

Data and Probability

Unit 15 Overview: 11 lessons

Students measure to the nearest eighth of an inch and show the data on line plots marked in halves, quarters and eighths, then add, subtract and share the total equally to answer questions about it. The rest of the unit is taught in 5th grade in some states: planning how to collect data, the mean as a fair share, the median, mode and range and which measure fits, stem-and-leaf plots and frequency tables, line graphs and double bar graphs, scatterplots, histograms and circle graphs, probability as a number from 0 to 1, and sample spaces in tree diagrams, counted by multiplying.

THE UNIT, DAY BY DAY

Day 1	Pre-Check	What students already know, before the first lesson.
Day 2	15.1 Make a line plot	I can make a line plot of halves, quarters and eighths.
Day 3	15.2 Solve problems with a line plot	I can solve line plot problems.
Day 4	15.3 Plan how to collect data ★	I can ask a question that needs data and plan to collect it.
Day 5	15.4 The mean ★	I can find the mean as a fair share.
Day 6	15.5 Median, mode and range ★	I can find the median, mode and range and pick a measure.
Day 7	15.6 Stem-and-leaf plots and frequency tables ★	I can make a stem-and-leaf plot and read a frequency table.
Day 8	15.7 Line graphs and double bar graphs ★	I can read line graphs and double bar graphs.
Day 9	15.8 Scatterplots ★	I can make a scatterplot and tell what it shows.
Day 10	15.9 Histograms and circle graphs ★	I can read a histogram and a circle graph.
Day 11	15.10 Probability from 0 to 1 ★	I can write a probability as a number from 0 to 1.
Day 12	15.11 Sample spaces ★	I can list outcomes in a tree and count them by multiplying.
Day 13	Unit Review	The review, to go over together.
Day 14	Unit Test	Form A; Form B (other numbers) is for a retest.

★ Taught in 5th grade in some states. Skip these lessons if yours teaches them in another grade; animalmath.com/standards shows your state's list.

GET READY FOR THE UNIT

- Rulers marked in eighths of an inch, paper strips, and sticky notes for class line plots
- Connecting cubes, and grid paper (the Graph Paper maker prints it)
- Whiteboards and markers, index cards and colored pencils
- For probability: bags of colored tiles, coins, number cubes, and paper spinners with paper clips

HOW EACH LESSON GOES

- 1. Warm up** (5 min)
 - 2. Teach** (10 min)
 - 3. Try it together** (10 min)
 - 4. Practice** (15 min)
 - 5. Exit ticket** (5 min): a quick check on the lesson.
- Each lesson page ends with the Animal Math sheets, makers, tools and quizzes for it. "Sheet 3" is the third worksheet of a pack; a color pack prints each sheet again in black and white.

CHECKING AS YOU GO

PRINTABLE	Pre-Check: Day 1, with a key	EXIT TICKET	Exit Tickets: one a lesson, two to a page
PRINTABLE	Unit Review: the day before the test	PRINTABLE	Unit Test: Forms A and B, with keys



Data and Probability

Lesson 15.1: Make a line plot

GOAL Students measure to the nearest eighth of an inch, label a line marked in eighths (halves and quarters among them), and make a line plot with one X for each measurement, then count from it.

About 45 minutes

I can make a line plot of halves, quarters and eighths.

THE LESSON

- 1 Warm up** (5 min) On whiteboards, write $\frac{1}{4}$, $\frac{1}{2}$ and $\frac{3}{4}$ as eighths. Then ask what $5\frac{6}{8}$ is in simplest form.
- 2 Teach** (10 min) Show the lengths of 9 used pencils in inches: $6\frac{3}{8}$, $6\frac{3}{4}$, $6\frac{1}{2}$, 7 , $6\frac{3}{8}$, $6\frac{7}{8}$, $6\frac{1}{2}$, $6\frac{3}{4}$, $6\frac{1}{2}$. Draw a line from 6 to 7 with 8 equal spaces and label every mark: $6\frac{1}{8}$, $6\frac{1}{4}$, $6\frac{3}{8}$, and on. Put an X above each length as you cross it off the table, stacking the Xs that repeat. Count: 9 Xs. How many pencils are shorter than $6\frac{5}{8}$ inches? The Xs left of that mark: 5.
Say: "Each space is one eighth of an inch. A quarter is two eighths and a half is four, so every length in the table has a mark of its own."
- 3 Try it together** (10 min) Partners measure 6 paper strips to the nearest eighth inch, write the lengths in a table and plot them on a line they label in eighths. Each partner writes a how many question about the plot for the other to answer.
- 4 Practice** (15 min) Students read line plots on sheet 1 of Line Plots with Fractions, make them from tables on sheet 2 (one line marked only in eighths), and measure ribbons to the nearest eighth inch and plot them on sheet 3. The Line Plots quiz level is 4th grade review.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 15.1** and circle a face beside the "I can" line. On question 1, look for $\frac{1}{8}$, $\frac{3}{8}$ and $\frac{5}{8}$ on the blank marks, and Xs at $\frac{1}{4}$ (two), $\frac{1}{2}$, $\frac{5}{8}$ (two) and $\frac{7}{8}$; Xs for $\frac{1}{4}$ on the $\frac{1}{8}$ mark mean quarters were counted as eighths. On question 2, look for 4; 3 counts the stack at $\frac{5}{8}$ once.

