Data and Graphs

Unit 9 Overview: 8 lessons

Students ask the class a question, tally the answers and write them in a table, then read and make picture graphs and bar graphs with up to four kinds, every picture or box standing for one. They use the graphs to put together, take apart and compare: how many of two kinds in all, how many are not one kind, how many more one kind has than another. Lessons 9.1 (surveys and tables), 9.7 (pictographs with a key) and 9.8 (bar graphs with a scale) are for the states that teach them in 2nd grade.

THE UNIT, DAY BY DAY

Day 1	**Pre-Check**	What students already know, before the first lesson.
Day 2	**9.1** Surveys, tallies and tables ★	I can tally answers in a table.
Day 3	**9.2** Read picture graphs	I can read a picture graph.
Day 4	**9.3** Make a picture graph	I can make a picture graph.
Day 5	**9.4** Read bar graphs	I can read a bar graph.
Day 6	**9.5** Make a bar graph	I can make a bar graph.
Day 7	**9.6** Put together, take apart, compare	I can use a graph to find how many more and how many in all.
Day 8	**9.7** Pictographs with a key ★	I can read a pictograph with a key.
Day 9	**9.8** Bar graphs with a scale of 2, 5 or 10 ★	I can read a bar graph that counts by 2s or 5s.
Day 10	**Unit Review**	The review, to go over together.
Day 11	**Unit Test**	Form A; Form B (other numbers) is for a retest.

★ Taught in 2nd 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

- Chart paper for class tally charts, picture graphs and bar graphs
- Square sticky notes, crayons, rulers and grid paper
- Snap cubes in four colors for building bars
- A class list for surveys, and whiteboards with dry erase markers

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

PRINTABLE **Unit Review**: the day before the test

EXIT TICKET **Exit Tickets**: one a lesson, four to a page

PRINTABLE **Unit Test**: Forms A and B, with keys

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Data and Graphs

Lesson 9.1: Surveys, tallies and tables

GOAL Students ask a survey question with three or four answers, make a tally mark for each answer, write the totals in a table, and check that the totals add up to the number of people asked.

I can tally answers in a table.

About 45 minutes

★ Taught in 2nd grade in some states

THE LESSON

1. **Warm up** (5 min) Ask: "How many windows are in our room?" and "What is our favorite fruit?" Which one can we count, and which one do we have to ask people?
2. **Teach** (10 min) Ask "Which pet would you like best: dog, cat, fish or bird?" Call on students one at a time; each answer is one tally mark in its row, and the student checks off their name. Bundle every fifth mark. Write each total, then add them: if 22 students voted, the totals add to 22.

   > **Say:** "One person, one answer, one mark. The totals add up to everyone we asked."

3. **Try it together** (10 min) Pairs choose a question card, ask 10 classmates and tally the answers, then write the totals and check that they add to 10. Save the charts for lessons 9.3 and 9.5, where they become graphs.
4. **Practice** (15 min) Students sort questions into needs data or one answer on sheet 1 of Survey Questions and Data Collection, then tally the class survey on sheet 3. Early finishers choose how to get the data on sheet 2.
5. **Exit ticket** (5 min) Students do **Exit Ticket 9.1** and circle a face beside the "I can" line. Frogs 4, turtles 2, ducks 5, butterflies 3, and 14 children answered. A total that is not 14 means a card was missed or tallied twice.

Need help? Tally a yes or no question for 5 classmates first, then add more choices.

Ready for more? Ask the same question in another class and compare the two tables: did the same answer win?

GET READY

- A class list for checking off names
- Question cards with four picture choices
- A four-row tally chart on chart paper

WORDS TO USE

survey: asking a group of people the same question

tally chart: a table of tally marks, one mark for each answer

total: how many in all

ASK

- How do you know you counted every card?
- Why does each person get only one mark?
- What do the totals add up to? Why?

WATCH FOR

Makes two marks for one answer, or skips one. Cross off each card or name as it is tallied, then check that the totals add to the number asked.

