

MATH UNIT

Making a graph somebody else can read

Grade 2

7 lessons

7 × 30 minutes

3 source books

210 minutes in all

THE QUESTION THIS UNIT FOLLOWS

What does this graph let you say?

ABOUT THIS UNIT

Grade 2 children can colour squares long before they can build a graph. The difference is stated in three places: the labels, the unit, and the key. This unit makes children state all three before anything is coloured, and then breaks each one on purpose so they can see what is lost.

It runs two representations side by side — the two-circle diagram, where a card answers two questions and some cards answer no to both, and the bar graph, where a numbered side and a stated key turn height into an amount. It closes on the question a graph cannot escape: a graph answers the question its survey asked, and no other.

THE MATHEMATICAL ARC

Each lesson does one job the lesson before it made possible.

- 1 Sort by an attribute you choose, and label it for a stranger
- 2 Two attributes at once: four places a card can go
- 3 Four counts that have to rebuild the whole set
- 4 Height stands for number only when the pieces match
- 5 A numbered side and a stated key
- 6 Change the key and rebuild: what a square is worth decides the picture

7 A graph answers the question its survey asked

SOURCE BOOKS

Every lesson in this unit is already published under Math lessons. Nothing here asks you to teach anything you cannot open today.



The Great Graph Contest

2 lessons in this unit



Fishy Mystery

2 lessons in this unit



Fair is Fair!

3 lessons in this unit

HOW TO USE THIS GUIDE

Open the source lesson before you teach.

Each day names one lesson that already exists under Math lessons, with its book, its number and its title. This guide says what that lesson is doing in the sequence and what to collect from it; the lesson itself carries the steps, the printables and the answers.

Thirty minutes a day.

Five minutes to connect to yesterday, the twenty-minute source lesson, five minutes to close on something you can see. A day that runs long should lose the close, never the core.

Teach a lesson on its own if you need to.

Every day carries a one-sentence opening for a teacher who is using that lesson outside the sequence.

Stop after a checkpoint.

The unit holds together if you stop after either checkpoint and come back to it. Stopping between a checkpoint and the next one leaves a lesson without the evidence it was built on.

WHERE THIS FITS IN YOUR YEAR

When to teach it

Any term after the class counts reliably to twenty-five and can add three or four small numbers. It runs well immediately before a science investigation.

What students need first

Children can sort by an attribute, count to twenty-five, and add four one-digit numbers.

What this unit develops

Labelling a category; sorting by two attributes with both and neither; accounting for a whole set across regions; a fair unit; a numbered scale and a stated key; matching a graph to the question its survey asked.

What it prepares them for

Scaled graphs in Grade 3, where one symbol stands for more than one thing, and any later work where a claim rests on a picture.

CURRICULUM CONNECTIONS

None claimed. The lessons in this unit carry their own standards classifications on their own pages, checked lesson by lesson. A unit-level expectation is a different claim, and none has been verified for this unit, so none is printed here. Use the placement guide above to site the unit in your year, and the individual lesson pages for the codes.

UNIT AT A GLANCE

#	MATHEMATICAL MOVE	SOURCE LESSON	COLLECT
1	Sort by an attribute you choose, and label it so a stranger can read it without asking	The Great Graph Contest lesson 1, Two Squares and the Words That Say What They Are	Two labelled squares holding every button, with a title card a stranger can read.
2	Two attributes at once: every card answers two questions, and some answer no twice	Fishy Mystery lesson 1, Label First, Then Let the Cards Move	A completed mat with all twelve cards placed, checked region by region against the rule cards.
3	Four regions, four counts, and a total that has to rebuild the whole set <i>Checkpoint after this lesson</i>	Fishy Mystery lesson 5, Four Numbers That Have To Add Back Up	A four-box recording strip with a total that matches the deck.
4	Height stands for number only when the pieces match	The Great Graph Contest lesson 3, The Taller Stack Only Wins If the Pieces Match	Three stacks on one base line with the tallest read by eye and then counted.
5	A numbered side and a stated key are what turn coloured squares into a graph	Fair is Fair! lesson 1, One Square, One Dollar: Building Marco's Graph the Way the Book Builds It	A grid with a numbered side, four named columns and one bar coloured to a stated key.
6	Change the key and rebuild: what a square is worth decides the picture <i>Checkpoint after this lesson</i>	Fair is Fair! lesson 4, What One Square Is Worth	Two grids of the same three amounts under two keys, with the awkward amount handled and explained.
7	A graph answers the question its survey asked, and no other	Fair is Fair! lesson 3, Two Surveys, Two Graphs: Which Question Did You Ask?	Two graphs matched to their questions and six can-or-cannot judgements, two of which are cannot.