Need help? Write every label in eighths first ($6\frac{2}{8}$, $6\frac{4}{8}$, $6\frac{6}{8}$), then find each length by counting eighths from 6.

Ready for more? Measure 8 things in your desk to the nearest eighth inch, plot them, and write three questions the plot answers.

GET READY

- Rulers marked in eighths of an inch
- Paper strips cut between 5 and 6 inches long
- Sticky notes for a class line plot

WORDS TO USE

line plot: a number line with an X above it for each measurement

eighth inch: one of the 8 equal spaces between two inch marks

data: the measurements we collect

ASK

- Which mark is $6\frac{3}{4}$ on a line marked in eighths?
- What label goes halfway between $6\frac{1}{4}$ and $6\frac{1}{2}$?
- How many Xs should your plot have?

WATCH FOR

Puts $6\frac{1}{4}$ on the first mark after 6. The first mark is $6\frac{1}{8}$; a quarter is two eighths, two marks along.

Labels the marks $\frac{1}{8}$, $\frac{2}{8}$, $\frac{3}{8}$ and leaves off the whole number. Every mark between 6 and 7 is 6 and some eighths: write the 6 too.

Draws one X for a length that comes three times. Cross each length off the table as its X goes on, then count the Xs.

ON ANIMAL MATH

PRINTABLE

Line Plots with Fractions: sheets 1-3

QUIZ

Graphs and Data Quiz: the Line Plots level

EXIT TICKET

5th Grade Data and Probability Exit Tickets: Exit Ticket 15.1

Data and Probability

Lesson 15.2: Solve problems with a line plot

GOAL Students use the data on a line plot to solve problems: they subtract to compare the greatest and the least, add the measurements for the total, and share the total equally by writing it in eighths and dividing.

About 45 minutes

I can solve line plot problems.

THE LESSON

- 1 Warm up** (5 min) On whiteboards: $\frac{3}{4} + \frac{5}{8}$, then $1\frac{1}{2} - \frac{3}{8}$. Write halves and quarters as eighths first.
- 2 Teach** (10 min) Show a line plot of the paint left in 6 jars, in cups: $\frac{1}{2}$, $\frac{3}{4}$, $\frac{5}{8}$, $\frac{3}{8}$, $\frac{7}{8}$ and $\frac{5}{8}$. How much more is in the fullest jar than the emptiest? $\frac{7}{8} - \frac{3}{8} = \frac{4}{8}$, or $\frac{1}{2}$ cup. The total, in eighths: $4 + 6 + 5 + 3 + 7 + 5 = 30$ eighths, or $3\frac{3}{4}$ cups. If the paint were poured so every jar held the same, 30 eighths shared by 6 jars is 5 eighths each: $\frac{5}{8}$ cup. Check: $6 \times \frac{5}{8} = \frac{30}{8}$.
Say: "I write every measurement in eighths. Then the total is a count of eighths, and sharing it equally is dividing that count."
- 3 Try it together** (10 min) Show lemonade in 4 pitchers, in quarts: $1\frac{1}{8}$, $1\frac{5}{8}$, $1\frac{3}{8}$ and $1\frac{7}{8}$. Partners plot it, then find how much more is in the fullest pitcher than the emptiest ($\frac{3}{4}$ quart), the total (48 eighths, or 6 quarts) and the fair share ($1\frac{1}{2}$ quarts).
- 4 Practice** (15 min) Students add and subtract with the yarn and rain line plots on sheet 4 of Line Plots with Fractions, then share totals equally on sheet 5.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 15.2** and circle a face beside the "I can" line. On question 1, look for $\frac{5}{8}$ cup ($\frac{3}{4}$ is $\frac{6}{8}$, take away $\frac{1}{8}$); $\frac{2}{4}$ subtracts the top numbers without making eighths, and $\frac{1}{2}$ takes a $\frac{1}{4}$ glass for the emptiest. On question 2, look for a total of $2\frac{1}{4}$ cups ($\frac{9}{4}$ or $\frac{18}{8}$ is the same) and $\frac{3}{8}$ cup in each glass, 18 eighths shared by 6; a share bigger than the fullest glass means the total was not divided.

Need help? Cut paper strips into eighths, one piece for each eighth in the total, and deal the pieces out to the jars.