Draws the fifth mark standing up. Four marks stand, the fifth goes across: a bundle is 5.

Asks a question with too many answers. Help them choose three or four answers to pick from.

ON ANIMAL MATH

- PRINTABLE — **Survey Questions and Data Collection**: sheets 1 and 3, then 2 for early finishers (sheet 4 is 3rd grade)
- MAKER — **Tally Marks**: Mode Draw Tallies, Number Range Within 20
- QUIZ — **Graphs and Data Quiz**: the Tally Charts level
- EXIT TICKET — **2nd Grade Data and Graphs Exit Tickets**: Exit Ticket 9.1

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Data and Graphs

Lesson 9.2: Read picture graphs

GOAL Students read a picture graph with up to four kinds, where each picture stands for one: they write how many in each row, find the most and the fewest, and answer questions from it.

I can read a picture graph.

About 45 minutes

THE LESSON

1. **Warm up** (5 min) Each student draws their favorite of four fruits on a sticky note and puts it in the next box of that fruit's row on the class graph.
2. **Teach** (10 min) Read the class graph. Point to the title, then the labels. Count each row from its first box and write the number at the end: apples 7, bananas 4, grapes 9, oranges 5. Which has the most? The longest row, grapes. The fewest? Bananas. When every box holds one picture, the longest row has the most.

   Say: "Each picture is one. I count every row from the first box."
3. **Try it together** (10 min) Show two picture graphs. Partners take turns asking how many in a row, which has the most, which the fewest, and how many more one row has than another. Include rows that differ by only 1, so students have to count, not guess.
4. **Practice** (15 min) Students write how many and circle the most on sheet 1 of Picture Graphs for 2nd Grade, then find the missing row and circle true or false on sheet 5.
5. **Exit ticket** (5 min) Students do **Exit Ticket 9.2** and circle a face beside the "I can" line. Carrots 6, corn 3, tomatoes 8, peppers 5, and the tomato circled as the most. A 7 for carrots means the label picture was counted.

Need help? Read three-row graphs to 6 first, building each row with cubes beside the graph.

Ready for more? Write three questions a graph can answer, and one it cannot, for a partner.

GET READY

- An empty four-row picture graph on chart paper
- Square sticky notes
- Whiteboards and markers

WORDS TO USE

picture graph: a graph with one picture for each thing

title: the name of the graph: what it is about

label: the picture or word that names each row

ASK

- What is this graph about? How do you know?
- How many peppers? How did you count them?
- Which row has the most? How can you tell without counting?

WATCH FOR

Counts the label picture as one more. Cover the label with a finger and count only the boxes.

Loses the place in a long row. Touch each picture while counting, or lay a ruler under the row.

Picks the row with the biggest pictures as the most. Count both rows: one picture is one, whatever its size.

ON ANIMAL MATH

PRINTABLE **Picture Graphs for 2nd Grade**: sheets 1 and 5

PRINTABLE **Picture Graphs for 1st Grade**: sheet 1, for students who need help

QUIZ **Graphs and Data Quiz**: the Picture Graphs level

EXIT TICKET **2nd Grade Data and Graphs Exit Tickets**: Exit Ticket 9.2

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Data and Graphs

Lesson 9.3: Make a picture graph

GOAL Students make a picture graph from a tally chart or a picture: they count each kind, draw one circle in a box for each, starting at the first box with no gaps, and give the graph a title.

I can make a picture graph.

About 45 minutes

THE LESSON

1. **Warm up** (5 min) Show a tally chart with 6, 3, 5 and 2. Students count each row by 5s and 1s and write the totals on whiteboards.
2. **Teach** (10 min) Use the same chart: cars 6, tops 3, teddy bears 5, robots 2. Draw an empty graph with a row for each toy. For cars, draw a circle in the first box, then the next, counting to 6, with no gaps. Do the other rows, then write a title and the key: each circle is 1 toy. Check each row against its tally.

   > **Say:** "One circle for each tally mark. Start at the first box and leave no gaps."

