"	N/A	Include a table of the corresponding coordinate points so students can have another method to find the krill with the largest/shortest height or eye distance.

Summary

Review and synthesize what a point represents in context and how the placement of a point changes the context.

Synthesize

Display graph from student edition summary page, circle the point (4,10)

Highlight placement of points in a scatter plot based on context.

Ask, "How do you know what a point represents in a scatter plot?" and "What does the point $(4, 10)$ tell you about the krill height and eye distance?"

Exit Ticket

Students demonstrate their understanding by identifying a point given a verbal description and data table.

Success looks like...

1. Coordinate (orally and in writing) data in a table and points on a scatter plot.
2. Describe (orally) the trend of the data, and use the trend to predict unknown values.
3. Interpret (orally and in writing) a point on a scatter plot in context.

Suggested next steps

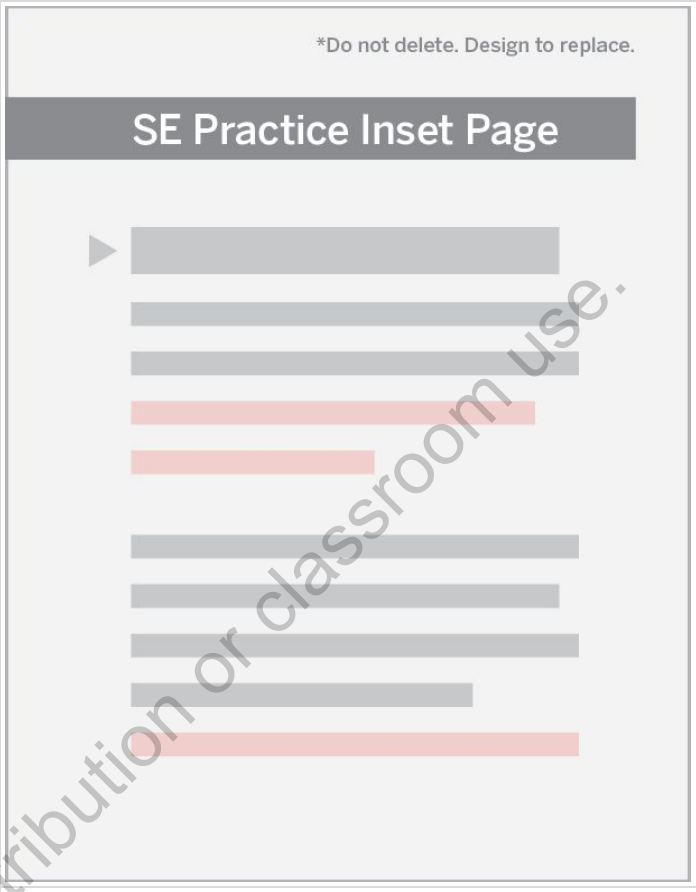
If students choose the point farthest right instead of the highest point for problem 1, consider:

- Asking students which label identifies the krill height. Ask them to identify the tallest and shortest krill.
- Assigning Practice Problem 1

If students write coordinates as (y, x), consider:

- Reviewing how to write coordinates from Activity 3.

Practice



Practice Problem Analysis

Problems	Refer to	Standards	DOK
1	Activity 3	8.SP.A.1	*2*
2	Activity 3	8.SP.A.1	*2*
3	Unit 5 Lesson 17	8.G.C.9	*2*
4	Unit 6 Lesson 3	8.EE.B.6	*1*

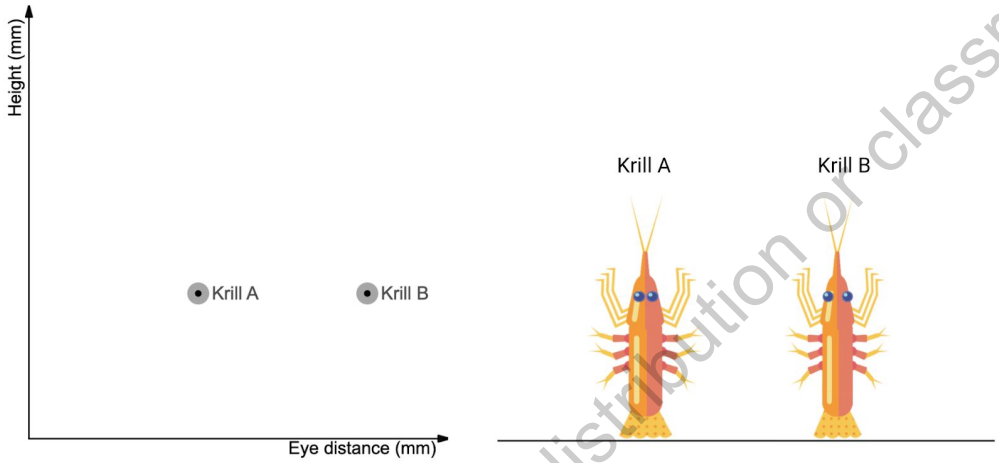
(Space to show the cover for Additional Practice?)

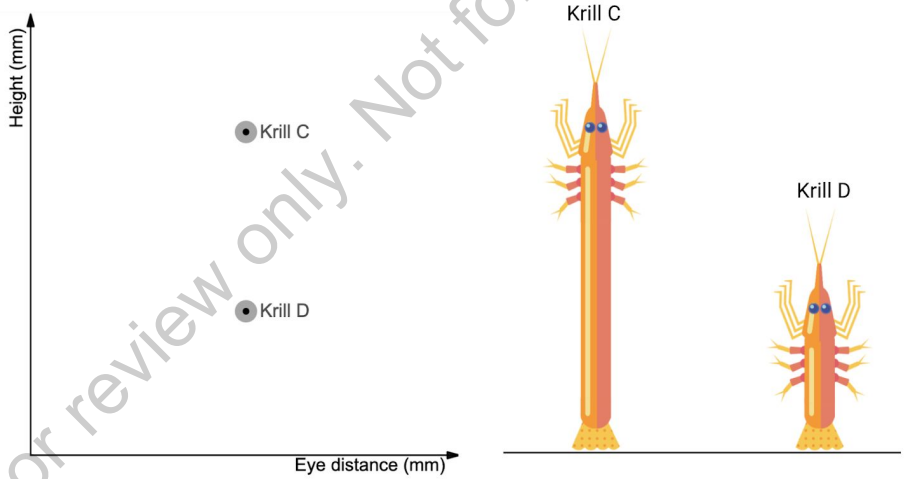
Interpreting Points on a Scatter Plot

Let's investigate points in a scatter plot.

Warm-up: Notice and Wonder

The Oceanological Institute is studying the effects of harmful UV radiation on different krill populations. Here are several specimens they've captured.



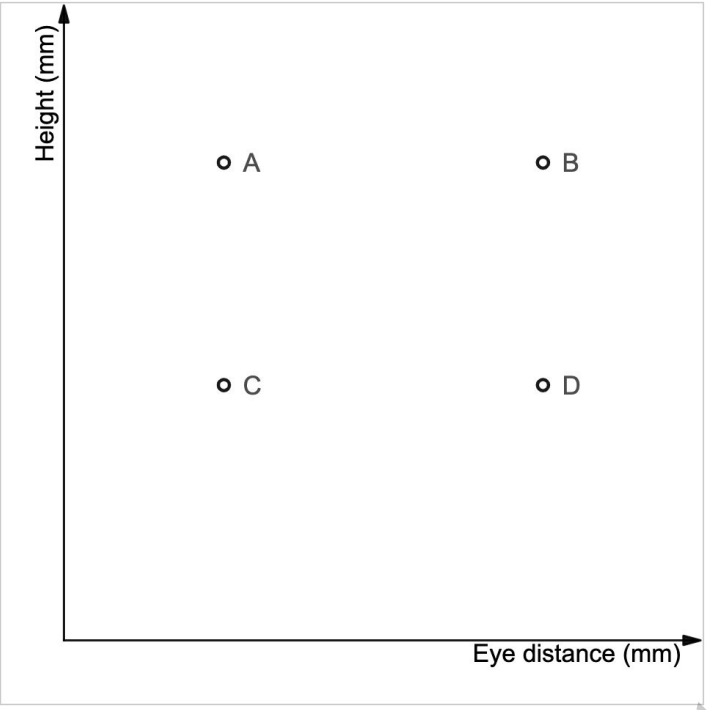


1. What do you notice?

2. What do you wonder?

Activity 1: Matching Krill

Here are four different species of krill currently being studied by marine scientists at the Oceanological Institute.