Ready for more? Change one jar so the fair share is $\frac{3}{4}$ cup. Which jar could change, and to what?

GET READY

- Line plots of paint and lemonade on chart paper
- Paper strips folded in eighths
- Whiteboards and markers

WORDS TO USE

total: all the measurements added together

fair share: the amount each gets when the total is shared equally

difference: how much more one amount is than another

ASK

- Which Xs do you need for this question?
- How many eighths are in the total? How many shares?
- How can you check a fair share?

WATCH FOR

Adds the bottom numbers: $\frac{3}{8} + \frac{5}{8} = \frac{8}{16}$.

Count eighths on the plot: 3 eighths and 5 eighths make 8 eighths, one whole.

Adds one X of a stack. A stack of two is that amount twice: tick each X as it is added.

Shares only the whole number of a mixed total. Write the total in eighths first ($3\frac{3}{4}$ is 30 eighths), then share the eighths.

ON ANIMAL MATH

PRINTABLE

Line Plots with Fractions: sheets 4-5

QUIZ

Graphs and Data Quiz: the Line Plot Problems level

EXIT TICKET

5th Grade Data and Probability Exit Tickets: Exit Ticket 15.2

Data and Probability

Lesson 15.3: Plan how to collect data

GOAL Students tell a question that needs data from one with a single answer, choose how to collect the data (a survey, observing, measuring or an experiment), and plan who or what to collect from and how to record it.

About 45 minutes

★ Taught in 5th grade in some states

I can ask a question that needs data and plan to collect it.

THE LESSON

- 1 Warm up (5 min)** Ask for a question you could answer by asking everyone in the room, and one only a ruler or a scale could answer.
- 2 Teach (10 min)** Sort question cards: "What day is the field trip?" has one answer; "How many books has each student read this month?" needs data. Match data questions to a way: "Which field trip do 5th graders want?" (survey), "How many people use the library each hour?" (observe), "How heavy are our backpacks?" (measure), "Does a folded towel soak up more water than a flat one?" (experiment). Then plan one: who to ask, how many, and a tally table.
Say: "A question needs data when different people or things give different answers. Then I choose how to collect it."
- 3 Try it together (10 min)** Partners write a question about the class that needs data (like how many glasses of water each of us drank yesterday) and plan it: the way, who, how many answers, and a table to record them. Two pairs trade plans and check them.
- 4 Practice (15 min)** Students circle the questions that need data and the way to collect it, and plan a question of their own, on sheet 5 of Line Graphs (questions 1 to 7), then sort questions and ways on sheet 1 of Frequency Tables and Stem-and-Leaf Plots, a 4th grade review.
- 5 Exit ticket (5 min)** Students do **Exit Ticket 15.3** and circle a face beside the "I can" line. On question 1, look for the wake up question; the school's start time has one answer. On question 2, look for survey (pizza) and measure (pumpkins); observe for the pizza mixes up asking and watching.

Need help? Sort the question cards into two piles first, one answer and many answers, then match each many answers card to a way.

Ready for more? Write a question for each of the four ways, and tell which kind of graph would show each one's data best.

GET READY

- Question cards to sort
- A planning sheet: question, way, who or what, how many, how to record
- Clipboards for collecting data

WORDS TO USE

survey: asking a group of people the same question

observe and measure: watch and count; use a tool like a ruler or a scale

experiment: change one thing, try it and record what happens

ASK

- Would different people give different answers?
- Would you ask, watch, measure or test?
- Who will you ask, and how many?

WATCH FOR

Picks a question with one answer, like the day of the field trip. Ask: would different people or things give different answers?

Chooses a survey for every question. Ask what the answer is: an opinion, a count, a length or weight, or what happens after a change.

Plans to ask only a few friends. Ask everyone the question is about, or a fair part of the group.

ON ANIMAL MATH

PRINTABLE

Line Graphs: sheet 5, questions 1 to 7

PRINTABLE

Frequency Tables and Stem-and-Leaf Plots: sheet 1, a review

EXIT TICKET

5th Grade Data and Probability Exit Tickets: Exit Ticket 15.3

Data and Probability

Lesson 15.4: The mean

GOAL

Students see the mean as a fair share: they level towers of cubes until every tower is the same height, then find the mean of a data set by adding the values and dividing by how many there are, and check it as the balance point.

About 45 minutes

★ Taught in 5th grade in some states

I can find the mean as a fair share.

THE LESSON

1 Warm up (5 min) Three friends have 1, 6 and 8 stickers. Students act it out with counters: how can they share so each friend has the same?

2 Teach (10 min) Build towers of 3, 8, 5 and 4 cubes. Move cubes from the tall towers to the short ones until all four match: 5 cubes each, the mean. With numbers: add ($3 + 8 + 5 + 4 = 20$) and divide by the number of towers ($20 \div 4 = 5$). Then the hours 5 students read in a week: 4, 7, 3, 8, 8. The total is 30, and $30 \div 5 = 6$ hours. Check the balance point: 4 and 3 are 2 and 3 below 6, a total of 5; 7, 8 and 8 are 1, 2 and 2 above, also 5.