3. **Try it together** (10 min) Pairs turn a tally chart saved from lesson 9.1 into a picture graph, then trade with another pair to check each row against the tally. Include a row of more than 5, so the circles go past the first bundle.
4. **Practice** (15 min) Students draw a circle for each animal from the tally chart on sheet 3 of Picture Graphs for 2nd Grade, then count the vegetables and color one box for each on sheet 4, and answer the questions on both.
5. **Exit ticket** (5 min) Students do **Exit Ticket 9.3** and circle a face beside the "I can" line. Cars 4, tops 7, teddy bears 2, robots 5, and the teddy bear circled as the fewest. Check that each row starts in the first box.

Need help? Make a graph of three kinds to 6 from real things, one thing a box, then draw it.

Ready for more? Survey 10 classmates, then make a picture graph of the answers with a title, labels and a key.

GET READY

- An empty four-row graph for each student
- The tally charts saved from lesson 9.1
- Crayons

WORDS TO USE

tally chart: a chart of tally marks

one for each: one picture for every thing counted

key: tells what each picture stands for; here, 1

ASK

- How many circles go in this row? How do you know?
- Where does every row start?
- Why does a graph need a title?

WATCH FOR

Draws one circle too many or too few. Cross off each tally mark while drawing its circle.

Leaves gaps, or starts a row partway across. Put a finger on the first box before drawing, and fill the boxes in order.

Draws circles in the wrong row. Match the picture at the start of each row with the tally chart first.

ON ANIMAL MATH

PRINTABLE **Picture Graphs for 2nd Grade**: sheets 3-4

EXIT TICKET **2nd Grade Data and Graphs Exit Tickets**: Exit Ticket 9.3

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Lesson 9.4: Read bar graphs

GOAL Students read a bar graph with up to four bars by following the end of each bar to its number on the scale, and tell how many in each group, which has the most and the fewest, and which bar shows a number.

I can read a bar graph.

About 45 minutes

THE LESSON

1. **Warm up** (5 min) Lay cube trains of 3, 6, 8 and 10 side by side. Which has the most? How can you tell without counting?
2. **Teach** (10 min) Lay the trains on a grid, one cube a box, then show the same counts as a bar graph that goes across, with a scale from 0 to 10. Put a paper strip at the end of the 6 bar and follow it down to the scale: 6. Every bar starts at 0. Then read a graph that goes up the same way.

   > **Say:** "I find the end of the bar and follow it to the scale. That is how many."

3. **Try it together** (10 min) Partners read the class bar graph: one points to the end of a bar, the other reads its number. Then they ask each other which has the most, which the fewest and which bar shows a number. Include a bar that ends at 10.
4. **Practice** (15 min) Students answer the questions on sheets 1 and 2 of Bar Graph - Fruits to 10, where the bars go up, and of Horizontal Bar Graph to 10, where they go across.
5. **Exit ticket** (5 min) Students do **Exit Ticket 9.4** and circle a face beside the "I can" line. Apples 7, bananas 4, oranges 9, pears 2, and the banana bar shows 4. A 6 or an 8 for apples means the student read the line before or after the end of the bar.

Need help? Build each bar with cubes beside a paper scale from 0 to 10, then read the number at the last cube.

Ready for more? Read a bar graph with five bars and write two questions about it for a partner.

GET READY

- Cube trains of 3, 6, 8 and 10 in four colors
- A bar graph on chart paper with a scale from 0 to 10
- A paper strip for each student

WORDS TO USE

bar graph: a graph with bars that show how many

scale: the numbers along the graph, from 0 up

bar: a long box; a longer bar shows more

ASK

- How many in this bar? How do you know?
- Where does every bar start?
- Which bar shows 4?

WATCH FOR

Reads the next number up or down the scale. Lay a paper strip from the end of the bar to the scale.

Counts the boxes and gets one too many. Read the number at the end of the bar instead.

Reads a graph that goes up as if it goes across. Find the numbers first, then follow each bar to them.