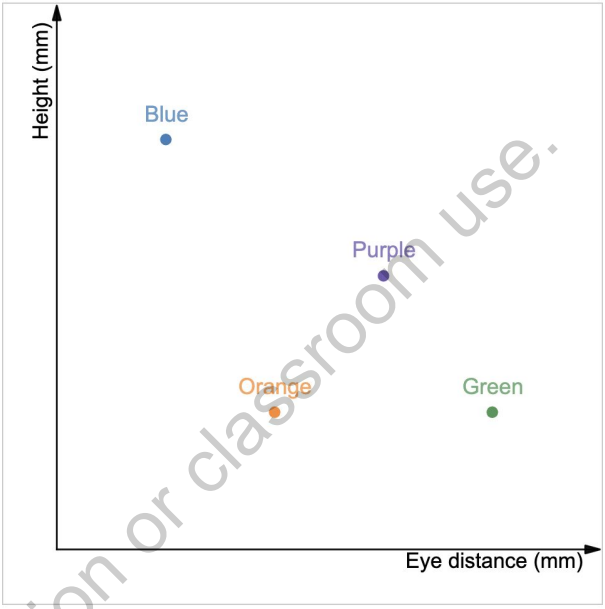


Next to each letter listed on the graph, write the corresponding krill color based on its features. Explain your thinking.

Activity 2: Adding a Point

The table shows the height and eye distance for five different krill.

Name	Eye distance (mm)	Height (mm)
Blue	2	30
Orange	4	10
Green	8	10
Purple	6	20
Red	8	20

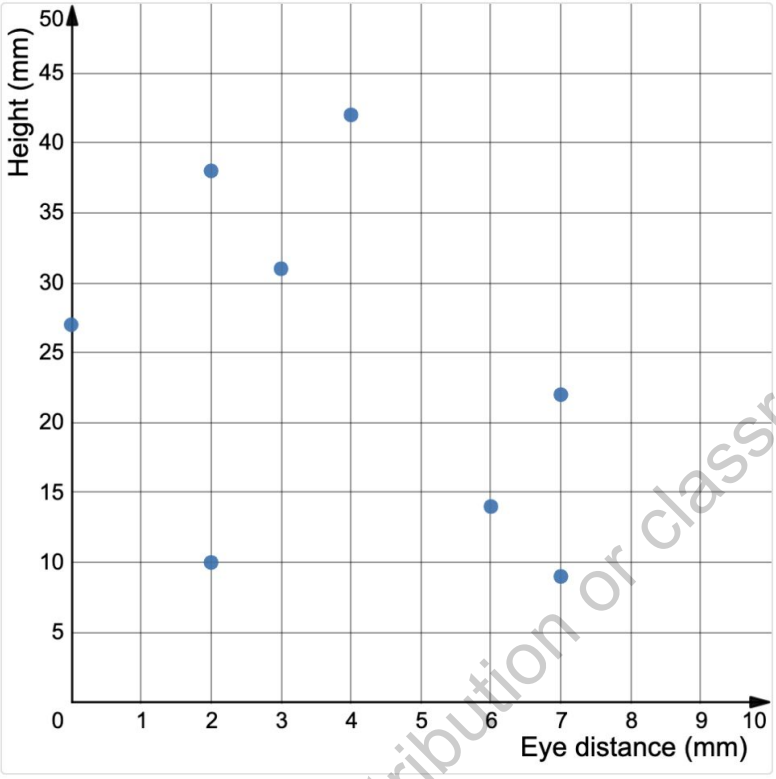


1. Add a point to the graph that represents the red krill.

2. Explain how you decided where to place the point.

Activity 3: What's the Point?

The graph shows the heights and eye distances for eight different blue krill.



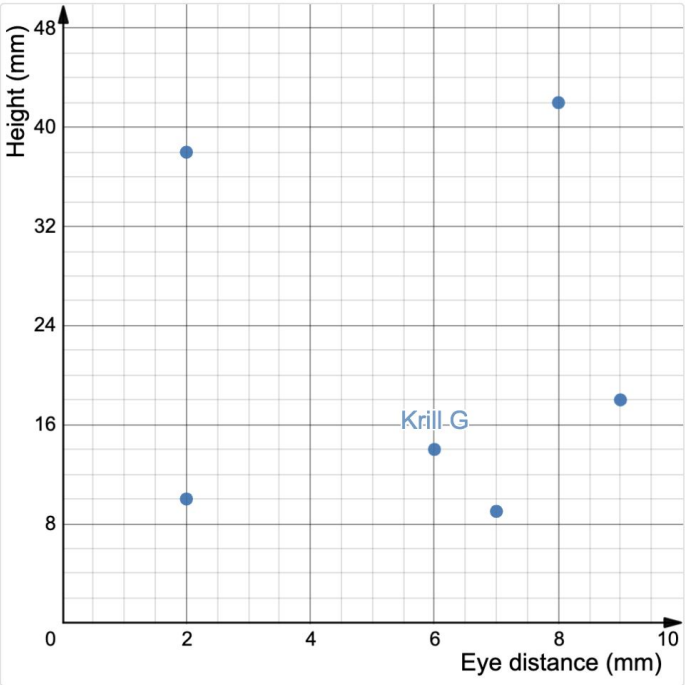
1. What are the coordinates of the krill with the shortest eye distance?

What does this tell you about the eye distance and height of the krill?

2. Add a point to the graph that represents a red krill and makes the following statement true: The red krill is taller than all the blue krill, and its eye distance is five centimeters. How did you decide where to put your point?

Exit Ticket

The table and scatter plot show the heights and eye distances of seven different krill, although some data is missing.



Krill	Eye distance (mm)	Height (mm)
A	7	9
B	2	38
C	2	10
D	8	42
E	7	22
F	9	20
G		

1. On the scatter plot, circle the point that represents the tallest krill.
2. On the scatter plot, plot a point that represents Krill E.
3. Fill in the table with the values that represent Krill G.