UNIT VOCABULARY

Words students say, not words they are taught to define.

label	What is written on a square, a loop or a column so a stranger can read it.
both, neither	Lesson 2: two of the four places a card can go.
scale	The numbered side of a bar graph.
key	The sentence that says what one square is worth.

MATERIALS

From the source lessons

Each day's materials are listed on that day's page below and on the source lesson itself. Nothing is duplicated here.

New for this unit

- Checkpoint 1 page, one per child
- Checkpoint 2 page, one per child
- Performance task set: a clipboard and recording sheet, thirty same-sized paper squares, a column base card, four blank label cards, per pair
- Performance task page, one per child

ASSESSMENT PLAN

Daily evidence

Keep the labelled squares from lesson 1, the four-region recording strip from lesson 3, and both grids from lesson 6.

Checkpoint 1, after lesson 3: Account for all of them

A deck of twelve cards sorted into a two-circle diagram. The child counts each of the four regions, writes the four numbers, adds them, and checks the total against the deck.

Book-free. A plain shape deck, no book.

Look for. Four counts summing to twelve. A total that is not twelve sends the child hunting for the card counted twice, which is the point of the check.

Checkpoint 2, after lesson 6: What is one square worth?

A grid with a numbered side and three amounts to plot: four, six and nine. The child states the key aloud before colouring, plots all three, and then replots them under a key of two.

Book-free. Blank grid paper.

Look for. The key said before the first bar goes down, and the second grid showing bars half as tall. A child who colours the same heights twice has not applied the key.

Culminating task: Ask, record, build, and say what it shows

Each pair writes one question with three allowed answers, tests it on each other, then asks at least twelve people and marks one answer per person as it is given. They build the columns from the record with one same-sized square per mark, label every column, write the question across the top as the title, and check each column against the marks. They then show it to a pair who were not asked, who must say what most people said from the graph alone, and finally write one sentence naming something the graph cannot tell anyone.

Collect. The recording sheet, the finished labelled graph, and the written sentence about what the graph cannot answer.

What it assesses. Categories, a fair unit, labels and a title, and the limits of what a graph shows — everything the unit built, with the data collected by the children.

DAILY LESSON PAGES

Lesson 1 Sort by an attribute you choose, and label it so a stranger can read it without asking

SKILL LESSON **The Great Graph Contest** (/math-library/567.html) · lesson 1, Two Squares and the Words That Say What They Are · Grade 2 · 20 minutes
Sorting a collection into two groups by an attribute you choose, and labelling them

I CAN	I can sort my collection and label what I did.
BIG IDEA	A sort means nothing to anyone else until the two groups are named on the page.
SUCCESS	Another pair can say what the graph shows from the cards alone, without asking.
CONNECT 5 MIN	First lesson. Put a pile of buttons in the middle and ask two children to split it. Then ask a third child what the two piles mean.
TAUGHT ON ITS OWN	Gonk is handed a pile of rocks and nothing else, and the first thing he does is decide what to look at.
SOURCE CORE 20 MIN	Pairs turn a button pile over, choose one attribute that splits it in two, move every button onto one of two paper squares saying why for any that are hard, and write a label for each square and a title for the whole thing.
COLLECT	Two labelled squares holding every button, with a title card a stranger can read.
CLOSE 5 MIN	Pairs hand their graph to another pair, who say what it shows from the cards alone, then find the pair whose two squares look closest to the same and say what they would have to do to be sure.