ON ANIMAL MATH

- PRINTABLE **Bar Graph - Fruits to 10**: sheets 1-2
- PRINTABLE **Horizontal Bar Graph to 10**: sheets 1-2
- MAKER **Bar Graphs**: Activity Read the Graph, Number of Categories 4, Max Value on Axis 10
- QUIZ **Graphs and Data Quiz**: the Bar Graphs level
- EXIT TICKET **2nd Grade Data and Graphs Exit Tickets**: Exit Ticket 9.4

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Data and Graphs

Lesson 9.5: Make a bar graph

GOAL Students make a bar graph from a tally chart, a table or a picture: they color one box for each, starting at 0, so that each bar ends at its number on the scale, and give the graph a title and labels.

I can make a bar graph.

About 45 minutes

THE LESSON

1. **Warm up** (5 min) Show a table: soccer balls 6, basketballs 3, footballs 8, beach balls 5. Which will have the longest bar? The shortest?
2. **Teach** (10 min) Use the same table. Color the soccer ball bar one box at a time, counting until you reach 6, and check that it ends at 6 on the scale. Do the other three bars, then write the title, a label for each bar and a label for the scale: Number of Balls. Compare the graph with the table: the same numbers, now easy to compare.

   Say: "One box for each. Start at 0 and stop at the number."
3. **Try it together** (10 min) Pairs turn one of their survey charts from lesson 9.1 into a bar graph on grid paper, with a title and labels, then trade with another pair to check each bar against the chart.
4. **Practice** (15 min) Students color the bars from the tally chart on sheet 1 of Bar Graphs for 2nd Grade, count the fruit and draw the bars on sheet 2, and draw a graph that goes across, with its title and labels, on sheet 3. Early finishers do the survey on sheet 5.
5. **Exit ticket** (5 min) Students do **Exit Ticket 9.5** and circle a face beside the "I can" line. Cupcakes 6, doughnuts 9, ice cream 3, bananas 5, and the doughnut circled as the longest bar. Check that each bar starts at 0 and stops on its number.

Need help? Build each bar with cubes on the graph first, then color under the cubes.

Ready for more? Survey 10 classmates, then make the bar graph with a title, labels and three questions about it.

GET READY

- An empty bar graph on chart paper
- The tally charts saved from lesson 9.1
- Grid paper, crayons and rulers

WORDS TO USE

bar: a row of colored boxes, one box for each

title: the name at the top: what the graph is about

label: the name of each bar, and of each side of the graph

ASK

- How do you know where to stop coloring?
- Where does every bar start?
- What does your title tell a reader?

WATCH FOR

Colors one box too many or too few. Say the number first, then count the boxes out loud while coloring.

Starts a bar partway along, leaving empty boxes. Put a finger on the first box, next to 0, before coloring.

Leaves off the title or the labels. Ask a partner to read the graph without the table: what would they need?

ON ANIMAL MATH

PRINTABLE **Bar Graphs for 2nd Grade**: sheets 1-3 and 5

MAKER **Bar Graphs**: Activity Make the Graph, Number of Categories 4

EXIT TICKET **2nd Grade Data and Graphs Exit Tickets**: Exit Ticket 9.5

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Data and Graphs

Lesson 9.6: Put together, take apart, compare

GOAL Students answer put together, take apart and compare questions from a graph: how many of two kinds in all, how many are not one kind, and how many more one kind has than another, with a number sentence for each.

I can use a graph to find how many more and how many in all.

About 45 minutes

THE LESSON

1. **Warm up** (5 min) Stand cube trains of 9 and 5 side by side. How many cubes stick out? How many cubes are there in all?
2. **Teach** (10 min) Show a graph: dogs 8, cats 5, fish 2, birds 6. How many more dogs than cats? Match the rows: 5 match and 3 dogs are left, so 8 – 5 = 3. How many dogs and birds in all? 8 + 6 = 14. How many pets are not fish? Add all four, 21, then take away the 2 fish: 19. Or add the other three: 8 + 5 + 6 = 19.