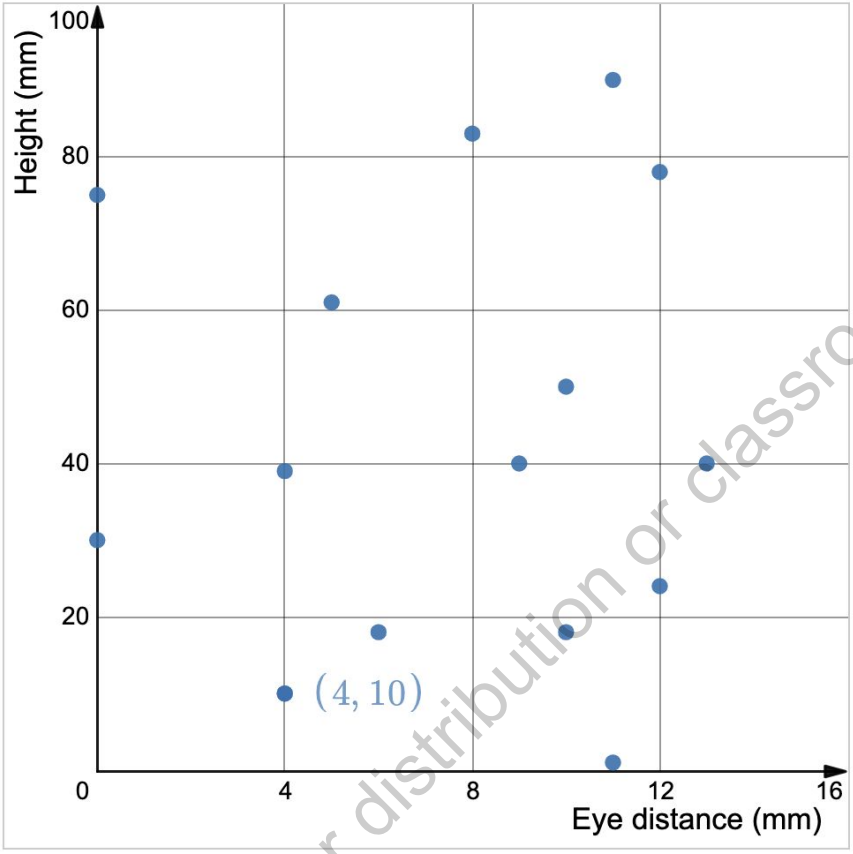
Self-Assess

A. I can describe the meaning of a point in a scatter plot in context.
B. I can identify a point on a scatter plot given a verbal description.
C. I can plot a point on a scatter plot given a data table.

Key:
1. I'm lost
2. I don't really get it
3. I'm starting to get it
4. I got it
5. I could teach it

Summary

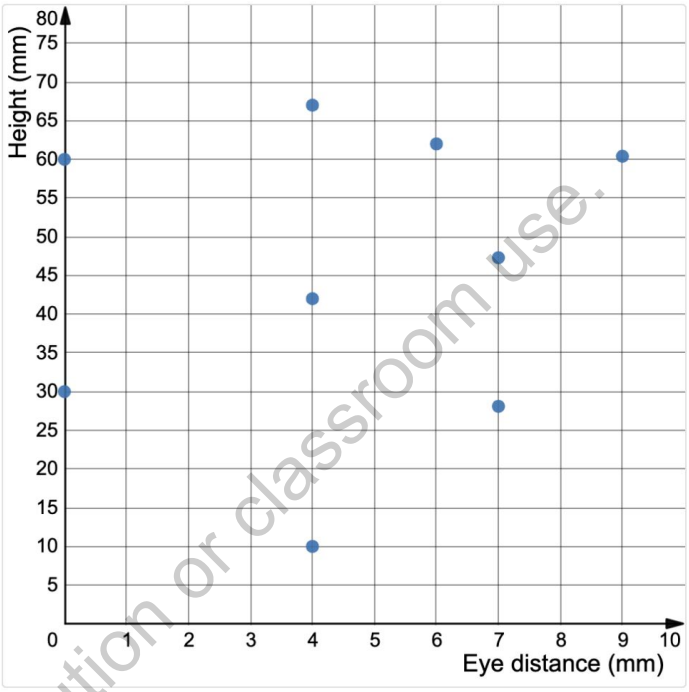
The scatter plot shows the eye distance and height of eight different krill. The krill with a greater eye distance are farther right horizontally, while taller krill are higher up vertically.



My Notes:

Practice

1. Circle the krill with the shortest eye distance. What are the height and eye distance of the krill?_____

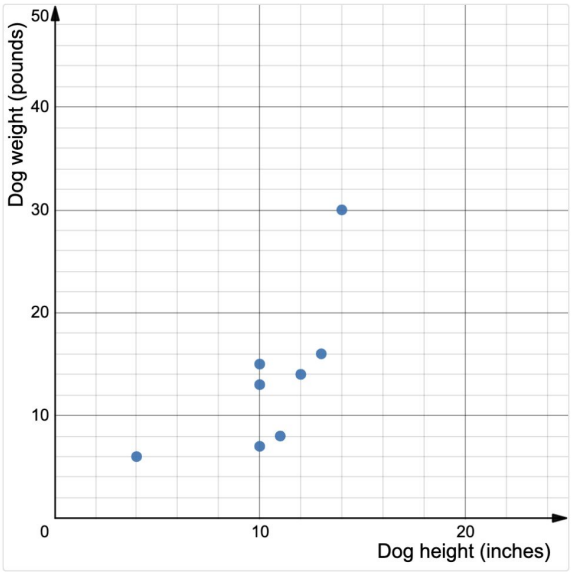


2. The scatter plot shows the height and weight of 8 different dogs.

a. How much does the tallest dog weigh?

b. What are the height and weight of the shortest dog?

c. Plot a point on the graph that represents a dog that is shorter than 5 inches and has a weight of 10 pounds.



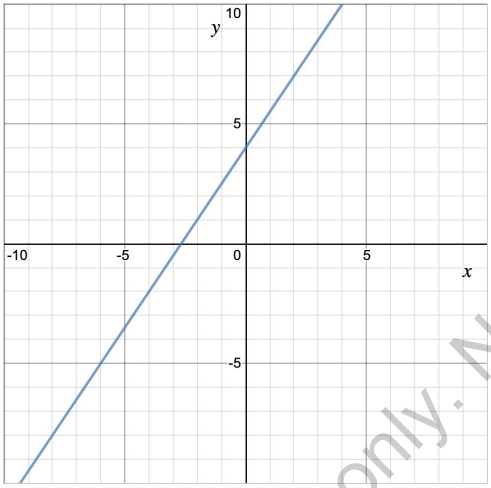
Practice (continued)

3. A cylinder has a radius of 6 meters, a height ofLet h meters, and a volume of V cubic meters.

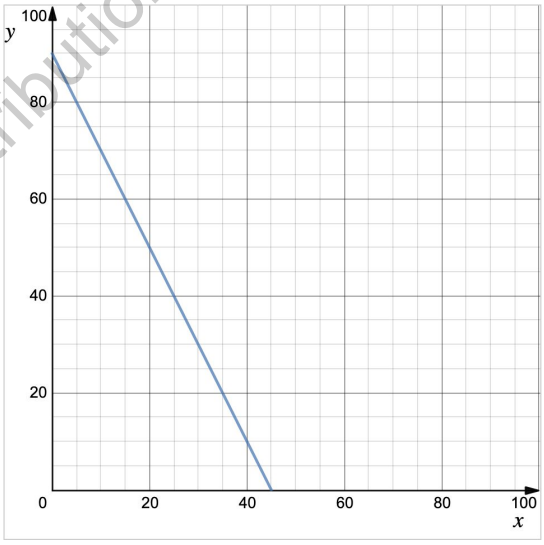
Write an equation that represents the volume, V, as a function of the height, h.

4. Identify whether the slope of each line is positive or negative.

a.