From the source lesson: Mixed button collection, about twenty-four per pair; Two large paper squares per pair; Blank label cards, three per pair; Word cards: label, more, rough, smooth, square, title

Watch for: A rule that leaves some buttons out. Ask the partner to find a button that fits neither before the sorting starts.

Lesson 2

Two attributes at once: every card answers two questions, and some answer no twice

SKILL LESSON

Fishy Mystery (/math-library/381.html) · lesson 1, Label First, Then Let the Cards

Move · Grade 2 · 20 minutes

Sorting a set of shapes into a two-circle diagram by two attributes

I CAN	I can sort by two things at once.
BIG IDEA	Once the labels are written, a card's own two answers fix where it goes, and no card is placed by how it looks or where there is room.
SUCCESS	Every card is on the mat and every region survives the rule-card check.
CONNECT 5 MIN	Yesterday one attribute split the pile in two. Today two attributes are in force at the same time, and some cards will answer no to both.
TAUGHT ON ITS OWN	The back of the book hands over the whole procedure in four sentences and adds that some shapes will belong in neither circle.
SOURCE CORE 20 MIN	Pairs draw a rectangle with two overlapping circles, write both labels before any card moves, then turn over each of twelve cards and ask it both questions, sending two yeses to the middle and two noes inside the rectangle but outside both circles.
COLLECT	A completed mat with all twelve cards placed, checked region by region against the rule cards.
CLOSE 5 MIN	Pairs hold up each rule card in turn and sweep the region it names, sending any card that breaks its rule back to be asked the two questions aloud.

From the source lesson: Large sheet of paper, one per pair; Wide marker, one per pair; Two blank label strips per mat; Deck of twelve shape cards per pair: three blue squares, four blue circles, three red squares, two red triangles; Rule card set: blue but not square, square but not blue, blue and square, neither; Word cards: label, overlap, rectangle, set

Watch for: Cards parked outside the rectangle altogether. Everything sorted stays inside the rectangle; say so while the mat is being drawn.

Lesson 3**Four regions, four counts, and a total that has to rebuild the whole set****SKILL LESSON** **Fishy Mystery** (/math-library/381.html) · lesson 5, Four Numbers That Have To Add

Back Up · Grade 2 · 20 minutes

Counting the four regions and adding them back to the whole set

I CAN

I can check that nothing is missing.

BIG IDEA

The four region counts have to rebuild the set they came from, so a total that is wrong names an error rather than hiding it.

SUCCESS

The four numbers add to the size of the deck, and any pair whose total is wrong finds the card they double-counted.

CONNECT | 5 MIN

Yesterday every card went somewhere. Today you prove it by counting the regions and adding them back up.

TAUGHT ON ITS OWN

A finished diagram carries four numbers: the two crescents, the middle, and the ground outside both circles.

SOURCE CORE | 20 MIN

Pairs count each of the four regions with one touch per card and write each count in its box, add the four and write the total, then count the deck itself and compare.

COLLECT

A four-box recording strip with a total that matches the deck.

CLOSE | 5 MIN

Pairs swap to the second pair of labels, sort the same twelve cards again and fill a fresh strip, then check each other's addition.

From the source lesson: Large paper mat with a rectangle and two overlapping circles, one per pair; Deck of twelve shape cards per pair: three blue squares, four blue circles, three red squares, two red triangles; Recording strip with four region boxes and a total box; Second pair of label strips per mat; Word cards: add, count, region, total

Watch for: A pair adjusts a count to make the total come out. Send them to find the card, not to fix the number.