   > **Say:** "Find the numbers on the graph first. Then decide: put together, take apart or compare."

3. **Try it together** (10 min) Pairs get a bar graph and question cards (how many more, how many fewer, in all, not one kind). They write a number sentence for each and say whether they put together, took apart or compared.
4. **Practice** (15 min) Students answer the more, fewer, in all and not questions on sheet 2 of Picture Graphs for 2nd Grade, then the questions on sheet 3 of Bar Graph - Fruits to 10. Early finishers go on to its sheets 4 and 5, or sheets 3 to 5 of Horizontal Bar Graph to 10.
5. **Exit ticket** (5 min) Students do **Exit Ticket 9.6** and circle a face beside the "I can" line. 3 more giraffes than lions, 11 lions and owls in all, and 14 animals that are not giraffes. A 13 for "more" means the student added.

Need help? Compare two cube trains within 10, cube to cube, before using a graph.

Ready for more? Write a two-step question about a graph for a partner to solve.

GET READY

- A picture graph and a bar graph on chart paper
- Cube trains in four colors
- Whiteboards and markers

WORDS TO USE

in all: the groups put together

how many more: the extras one group has

not: all the kinds but one

ASK

- Which numbers on the graph do you need?
- Are we putting together, taking apart or comparing?
- How can you check your answer?

WATCH FOR

Adds when asked how many more: 8 + 5. Match the two rows and count only the extras.

Answers "not fish" with the fish row. Cover the fish row with a hand and add everything left.

Reads the wrong row from the graph. Point to the row's label and say its name before reading its number.

ON ANIMAL MATH

- PRINTABLE **Picture Graphs for 2nd Grade**: sheet 2
- PRINTABLE **Bar Graph - Fruits to 10**: sheet 3, then 4-5 for early finishers
- PRINTABLE **Horizontal Bar Graph to 10**: sheets 3-5, for early finishers
- MAKER **Bar Graphs**: Activity Read the Graph, Number of Categories 4, Questions per Graph 5
- EXIT TICKET **2nd Grade Data and Graphs Exit Tickets**: Exit Ticket 9.6

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Lesson 9.7: Pictographs with a key

GOAL Students read and make a pictograph where each picture stands for 2: they read the key first, count the whole pictures by 2s and add 1 for a half picture, and answer how many more and how many in all.

I can read a pictograph with a key.

About 45 minutes

★ Taught in 2nd grade in some states

THE LESSON

1. **Warm up** (5 min) Count by 2s to 20. Then hold up 3 paper smiley faces: if each face is 2 children, how many children?
2. **Teach** (10 min) Show a pictograph of favorite fruit with the key: each face is 2 votes. Apples have 4 faces: 2, 4, 6, 8, so 8 votes. Grapes have 3 faces and a half: 2, 4, 6, and the half is 1 more, so 7. Then make a row together: 9 votes for pears is 4 faces and a half, because 2, 4, 6, 8 and 1 more is 9.

   > **Say:** "Read the key first. Each face is 2, and half a face is 1."
3. **Try it together** (10 min) Partners turn a table into a pictograph with a key of 2, drawing whole and half faces for 6, 9, 4 and 7 votes, then trade and read each other's graphs. Ask which rows need a half face, and why: only the odd numbers.
4. **Practice** (15 min) Students write how many and answer the questions on sheet 1 of Pictographs with a Key, then draw the cookies from the table on sheet 2. Early finishers read the keys of 5 and 10 on sheet 3.
5. **Exit ticket** (5 min) Students do **Exit Ticket 9.7** and circle a face beside the "I can" line. Dogs 9, cats 6, fish 3, birds 4, and 3 more dogs than cats. A student who writes 5 for dogs counted the faces, not by 2s.

Need help? Build each row with pairs of cubes, one pair for each face, before reading the faces.

Ready for more? Make the same pictograph with a key of 5 and tell which key needs fewer pictures.