Say: "The mean is the fair share. I add all the values, then divide by how many values there are."

3 Try it together (10 min) In the Ten Frames tool, partners show the runs a team scored in 5 games, 2, 9, 6, 4 and 4, one frame a game. They move counters until every frame shows the same number (5), then check by adding and dividing: $25 \div 5 = 5$.

4 Practice (15 min) Students level towers and share stories fairly on sheet 1 of Mean, Median, Mode and Range, then find means and check them as balance points on sheet 2.

5 Exit ticket (5 min) Students do **Exit Ticket 15.4** and circle a face beside the "I can" line. On question 1, look for 4 cubes, 16 cubes shared by 4 towers; 16 is the total, not shared. On question 2, look for 9 points, $45 \div 5$; 45 is the total, and 10 is the value that comes twice.

Need help? Build each value as a tower of cubes and move one cube at a time from the tallest tower to the shortest until all match.

Ready for more? Write five different numbers with a mean of 7, none of them 7.

GET READY

- Connecting cubes for each pair
- A number line from 0 to 10 on the board
- Whiteboards and markers

WORDS TO USE

mean: the fair share: the total shared equally among the values

data set: a list of numbers collected

balance point: the mean: the distances below it add up to the distances above it

ASK

- What is the total? How many values are there?
- Is the mean between the least and the greatest value? Why must it be?
- How far below the mean are the small values? How far above are the big ones?

WATCH FOR

Divides by the greatest value, not by how many values. Count the values first, and divide by that count.

Gives the total as the mean. Ask: is that each one's fair share? Share it out.

Thinks the mean must be one of the values. The fair share can be a number nobody had, like the 6 hours: level the towers and see.

ON ANIMAL MATH

PRINTABLE

Mean, Median, Mode and Range: sheets 1-2

TOOL

Ten Frames: a frame for each value with + 10-Frame, Show Numbers on

EXIT TICKET

5th Grade Data and Probability Exit Tickets: Exit Ticket 15.4

Data and Probability

Lesson 15.5: Median, mode and range

GOAL

Students put data in order to find the median, the mode and the range, and decide which measure tells a typical value best: the mean when the values are close together, the median when one value is far from the rest.

About 45 minutes

★ Taught in 5th grade in some states

I can find the median, mode and range and pick a measure.

THE LESSON

- 1 **Warm up** (5 min) Students write 31, 18, 25, 18 and 40 in order, then point to the middle value and the one that comes twice.
- 2 **Teach** (10 min) Show the cans 7 students brought to a food drive: 12, 10, 62, 10, 15, 14, 10. In order: 10, 10, 10, 12, 14, 15, 62. The median is the 4th of 7 values, 12; the mode is 10; the range is $62 - 10 = 52$. The mean is $133 \div 7 = 19$, more than six of the seven values, because the 62 pulls it up. So the median, 12, tells the typical number better. Take the 62 away and the mean drops below 12, while the median moves only to 11.
Say: "For the median, I put the data in order and find the middle. One value far from the rest pulls the mean toward it, so the median shows a typical value better."
- 3 **Try it together** (10 min) Show noon temperatures for a week, in degrees: 68, 63, 70, 63, 66, 75, 63. Partners find the median (66), the mode (63) and the range (12). Then add an 8th day, 72: with two middle values, 66 and 68, the median is halfway between, 67.
- 4 **Practice** (15 min) Students put data in order and find the median, mode and range on sheet 3 of Mean, Median, Mode and Range, then find all four from a line plot and choose the measure that fits best on sheet 4.
- 5 **Exit ticket** (5 min) Students do **Exit Ticket 15.5** and circle a face beside the "I can" line. On question 1, look for a median of 11, a mode of 9 and a range of 7; a median of 9 is the middle of the list as written, and a range of 16 is the greatest value. On question 2, look for a mean of 12, a median of 8 and the median circled: the 30 pulls the mean past every other age.

Need help? Write each value on a sticky note, line the notes up in order, and take one off each end until one or two are left.

Ready for more? Write 7 values whose mean, median and mode are all different, then change one value so the median fits better than the mean.

ON ANIMAL MATH

PRINTABLE

Mean, Median, Mode and Range: sheets 3-4

EXIT TICKET

5th Grade Data and Probability Exit Tickets: Exit Ticket 15.5

GET READY

- Sticky notes for lining data up in order
- A class chart of the four measures
- Whiteboards and markers

WORDS TO USE

median: the middle value when the data are in order

mode: the value that shows up most often

range: the greatest value minus the least: how spread out the data are

outlier: a value far from all the others

ASK

- Did you put the data in order first?
- Is there one middle value, or two?
- Which value is far from the rest? What does it do to the mean?