Checkpoint after this lesson: Account for all of them. The page is at the end of this guide.

Lesson 4 **Height stands for number only when the pieces match**

SKILL LESSON **The Great Graph Contest** (</math-library/567.html>) · lesson 3, The Taller Stack Only

Wins If the Pieces Match · Grade 2 · 20 minutes

Building a bar graph from real objects in three categories, with a fair unit

I CAN	I can build a graph with a fair unit.
BIG IDEA	Height stands for number only if the pieces are the same, and a taller stack can hold fewer things.
SUCCESS	The child catches the thick block and can say what rule would stop it.
CONNECT 5 MIN	You have counted your regions. Today the counts turn into height, and height can lie.
TAUGHT ON ITS OWN	Beezy stacks each kind of cookie separately so height stands in for number, and the book gives the condition that makes it honest.
SOURCE CORE 20 MIN	Pairs decide the three kinds in their tray, build one stack per kind straight up from a common base line with every counter in a stack, and read the tallest by looking across the tops before counting it.
COLLECT	Three stacks on one base line with the tallest read by eye and then counted.
CLOSE 5 MIN	Two thick blocks are added to the shortest stack. Pairs look across the tops again, count all three, and say whether the tallest stack really holds the most and what rule would stop it.

From the source lesson: Tray of flat counters in three colours, about thirty per pair; A flat board or tabletop with a marked base line; Two thick blocks the same footprint as the counters; Word cards: accurate, kind, most, stack, taller, thickness

Watch for: Stacks started from different levels. Mark one base line on the desk and check every stack against it before anything is read.

Lesson 5

A numbered side and a stated key are what turn coloured squares into a graph

SKILL LESSON Fair is Fair! (/math-library/380.html) · lesson 1, One Square, One Dollar: Building

Marco's Graph the Way the Book Builds It · Grade 2 · 20 minutes

Building a bar graph with a numbered scale and one square for one unit

I CAN	I can number the side and say what one square is worth.
BIG IDEA	A bar means an amount because a numbered side and a stated key make it mean one.
SUCCESS	The child says the key aloud with a finger on a single square before colouring anything.
CONNECT 5 MIN	Yesterday the stacks were real objects. Today the objects go away and squares on paper have to carry the count.
TAUGHT ON ITS OWN	The book stops the story to narrate how Marco makes his graph, and gives four moves in order.
SOURCE CORE 20 MIN	Pairs put the four move cards in the book's order, number a grid nought to ten up the left side, say the key aloud touching one square, name four columns, then colour Marco's three dollars counting each square as it fills.
COLLECT	A grid with a numbered side, four named columns and one bar coloured to a stated key.
CLOSE 5 MIN	Partners name an amount for another column each, colour it, then trade grids and read each other's bars by running a finger across to the numbered side.

From the source lesson: Grid paper, one sheet per pair, at least ten squares tall and five columns wide; Four move cards per pair, one sentence to a card; A pencil for each student; Crayons or coloured pencils in two colours; A number card set from 0 to 10 for each pair; Word cards: column, square, scale, stands for

Watch for: Colouring before the side is numbered. The four move cards are in order for a reason; do not let a step be skipped.

Lesson 6

Change the key and rebuild: what a square is worth decides the picture

MATH THROUGH THE READING **Fair is Fair!** ([/math-library/380.html](http://math-library/380.html)) · lesson 4, What One Square Is Worth · Grade 2 · 20 minutes

Students build the same allowance data under the book's key and under a swapped key, and say what a square is worth before either bar goes down.