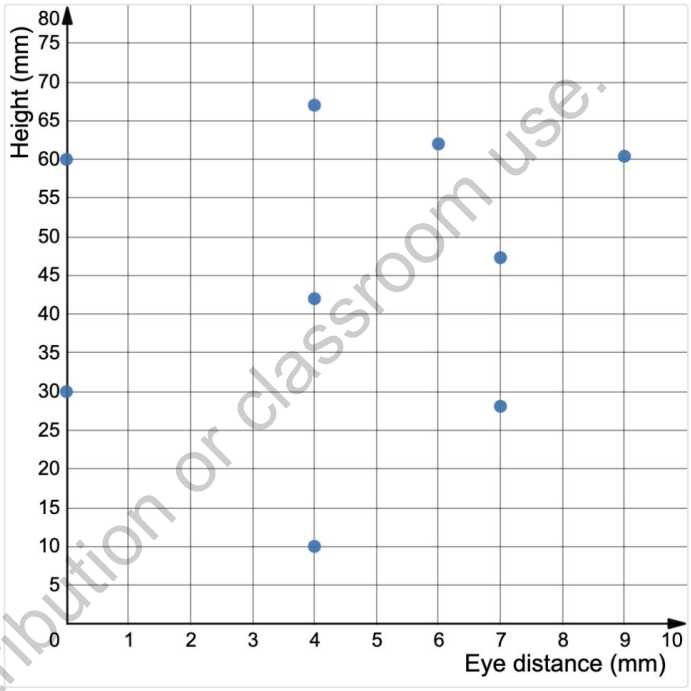


b.



Practice

1. Circle the krill with the shortest eye distance. What are the height and eye distance of the krill?_____

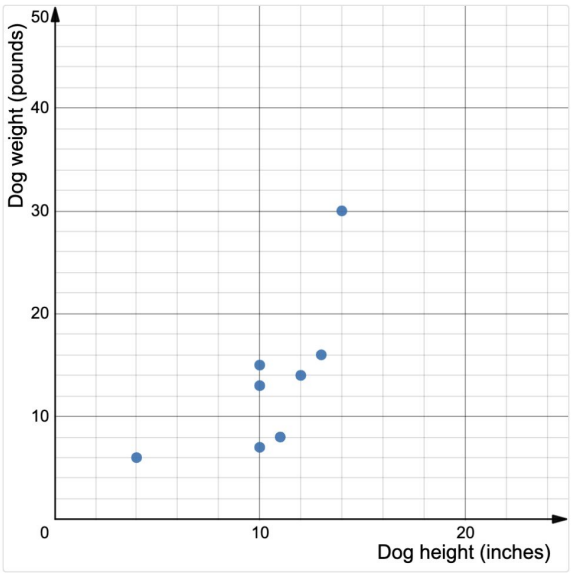


2. The scatter plot shows the height and weight of 8 different dogs.

a. How much does the tallest dog weigh?

b. What are the height and weight of the shortest dog?

c. Plot a point on the graph that represents a dog that is shorter than 5 inches and has a weight of 10 pounds.



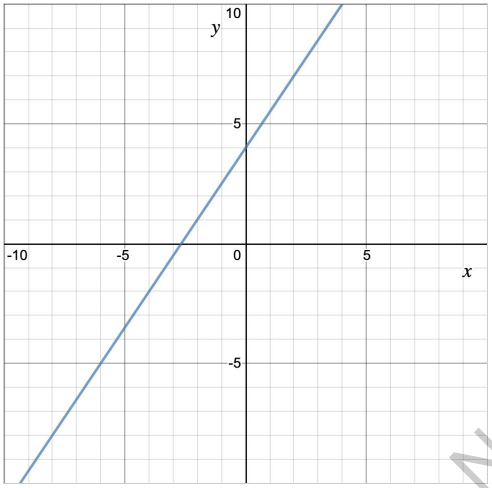
Practice (continued)

3. A cylinder has a radius of 6 meters, a height ofLet h meters, and a volume of V cubic meters.

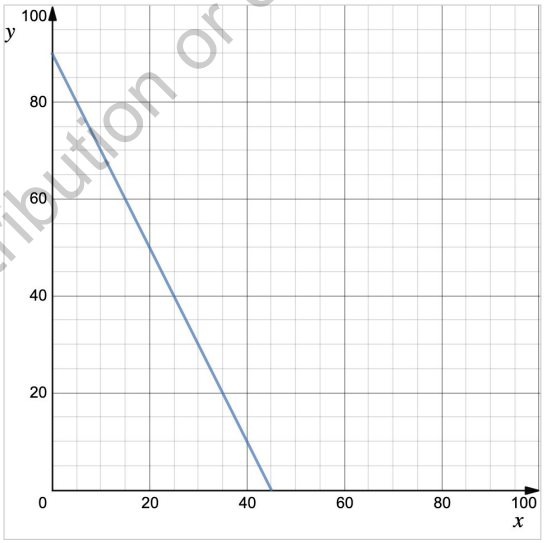
Write an equation that represents the volume, V, as a function of the height, h.

4. Identify whether the slope of each line is positive or negative.

a.



b.



Unit 6 | Lesson 3

Observing Patterns in Scatter Plots

Let's look for patterns in scatter plots.

Focus

Goal(s):

1. Categorize data sets, and describe (orally) the properties used to create categories.
2. Describe (orally) features of data on scatter plots, including "linear" and "nonlinear association", "positive" and "negative association", and "clustering" using informal language.
3. Explain (orally) what might cause a nonlinear association or clustering of data points in context.

Coherence

Today:

Students look at scatter plots as a whole (MP1). They determine if a scatter plot has a linear or nonlinear association, a positive or negative association, and identify any clusters in the data. They learn how to use appropriate vocabulary and precise language to describe patterns (MP6).

Previously:

In Lesson 1, students created a scatter plot to see patterns more clearly. In Lesson 2, students described the meaning of a point on a scatter plot in context.

Coming Soon:

In Lessons 4-5, students draw a line to fit to model data in a linear scatter plot. Students will use and assess the line of fit to judge the closeness of data points and to solve problems given context.

Standards

- **Addressing:**
  8.SP.A.1
  Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.
- **Building On:**
  - 5.G.A.2
- **Building Toward:**
  - 8.SP.A.2
  - 8.SP.A.3

Pacing Guide

Suggested Total Lesson Time | ~45 min

Warm-up	Activity 1	Activity 2	Activity 3	Activity 4	Summary	Exit Ticket
5 min	10 min	8 min	5 min	7 min	5 min	5 min
Independent	*Pairs*	*Pairs*	*Independent*	*Pairs*	*Whole Class*	*Independent*
8.SP.A.1	*8.SP.A.1*	*8.SP.A.1*	*8.SP.A.1*	*8.SP.A.1*	*8.SP.A.1*	*8.SP.A.1*
MP1		*MP6*		*MP6*	*MP6*	
Desmos Activity and Presentation Slides						
Slide(s) 1	Slide(s) 2	Slide(s) 3	Slide(s) 4	Slide(s) 5–8	Slide(s) 9	Slide(s) 10

Vocabulary

New

- **Linear association**
- **Nonlinear association**
- **Positive association**
- **Negative association**
- **Cluster**