WATCH FOR

Finds the middle of the list as written. Write the data in order first, then cross off one value from each end until the middle is left.

Gives the greatest value as the range. The range is a difference: the greatest minus the least.

Picks the mean for data with a value far from the rest. Count the values above the mean. If almost none are, the median fits better.

Data and Probability

Lesson 15.6: Stem-and-leaf plots and frequency tables

GOAL Students make a stem-and-leaf plot with the leaves in order and a key, make a frequency table from data, and use both to answer one- and two-step questions.

I can make a stem-and-leaf plot and read a frequency table.

About 45 minutes

★ Taught in 5th grade in some states

THE LESSON

- 1 Warm up** (5 min) Sort 31, 26, 38, 22 and 35 into the 20s and the 30s. Which digit tells the group?
- 2 Teach** (10 min) Show the heights of 10 seedlings in centimeters: 14, 32, 25, 18, 27, 25, 19, 36, 25, 22. Write the stems 1, 2 and 3 down the left of a line, put each ones digit beside its stem, then rewrite each row in order: 1 | 4 8 9, 2 | 2 5 5 5 7, 3 | 2 6. Add a key: 2 | 5 means 25. Make a frequency table by tens from it: 10 to 19 cm, 3 seedlings; 20 to 29 cm, 5; 30 to 39 cm, 2. A two-step question: how many more are in the 20s than in the 30s? $5 - 2 = 3$.
Say: "The stem is the tens and the leaves are the ones, in order. A value that comes three times gets three leaves."
- 3 Try it together** (10 min) Partners make a stem-and-leaf plot of the words per minute 12 students typed, 56, 71, 48, 63, 56, 75, 49, 68, 56, 70, 62 and 53, then a frequency table by tens, and find how many typed 60 words or more (6).
- 4 Practice** (15 min) Students make a stem-and-leaf plot with a title and a key and read another on sheet 5 of Mean, Median, Mode and Range, then tally data into frequency tables on sheet 2 of Frequency Tables and Stem-and-Leaf Plots, a 4th grade review. Early finishers read the plot and the tables on sheet 5 there.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 15.6** and circle a face beside the "I can" line. On question 1, look for 2 | 7 7 7, 3 | 1 5 9 and 4 | 3 4 8, every row in order and 27 written three times. On question 2, look for 11 ($5 + 4 + 2$); 6 leaves out the 3 books row, and 5 reads only that row.

Need help? Write each number on a card, sort the cards into rows by their tens, then copy each row as a stem and its leaves.

Ready for more? Find the median and the range of the typing data from the plot, and write a two-step question it answers.

GET READY

- Index cards with one number each, for sorting by tens
- A blank stem-and-leaf plot and frequency table on chart paper
- Whiteboards and markers

WORDS TO USE

stem: the tens digit, written once at the left

leaf: the ones digit, written beside its stem, in order

key: tells how to read the plot: 2 | 5 means 25

frequency table: a table of each value or interval and how many times it comes up

ASK

- Which digit is the stem? Which is the leaf?
- Are the leaves in each row in order?
- How many values are 20 or more? How can the plot tell you fast?

WATCH FOR

Writes a value once when it comes three times. Every value gets its own leaf: 25 three times is 5 5 5.

Leaves the leaves out of order. Write them as they come, then rewrite each row from least to greatest.

Reads "or more" as only one row. Or more means that row and every row after it: add them all.

ON ANIMAL MATH

PRINTABLE

Mean, Median, Mode and Range: sheet 5

PRINTABLE

Frequency Tables and Stem-and-Leaf Plots: sheets 2 and 5, a review

EXIT TICKET

5th Grade Data and Probability Exit Tickets: Exit Ticket 15.6

Data and Probability

Lesson 15.7: Line graphs and double bar graphs

GOAL Students read line graphs whose scales count by whole numbers, halves or decimals, tell how the data changed and by how much, and read double bar graphs to compare two sets of data.

About 45 minutes

★ Taught in 5th grade in some states

I can read line graphs and double bar graphs.