GET READY

- A pictograph on chart paper with a key of 2
- Paper smiley faces, some whole and some cut in half
- Whiteboards and markers

WORDS TO USE

pictograph: a picture graph with a key

key: tells how many each picture stands for

half picture: half of a picture; with a key of 2 it stands for 1

ASK

- What does the key tell you?
- How many does half a face stand for? Why?
- Which rows need a half face?

WATCH FOR

Counts each face as 1. Read the key aloud first, then count by 2s, touching each face.

Counts a half face as 2, or skips it. A half face is half of 2. Count the whole faces by 2s, then add 1.

Draws a half face for an even number. Count by 2s to the number; if you land on it, no half is needed.

ON ANIMAL MATH

PRINTABLE **Pictographs with a Key**: sheets 1-2, then 3

EXIT TICKET **2nd Grade Data and Graphs Exit Tickets**: Exit Ticket 9.7

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Lesson 9.8: Bar graphs with a scale of 2, 5 or 10

GOAL Students read bar graphs whose scale counts by 2s, 5s or 10s: they count by the scale along the side, read a bar that ends halfway between two lines on a graph that counts by 2s or 10s, and answer how many more and in all.

I can read a bar graph that counts by 2s or 5s.

About 45 minutes

★ Taught in 2nd grade in some states

THE LESSON

1. **Warm up** (5 min) Count by 2s to 20, by 5s to 50 and by 10s to 100, pointing to a number line as you go.
2. **Teach** (10 min) Show a graph that counts by 2s: 0, 2, 4, 6 along the scale. A bar that ends on the 8 line is 8. A bar that ends halfway between 6 and 8 is 7, the number in the middle. Then show a graph that counts by 5s: a bar that ends on the line after 20 is 25. On a graph that counts by 10s, a bar halfway between 60 and 70 is 65, because half of 10 is 5. Read the scale first and count by it, never by 1s.

   Say: "Read the scale first. Each line counts by the same number."
3. **Try it together** (10 min) Partners read three graphs, one by 2s, one by 5s and one by 10s: one points to the end of a bar, the other counts by the scale to read it. Then they ask each other how many more one bar shows than another.
4. **Practice** (15 min) Students read the graph that counts by 2s on sheet 1 of Scaled Bar Graphs and the graph by 5s on sheet 2, then make a graph by 10s from a table on sheet 3. Early finishers draw the bars on the graph by 2s on sheet 4 of Bar Graphs for 2nd Grade.
5. **Exit ticket** (5 min) Students do **Exit Ticket 9.8** and circle a face beside the "I can" line. Soccer balls 13, basketballs 8, footballs 5, beach balls 16, and 35 cars on the graph by 5s. A 12 for soccer balls means the half box was missed; a 14 means it was counted as a whole box.

Need help? Make a scale by 2s on a number line first, writing the odd numbers in the gaps.

Ready for more? Pick the best scale for a set of numbers, as on sheet 5 of Scaled Bar Graphs, and make the graph.

GET READY

- Bar graphs on chart paper with scales of 2, 5 and 10
- A paper strip for each student
- Whiteboards and markers

WORDS TO USE

scale: the numbers along the graph

count by: what each line adds: 2, 5 or 10

halfway: in the middle of two lines: 7 is halfway between 6 and 8, and 65 between 60 and 70

ASK

- What does each line count by? How do you know?
- What number is halfway between 6 and 8?
- How would this bar look on a graph that counts by 1s?

WATCH FOR

Counts the lines by 1s on a scaled graph. Point to the scale numbers and count by them, touching each line.

Reads a bar that ends halfway as the line before it. Ask what number is in the middle of the two lines.

Reads a halfway bar on a graph by 10s as 1 more than the line. Halfway between 60 and 70 is 65: half of 10 is 5, not 1.

ON ANIMAL MATH

PRINTABLE **Scaled Bar Graphs**: sheets 1-3, then 5

PRINTABLE **Bar Graphs for 2nd Grade**: sheet 4

EXIT TICKET **2nd Grade Data and Graphs Exit Tickets**: Exit Ticket 9.8

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