Review words

- **Scatter plot**

Materials

- Exit Ticket PDF
- Additional Practice Book
- Activity 1-2 BLM

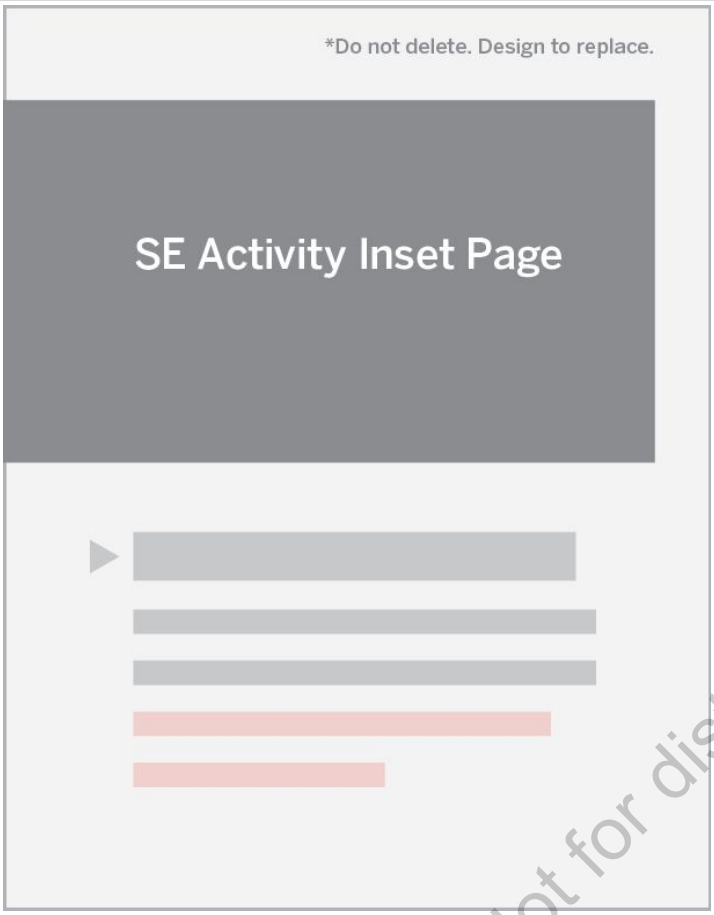
Desmos Digital Classroom

Activity 1: Card Sort
Students move and group digital cards based on their association: linear vs. nonlinear, and positive vs. negative.

Activity 4: Identifying Clusters
Students circle clusters using the sketch tool, which you can overlay to assess student work and give immediate feedback.

Warm-up: Notice and Wonder

Students are asked to analyze a scatter plot by noticing things and asking questions. Students are introduced to two new vocabulary words, *linear association* and *nonlinear association*.



Launch

Say, "The scatter plot shows the Antarctic ozone hole area changing over time. How does this compare to what we learned about the ozone hole area in Lesson 1?" *(Here, the ozone hole area increases, but seems to change after 1990).*

Monitor

Help students get started by asking how the shape of this graph is different than the ones they've seen so far.

Look for points of confusion:

- **Struggling with describing the pattern**. Ask, "Are the values increasing or decreasing?" and "Does the graph look curved or straight?"
- **Having trouble understanding the context.** Ask, "What do the axes represent?" and "What does the point $(1998, 10)$ represent?"

Look for productive strategies:

- **Noticing the pattern is not linear.** Ask students to describe how the data changes.

Connect

Ask, "How does the data change? What does this tell us about the ozone hole area?" *(At first, the data increased at a steady rate, then changed slowed down. This tells us the ozone hole area got smaller and shows improvement after 1990.)*

Highlight the different patterns shown in this scatter plot. It is different than the previous ones because it shows a curve rather than a straight line.

Define *linear* and *nonlinear association* at the end of the Warm-up. Say, "If a straight line can model the data, it has a *linear association.* If a straight line cannot model the data it has a *nonlinear association*."

Alternate Warm-up Activity

For students who need additional support with identifying a positive or negative slope (from Lesson 2 Practice Problem 4):
Draw three lines that have different positive slopes then ask students to identify similarities and features that make the line positive. Have students draw two more lines that have a positive slope. Repeat with three lines with negative slopes.

Differentiated Support

English Language Learners
N/A

Students with Disabilities
N/A

Activity 1: Card Sort Part One

Students sort cards based on linearity. At the end of the activity, students are introduced to two new vocabulary words, *positive associations* and *negative associations*.

Launch

Pair students up then distribute cards from the blackline master to each pair of students. Have students discuss and sort cards into *linear* and *nonlinear associations*.

Monitor

Help students get started by asking what they know about linear associations and which cards appear to match that definition.

Look for points of confusion:

- **Thinking linear associations can only be positive/negative.** Remind students that scatter plots with a linear association model a straight line so linear scatter plots can be positive or negative.
- **Thinking Card D and Card E are linear.** Tell students although parts of the graph look linear, they should look at the entire data set before identifying the association.

Connect

Have students share their reason for card placement during whole-class discussion.

Ask, "What do the linear association cards have in common?" Have students draw a line on cards A and F to reinforce the concept of a linear association.

Define *positive* and *negative associations*. At the end of the activity, have students compare the difference in Cards A and F to introduce *positive and negative associations*. Card A has a *negative association* because the y-value decreases as the x-value increases. Card F has a *positive association* because the y-value increases as the x-value increases.

Highlight the differences between a linear and nonlinear association.

Differentiated Support

Students Who Need Help	Students Ready for More	English Language Learners	Students with Disabilities
Limit the number of cards to sort to focus on mastery of differences between associations.	Have students create two more cards that have a linear and nonlinear association.	*MLR8: Discussion Supports.* To support students' explanations for sorting the scatter plots in the way they chose, display sentence frames for students to use when they are working with their partner. For example, "I think ____ because _____ " or "I (agree/disagree) because _____".	Engagement: Develop Effort and Persistence. Encourage and support opportunities for peer interactions. Display sentence frames to support student conversation such as: "_____ and _____ are different because…" and "What do _____ and _____ have in common?"

Activity 2: Card Sort Part Two

Students sort cards based on positive, negative, or neither positive nor negative association to identify similarities and differences.

Launch

Keep students in pairs and have them sort the same cards from Activity 1 into the categories *positive*, *negative*, or *neither positive nor negative association*.

Monitor

Help students get started by asking students to describe positive and negative associations in their own words. Record student answers with a sketch of the description.

Look for points of confusion:

- **Thinking card F is negative.** Ask, "As the x-value increases, what do you notice about the y-value?"
- **Thinking card E can be both positive and negative.** Remind students to look at the entire data set before determining their answer.

Look for productive strategies:

- **Only sorting nonlinear cards.** Tell students positive and negative associations can be used to describe both linear and nonlinear data values as long as the y-value increases/decreases when the x-value increases.

Connect

Display the different ways students sorted their cards.

Have students share their thinking for each card placement.Draw out reasons for each figure, attending to appropriate vocabulary and precise use of language (MP6).

Highlight the differences in positive and negative associations. Positive associations have increasing y-values while negative associations have decreasing y-values as x-increases.

Ask, "What makes Card B and Card E different than the rest of the cards?"

Differentiated Support

Students Who Need Help	Students Ready for More	English Language Learners	Students with Disabilities
Limit the number of cards to sort to focus on mastery of differences between associations.	Have students create three more cards that have positive, negative, and no association.	*MLR8: Discussion Supports.* To support students' explanations for sorting the scatter plots in the way they chose, display sentence frames for students to use when they are working with their partner. For example, "I think ____ because _____ " or "I (agree/disagree) because _____".	Engagement: Develop Effort and Persistence. Encourage and support opportunities for peer interactions. Display sentence frames to support student conversation such as: "_____ and _____ are different because…" and "What do _____ and _____ have in common?"

Activity 3: Spot the Difference

Students compare scatter plots to learn about a new term, *cluster*.

Launch

Have students compare the scatter plots individually before sharing with the class.

Monitor

Help students get started by asking what they notice about the patterns in each scatter plot.

Look for points of confusion:

- **Having trouble seeing similarities.** Ask, "As the x-value is increasing, what is happening with the y-value in both scatter plots?"

Connect

Highlight the two separate groupings of data in Scatter plot B.

Define the term *cluster* as a grouping of points around the same value or a distinct separate grouping of points like seen in scatter plot B. Since the number of data values that make up a cluster can be subjective, reinforce the idea that clusters are used to look for trends in data.

Ask, "How can I identify if there is a cluster in a scatter plot?"

Differentiated Support

Students Who Need Help	Students Ready for More	English Language Learners	Students with Disabilities
N/A	N/A	*MLR7: Compare and Connect.* Ask students to identify what is the same and what is different about each scatter plot. Draw students' attention to the way the data points are represented in each of the scatter plots. In this discussion, emphasize the mathematical language used to make sense of the different trends in the data.	Engagement: Develop Effort and Persistence. Encourage and support opportunities for peer interactions. Display sentence frames to support student conversation such as: "Something different I notice in this graph is _____".