THE LESSON

- 1 Warm up (5 min)** Count together by 0.5 from 0 to 4, then by halves. Ask what is halfway between 40 and 50, and between 2.5 and 3.
- 2 Teach (10 min)** Show a line graph of a candle burning, its scale counting by 0.5: 4 inches tall at hour 0, then 3.5, 3, 2.5 and 2 inches at hours 1 to 4: the line falls the same amount each hour. How much did it burn from hour 1 to hour 3? $3.5 - 2.5 = 1$ inch. Then a double bar graph of the cans two classes collected in 3 weeks, counting by 10s: Room 5 has 35, 50 and 45, Room 6 has 40, 30 and 55. A bar halfway between 30 and 40 is 35. In week 3, Room 6 collected $55 - 45 = 10$ more.
- Say:** "I read the scale first: what is each line worth? A bar or point halfway between two lines is half a jump more."
- 3 Try it together (10 min)** Partners draw a line graph of the books a library lent in 5 months, 150, 250, 225, 275 and 300, numbering the scale by 25s. They find the biggest rise (100 books, from month 1 to month 2) and the one fall.
- 4 Practice (15 min)** Students read line graphs on sheet 1 of Line Graphs, make them on sheet 2, read fraction and decimal scales on sheet 3, and read and finish double bar graphs on sheet 4. The Bar Graphs maker adds single bar graphs.
- 5 Exit ticket (5 min)** Students do **Exit Ticket 15.7** and circle a face beside the "I can" line. On question 1, look for 1.5 inches ($2 - 0.5$), or $1\frac{1}{2}$; 3 counts each line as 1. On question 2, look for 4 goals ($8 - 4$); 2 counts each line as 1, not 2.

Need help? Write the value beside every point or bar before answering any question.

Ready for more? Draw the cans graph again with a scale that counts by 5s, and tell which scale is easier to read.

GET READY

- A line graph and a double bar graph on chart paper
- Grid paper and rulers
- Colored pencils for the two sets of bars

WORDS TO USE

scale: the numbers up the side that tell what each line is worth

line graph: points joined by lines to show how data changes over time

double bar graph: two bars for each category, with a key to tell them apart

ASK

- What is each line on the scale worth?
- Where does the line go up, go down or stay flat?
- Which bar in each pair is which? How do you know?

WATCH FOR

Counts each line as 1. Read the scale aloud before reading any point or bar.

Reads a bar that ends halfway as the line below it. Halfway between 30 and 40 is 35: lay a ruler across from the top of the bar.

Mixes up the two sets of bars. Check the key and follow one color all the way across.

ON ANIMAL MATH

PRINTABLE

Line Graphs: sheets 1-4

MAKER

Bar Graphs: Activity Read the Graph, Scale Count by 5s, Max Value on Axis 50, Questions per Graph 5

EXIT TICKET

5th Grade Data and Probability Exit Tickets: Exit Ticket 15.7

Data and Probability

Lesson 15.8: Scatterplots

GOAL

Students make a scatterplot from a table of paired data, one point for each pair, tell what a point means, and tell the trend: as one value goes up, the other tends to go up, go down, or show no trend.

I can make a scatterplot and tell what it shows.

About 45 minutes

★ Taught in 5th grade in some states

THE LESSON

- 1 Warm up** (5 min) Plot (3, 5) and (5, 3) on a grid. Are they the same point? What does the first number tell you?
- 2 Teach** (10 min) Show how far a toy car rolled from a ramp at 5 heights, as pairs (height in inches, distance in feet): (2, 3), (4, 5), (6, 6), (8, 9), (10, 10). For each pair, go across to the height, then up to the distance, and draw a dot; the dots are not joined. The point (6, 6) means a 6 inch ramp sent the car 6 feet. As the height goes up, the distance tends to go up. A scatterplot of shoe sizes and spelling scores has dots spread with no pattern: no trend.
Say: "Each dot is one pair: across for the first number, up for the second. I look at all the dots, from left to right, to see the trend."
- 3 Try it together** (10 min) Partners plot a table of hours of sleep and minutes to finish a puzzle: (6, 30), (7, 25), (8, 20), (9, 20), (10, 15). They label both axes, number the scales, plot the 5 pairs and tell the trend (down).
- 4 Practice** (15 min) Students read lettered scatterplots on sheet 1 of Scatterplots, Histograms and Circle Graphs and make one, with its title, labels and scales, on sheet 2. Early finishers plot the free throw pairs on sheet 5 of Line Graphs.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 15.8** and circle a face beside the "I can" line. On question 1, look for five dots, not joined, each across at its temperature and up at its cups. On question 2, look for go down: warmer days, fewer cups sold.

Need help? Put a finger on the first number along the bottom and slide up to the second before drawing each dot.

Ready for more? Name two things you think would show no trend and two with a trend that goes down, and sketch each scatterplot.

GET READY

- A coordinate grid for each student (the Graph Paper maker prints one)
- A table of paired data on chart paper
- Rulers and colored pencils

WORDS TO USE

paired data: two numbers that go together, like a ramp's height and how far a car rolled

scatterplot: a graph with one point for each pair

trend: the way the points tend to go: up, down, or no trend

ASK

- Which number in each pair goes across? Which goes up?
- As one value goes up, what does the other tend to do?
- What does this one point tell you?

WATCH FOR

Joins the dots like a line graph. Each dot is its own pair: leave them as dots.

Swaps the two numbers of a pair. Say the column names: across to the first, then up to the second.