Activity 4: Identifying Clusters

Students identify *clusters* and interpret what it represents in context.

Launch

Have students pair up and discuss each question before writing an answer.

Note: since the number of data values that make up a cluster can be subjective, ask students to explain their thinking during discussions.

Monitor

Help students get started by having them explain the term cluster in their own words.

Look for points of confusion:

- **Getting stuck on question C**. ask students to look for groupings of data.

Look for productive strategies:

- **Thinking a cluster is limited to one grouping.** Have students circle any and all cluster groupings.

Connect

Have students share their answers. Take turns displaying different student answers. Ask the input from peers to see if they had similar answers (MP6).

Highlight that a cluster can be one or more grouping of points.

Ask, "What does a cluster represent in context?"

Differentiated Support

Students Who Need Help	Students Ready for More	English Language Learners	Students with Disabilities
Reduce the number of questions by eliminating Question 2.	Have students make connections to a real-world example where clustering may take place and what the cluster represents.	*MLR2: Collect and Display.* As students discuss where they see clusters, listen for students who identify multiple patterns in one graph. Record their language on the graph. This will help students produce and make sense of the language needed to communicate about trends in scatter plots.	Engagement: Develop Effort and Persistence. Encourage and support opportunities for peer interactions. Display sentence frames to support student conversation such as: "Something different I notice in this graph is _____".

Summary

Review and synthesize the associations between two quantities and interpret the type of associations and clusters in data.

Synthesize

Review vocabulary:

- Linear association
- Nonlinear association
- Positive association
- Negative association
- Cluster

Have students share each new vocabulary word learned today using precise language (MP6).

Highlight associations and clusters help us look for patterns between two variables.

Ask, "What patterns help us to identify a positive/negative and linear/nonlinear association?" and "What does each association mean in terms of the given context?"

Differentiated Support

Students Who Need Help	Students Ready for More	English Language Learners	Students with Disabilities
N/A	N/A	*MLR2: Collect and Display.* Collect and display students' verbal descriptions next to corresponding graphs. For the scatter plot, write the words "linear, negative, and clusters". This will help students make connections between language and diagrams.	

Exit Ticket

Students demonstrate their understanding by identifying associations and clustering in a scatter plot.

Success looks like...

- Categorize data sets, and describe (orally) the properties used to create categories.
- Describe (orally) features of data on scatter plots, including “linear” and “nonlinear association”, “positive” and “negative association”, and “clustering” using informal language.
- Explain (orally) what might cause a nonlinear association or clustering of data points in context.

Suggested next steps

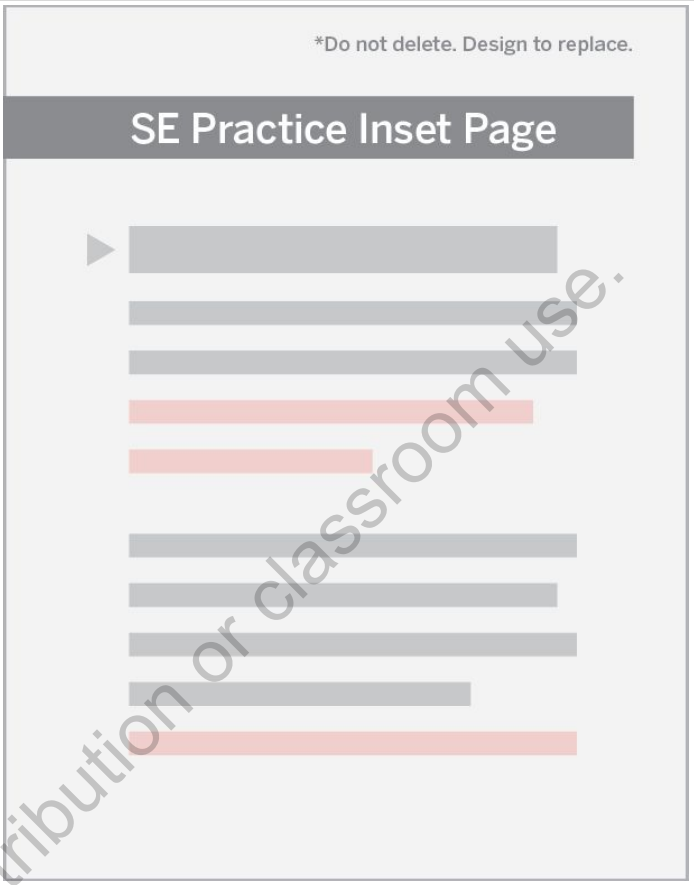
If students do not correctly identify a positive, negative, linear, or nonlinear association, consider:

- Showing diagrams of a linear graph in place of a scatter plot and review positive and negative associations before repeating with positive and negative scatter plots.
- Show a diagram of a linear graph highlighted with descriptive words such as “straight line” or “can increase or decrease”. Then present a nonlinear graph and have students state differences from a linear graph.

If student do not identify clusters, consider:

- Displaying three similar graphs, one with clustering and two without clustering. Ask students to choose the graph that has a distinct grouping of points.
- Having students write the definition of an outlier
- Assigning Practice Problem 2

Practice



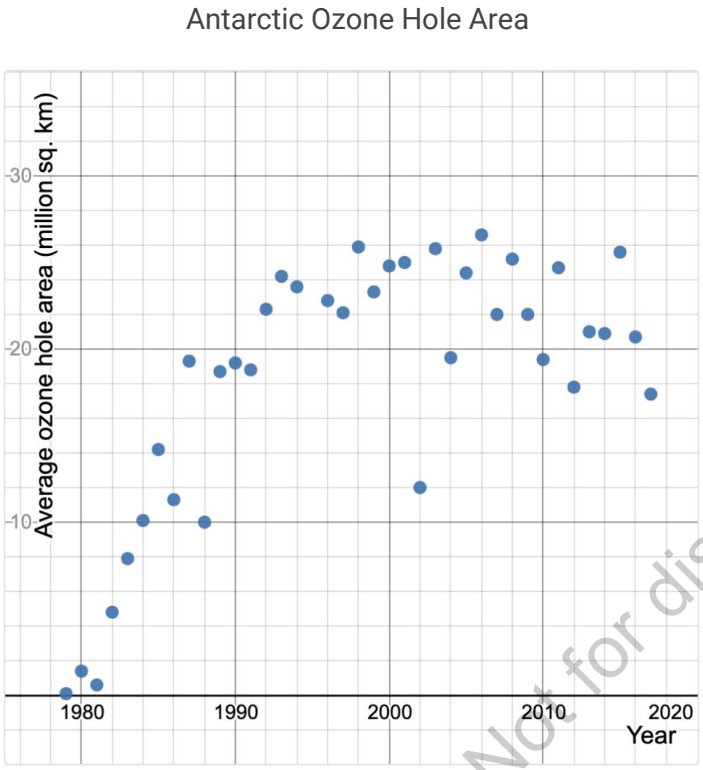
Practice Problem Analysis

Problems	Refer to	Standards	DOK
1	Activity 1,2	8.SP.A.1	*2*
2	Activity 4	8.SP.A.1	*1*
3	Activity 1-4	8.SP.A.1	*3*
4	Unit 5 Lesson 17	8.G.C.9	*3*
5	Unit 6 Lesson 4	8.EE.B.6	*1*

Observing Patterns in Scatter Plots

Let's look for patterns in scatter plots.

Warm-up: Notice and Wonder



What do you notice?

What do you wonder?

Activity 1: Card Sort Part One

Your teacher will supply you with a set of cards. Sort the cards into two categories: linear association and nonlinear association. Compare your sorting with your partner and discuss the strategies you used to sort each card.

Linear association	Nonlinear association

Activity 2: Card Sort Part Two

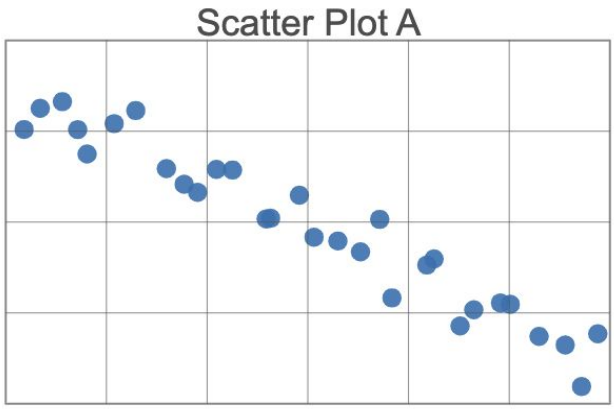
Use the cards from activity one and sort them into three categories: positive association, negative association, neither positive nor negative association. Compare your sorting with your partner and discuss the strategies you used to sort each card.

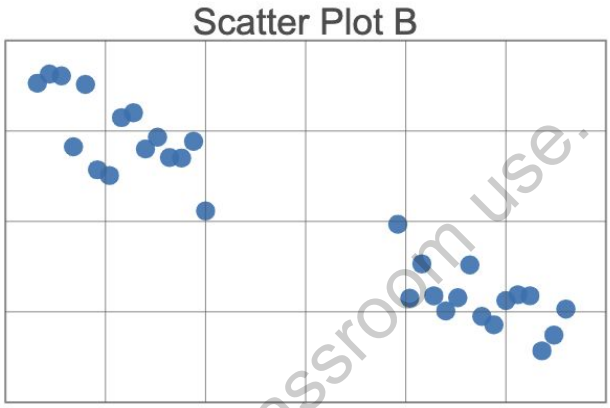
Positive association	Negative association	Neither positive nor negative association

Explain how you determined which cards were sorted as “neither positive nor negative association”.

Activity 3: Spot the Difference

Compare the scatter plots below.





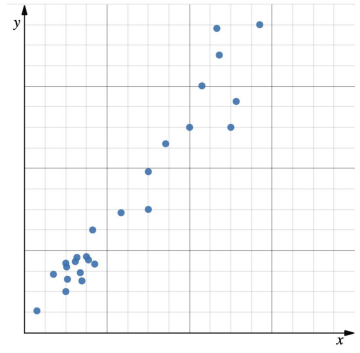
What similarities do you see?

What differences do you see?

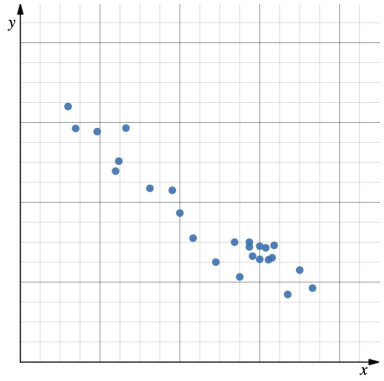
Activity 4: Identifying Clusters

1. Circle any clusters you see in the scatter plots.

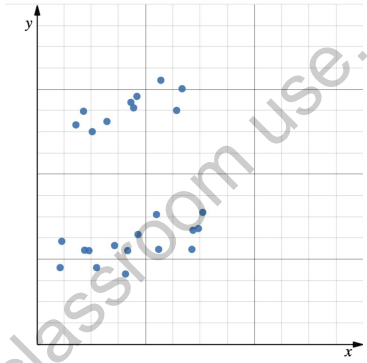
a.



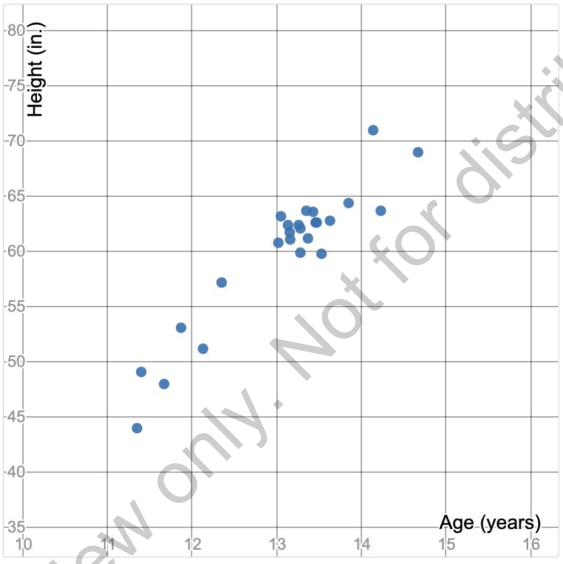
b.



c.



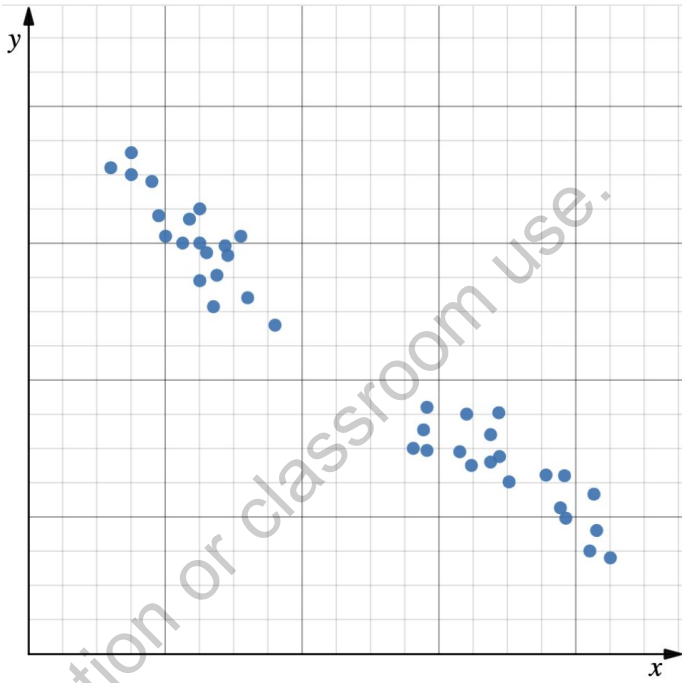
2. The scatter plot shows the age and height of several students in Jada's school.



Circle the cluster in the data. What does the cluster represent in this situation?

Exit Ticket

Which terms describe the association in the scatter plot?



Select all that apply. Sketch on the graph if it helps your thinking.

A. positive association
B. negative association
C. linear association
D. nonlinear association
E. clustering

Self-Assess
A. I can use a scatter plot to decide if two variables have a positive or negative association. B. I can use a scatter plot to decide if two variables have a linear association. C. I can pick out clusters from a scatter plot.
Key: 1. I'm lost 2. I don't really get it 3. I'm starting to get it 4. I got it 5. I could teach it

Summary

In this lesson, we observed patterns in scatter plots. We sorted cards into different associations and identified ***clusters***.

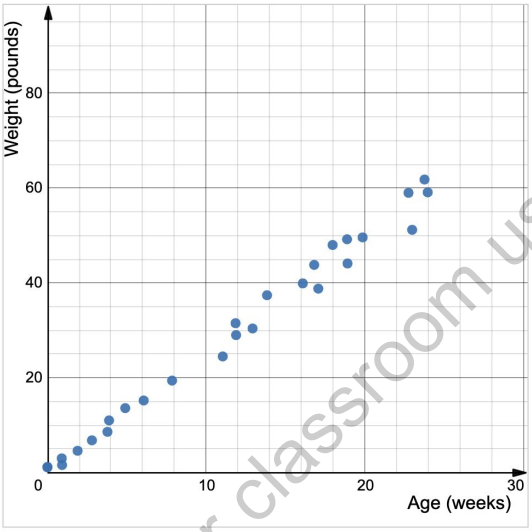
We found that if a straight line can model the data, it has a ***linear association***. If a straight line cannot model the data, it has a ***nonlinear association***. We also found that a ***positive association*** exists when one variable increases while the other increases. A ***negative association*** exists when one variable increases while the other decreases.