Calls the trend from one or two dots. Look at all the dots, from left to right, before deciding.

ON ANIMAL MATH

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Scatterplots, Histograms and Circle Graphs: sheets 1-2

PRINTABLE

Line Graphs: sheet 5, the scatterplot

MAKER

Graph Paper: Paper Type Coordinate Grid: First Quadrant

EXIT TICKET

5th Grade Data and Probability Exit Tickets: Exit Ticket 15.8

Data and Probability

Lesson 15.9: Histograms and circle graphs

GOAL Students read histograms (bar graphs of number data in equal intervals, with the bars touching) and circle graphs (each slice a fraction of the whole), and answer questions with them.

About 45 minutes

★ Taught in 5th grade in some states

I can read a histogram and a circle graph.

THE LESSON

- 1 Warm up** (5 min) Find $\frac{1}{8}$ of 64, then $\frac{5}{8}$ of 64. How did the first answer help with the second?
- 2 Teach** (10 min) Show a histogram of the heights of 24 sunflowers, in inches: 40 to 49, 3 sunflowers; 50 to 59, 8; 60 to 69, 9; 70 to 79, 4. The intervals are equal and meet, so the bars touch. How many are 60 inches or taller? $9 + 4 = 13$. Then a circle graph of how 56 fifth graders voted for a field trip: zoo $\frac{3}{8}$, museum $\frac{3}{8}$, farm $\frac{1}{4}$. One eighth of 56 is 7, so the zoo got $3 \times 7 = 21$ votes, and the farm, 2 eighths, got 14.
Say: "A histogram counts numbers in equal intervals. In a circle graph, I find one part of the total first, then as many parts as the slice has."
- 3 Try it together** (10 min) Show a circle graph of how 36 students got to a game, cut into sixths: car $\frac{1}{3}$, bus $\frac{1}{3}$, walk $\frac{1}{6}$, bike $\frac{1}{6}$. Partners find each count (12, 12, 6 and 6) and check that they add up to 36. Then they sort data sets: histogram or bar graph?
- 4 Practice** (15 min) Students read histograms and tell them from bar graphs on sheet 3 of Scatterplots, Histograms and Circle Graphs, tally data into equal intervals and draw histograms on sheet 4, and read circle graphs and choose the best display on sheet 5.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 15.9** and circle a face beside the "I can" line. On question 1, look for 12 ($8 + 4$); 8 reads only the 30 to 39 bar, and 6 counts each line as 1 when the scale counts by 2s. On question 2, look for 9: one eighth of 24 is 3, and the swim slice is 3 eighths; 3 is one eighth only.

Need help? Draw dashed lines to cut the circle into its equal parts, then count the parts in each slice.

Ready for more? Make a circle graph of 16 votes with slices of $\frac{3}{4}$, $\frac{1}{8}$ and $\frac{1}{8}$, and write two questions for it.

GET READY

- A histogram and a circle graph on chart paper
- Paper circles cut into eighths and sixths
- Whiteboards and markers

WORDS TO USE

histogram: a graph of number data in equal intervals, with the bars touching

interval: a range of numbers, like 50 to 59

circle graph: a circle cut into slices that show fractions of the whole

ASK

- What interval does each bar show? What does the scale count by?
- Which bars do you need for "or taller"?
- What fraction is this slice? What is one part of the total?

WATCH FOR

Reads one bar for "60 inches or taller". Or taller means that interval and every interval above it: add those bars.

Reads the scale as counting by 1s. Read the scale numbers aloud first.

Counts the slices, not the parts of the whole. Find the size of one part first, then count the parts in the slice.

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Scatterplots, Histograms and Circle Graphs: sheets 3–5

EXIT TICKET

5th Grade Data and Probability Exit Tickets: Exit Ticket 15.9

Data and Probability

Lesson 15.10: Probability from 0 to 1

GOAL Students write the probability of an event as a number from 0 to 1, the outcomes that fit over all the equally likely outcomes (0 for impossible, 1 for certain), and place it on a number line to say how likely it is.

About 45 minutes

★ Taught in 5th grade in some states

I can write a probability as a number from 0 to 1.