A ***cluster*** can be identified as grouping of points around the same value or if there is a distinct separate grouping of points.

My Notes:

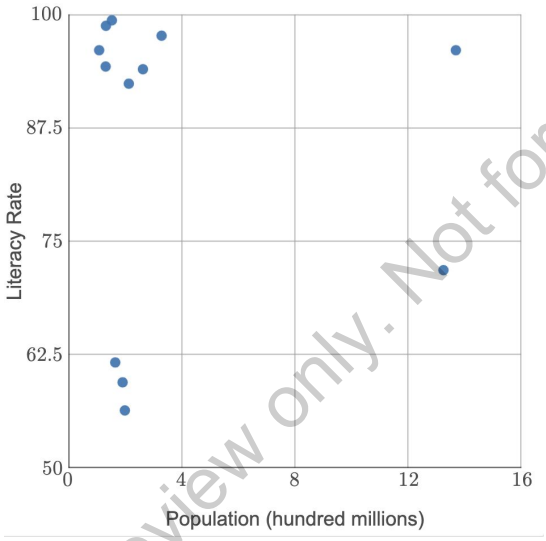
Practice

1. Select all of the following that describe the association in the scatter plot:



A. linear association
B. nonlinear association
C. positive association
D. negative association
E. no association

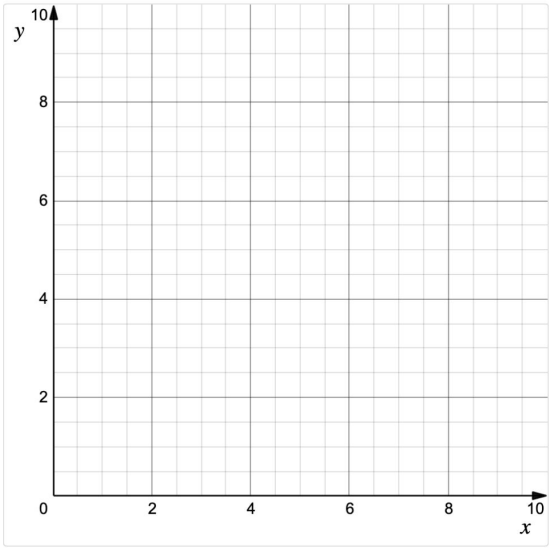
2. Circle any clusters in the data.



Explain what the clusters mean in context.

Practice (continued)

3. Create a scatter plot that has a positive, linear association with clustering.

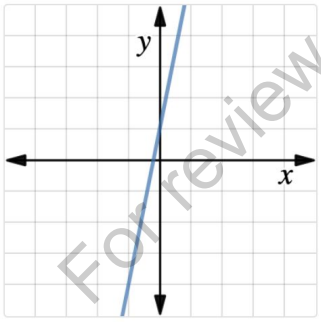


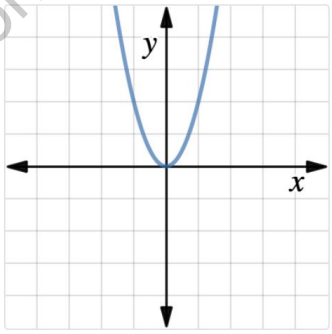
4. **A cone has volume V, radius r, and a height of 12 cm.**

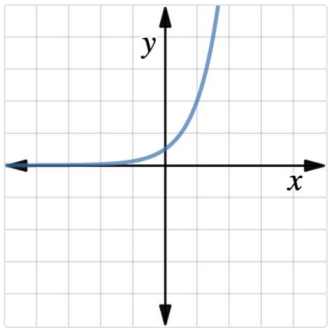
a. Write an expression for the cone's volume. $V =$

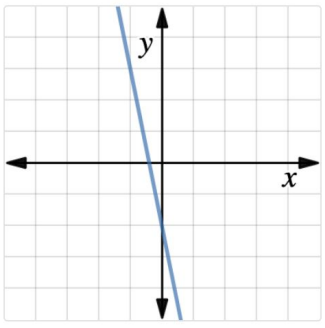
b. Another cone has the same height and three times the radius of the original cone. How does the volume of the new cone compare to the volume of the original cone?

5. Circle the graphs that represent a linear function.









Practice

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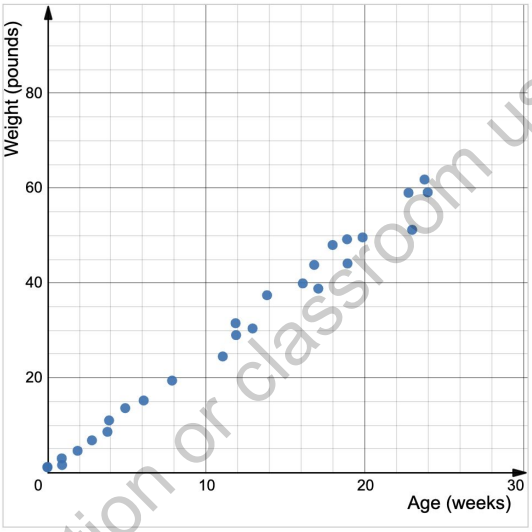
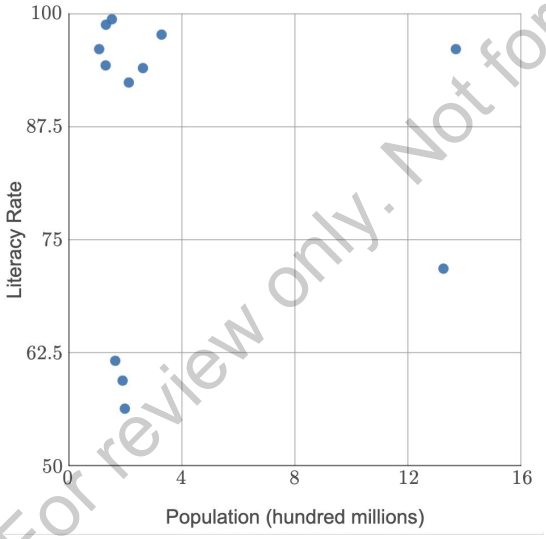


A. linear association
B. nonlinear association
C. positive association
D. negative association
E. no association

2. Circle any clusters in the data.



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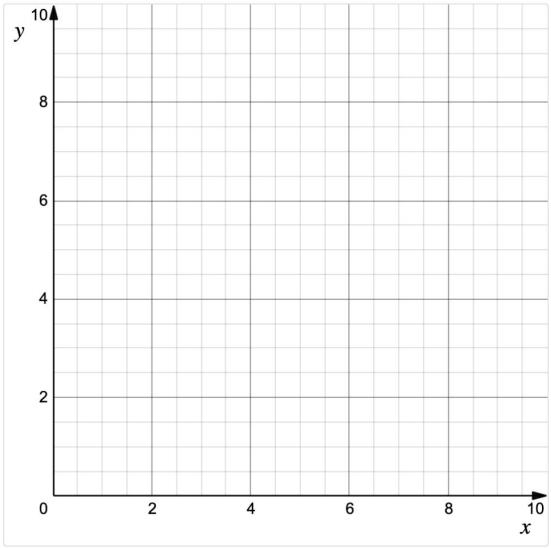

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