THE LESSON

- 1 Warm up** (5 min) Ask where impossible, unlikely, equally likely, likely and certain go on a number line from 0 to 1.
- 2 Teach** (10 min) Show the bag: 4 red, 7 yellow and 1 green tile, 12 in all. The probability of red is $4/12$ (or $1/3$), of yellow $7/12$, of green $1/12$. Blue is $0/12$, or 0: impossible. Red, yellow or green is $12/12$, or 1: certain. Mark each one on the number line: $1/12$ is close to 0, so unlikely; $7/12$ is just past $1/2$, so likely.
Say: "The probability is the outcomes that fit over all the outcomes. Zero means it cannot happen, and one means it always will."
- 3 Try it together** (10 min) Partners color a spinner with 10 equal parts so that red is $1/2$, blue is $3/10$ and green is $1/5$. They write the probability of blue or green ($5/10$), of not green ($8/10$), of yellow (0) and of red, blue or green (1), then spin 20 times and compare.
- 4 Practice** (15 min) Students name how likely events are on sheet 1 of Probability, write probabilities as fractions on sheet 2, mark them on number lines from 0 to 1 on sheet 3, and make spinners, tiles and stories to fit given probabilities on sheet 5.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 15.10** and circle a face beside the "I can" line. On question 1, look for $5/8$ for blue and 0 for green ($0/8$ is the same); $5/3$ compares blue with red, so ask how many marbles there are in all. On question 2, look for point A, at $3/8$; point B is the blue marbles' $5/8$.

Need help? Lay out real tiles and move the ones that fit into a pile, then count the pile and all the tiles.

Ready for more? Fill a bag of 20 cubes so the probability of red is $1/4$, of blue is $1/2$ and of green is 0.

GET READY

- A bag of 12 tiles: 4 red, 7 yellow and 1 green
- A number line from 0 to 1 on the board
- Paper spinners with 10 equal parts, and paper clips

WORDS TO USE

probability: how likely an event is, a number from 0 to 1

outcome: one thing that can happen

impossible and certain: can never happen (0); will always happen (1)

ASK

- How many outcomes are there in all? How many fit?
- Is the probability more or less than $1/2$? Which word fits?
- What is the probability of something that cannot happen?

WATCH FOR

Writes the outcomes that fit over the ones that do not: $4/8$ for red. The bottom number is all the outcomes: count every tile.

Thinks a probability can be more than 1. The tiles that fit can never be more than all the tiles.

Leaves an impossible event blank. No tiles fit, so its probability is 0.

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Probability: sheets 1-3 and 5

EXIT TICKET

5th Grade Data and Probability Exit Tickets: Exit Ticket 15.10

Data and Probability

Lesson 15.11: Sample spaces

GOAL Students list a sample space (each first choice with every second choice) in a tree diagram or an organized list, count the outcomes by multiplying, and find the probability of one outcome.

About 45 minutes

★ Taught in 5th grade in some states

I can list outcomes in a tree and count them by multiplying.

THE LESSON

- 1 Warm up** (5 min) Flip a coin: what can happen? Roll a number cube: what can happen? List each outcome once.
- 2 Teach** (10 min) Flip a coin, then roll a number cube. Draw the tree: H branches to 1, 2, 3, 4, 5 and 6, and so does T. List the outcomes at the ends, H1 to H6 and T1 to T6: 12 in all. Count them another way: 2 sides times 6 numbers, $2 \times 6 = 12$. The probability of heads and an even number is $3/12$. Then without drawing: a pizza is one of 3 crusts and one of 7 toppings, so there are $3 \times 7 = 21$ pizzas.
Say: "Each first choice goes with every second choice, so I multiply the number of first choices by the number of second choices."
- 3 Try it together** (10 min) Partners make an organized list of T-shirts, one of 4 colors with one of 4 animal pictures. They list all 16, check by multiplying ($4 \times 4 = 16$), and find the probability that a shirt picked without looking is red with a fox ($1/16$).
- 4 Practice** (15 min) Students finish tree diagrams and a chart, find probabilities and count outcomes by multiplying on sheet 4 of Probability. Students who need a step back list outcomes, each one once, on sheets 1 and 3 of Possible Outcomes.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 15.11** and circle a face beside the "I can" line. On question 1, look for all 8 outcomes, H1 to H4 and T1 to T4, one in each box; only H outcomes means one branch was followed. On question 2, look for 20 (4×5); 9 adds the choices instead of multiplying.

Need help? Act it out: lay each first choice in a row and put every second choice beside it, then count.

Ready for more? Flip a coin three times: draw the tree, list the outcomes, and check with $2 \times 2 \times 2$.

GET READY

- A coin and a number cube
- Chart paper for a tree diagram
- Whiteboards and markers

WORDS TO USE

sample space: the list of every possible outcome

tree diagram: branches that show each first choice with every second choice

outcome: one result, like heads and a 4 (H4)

ASK

- Did every first choice get every second choice?
- How can you check the count without listing?
- When all the outcomes are equally likely, what is the probability of one of them?

WATCH FOR

Adds the choices: $2 + 6 = 8$. Each of the 2 coin sides goes with all 6 numbers: 6 and 6 more.

Follows only the first branch. Every first choice gets its own set of second choices.

Lists an outcome twice or misses one. List in order (H1, H2 and on, then T1, T2) and check the count by multiplying.

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Probability: sheet 4

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Possible Outcomes: sheets 1 and 3, a step back

EXIT TICKET

5th Grade Data and Probability Exit Tickets: Exit Ticket 15.11