I CAN	I can say what changes when the key changes.
BIG IDEA	Nothing about the numbers says how tall a bar should be; the key sentence does, and changing it changes the picture without changing the data.
SUCCESS	Two grids stand side by side, and a listening pair can say which key built which by looking at the bars alone.
CONNECT 5 MIN	Yesterday you said what one square was worth. Today you say it again with a different number in it and rebuild.
TAUGHT ON ITS OWN	This book says out loud the thing most graphs leave implicit: one square stood for each dollar.
SOURCE CORE 20 MIN	Pairs build the book's grid to a key of one dollar a square, then take the changed key sentence, say it aloud, and plot the same three amounts on a second grid, dealing with the amount that will not fill whole squares.
COLLECT	Two grids of the same three amounts under two keys, with the awkward amount handled and explained.
CLOSE 5 MIN	Pairs lay the two grids side by side and say one sentence naming something that changed and something that did not, using a number from each grid.

From the source lesson: Grid paper, two sheets per pair, at least ten squares tall and five columns wide; Crayons or coloured pencils in two colours; A number card set from 0 to 10 for each pair; A pencil for each student; The book's four building sentences, one to a strip, in the order the text gives them; Two key cards: one square stands for one dollar, and one square stands for two dollars

Watch for: The second grid copied from the first. Cover the first grid while the second is plotted.

Checkpoint after this lesson: What is one square worth?. The page is at the end of this guide.

Lesson 7**A graph answers the question its survey asked, and no other****SKILL LESSON****Fair is Fair!** (</math-library/380.html>) · lesson 3, Two Surveys, Two Graphs: Which

Question Did You Ask? · Grade 2 · 20 minutes

Choosing which survey question a graph can answer

I CAN

I can say which question a graph can answer.

BIG IDEA

A graph answers the question its survey asked and no other, so two graphs of the same children can disagree without either being wrong.

SUCCESS

The child finds the two pairings a graph cannot answer and gives a reason from the columns.

CONNECT | 5 MIN

You have changed the key and watched the picture move. Today the picture stays and the question changes.

TAUGHT ON ITS OWN

Marco makes two graphs of the same classmates, and because the questions differ his own column is the shortest on one and the tallest on the other.

SOURCE CORE | 20 MIN

Pairs write the two questions Marco asked, match each to a finished untitled graph and say what told them, then take three questions in turn and decide for each graph whether it can be answered, giving the reason from the columns.

COLLECT

Two graphs matched to their questions and six can-or-cannot judgements, two of which are cannot.

CLOSE | 5 MIN

Pairs say to each other what the second graph showed that the first could not, using a number from each, and listen for whether the partner's reason names a bar or only a feeling.

From the source lesson: Two blank question cards per pair; A pencil for each student; Two prepared bar graphs per pair, numbered and named but untitled; A card with the three questions, one per pair; A sentence frame card reading: The second graph showed ____, and the first graph could not show that because ____; Word cards: survey, cannot, title

Watch for: A child says a graph cannot answer a question because the answer is not obvious. Ask

which column would carry it, and whether that column exists.

CULMINATING PERFORMANCE TASK

Ask, record, build, and say what it shows

Each pair writes one question with three allowed answers, tests it on each other, then asks at least twelve people and marks one answer per person as it is given. They build the columns from the record with one same-sized square per mark, label every column, write the question across the top as the title, and check each column against the marks. They then show it to a pair who were not asked, who must say what most people said from the graph alone, and finally write one sentence naming something the graph cannot tell anyone.

Collect. The recording sheet, the finished labelled graph, and the written sentence about what the graph cannot answer.

What it assesses. Categories, a fair unit, labels and a title, and the limits of what a graph shows — everything the unit built, with the data collected by the children.

TEACHER KEY AND RUBRIC

Key

- Checkpoint 1: four counts totalling twelve. The individual counts depend on the deck; check them before the lesson.
- Checkpoint 2: bars of four, six and nine under a key of one; two, three and four-and-a-half under a key of two. The nine is the one that will not fill whole squares, and saying so is a correct answer.
- Task: no fixed answer. The graph is correct when every column's square count matches its marks and every column carries a label.

Rubric

STRAND	SECURE LOOKS LIKE	DEVELOPING	NOT YET
Representation	Every square is the same size, every column is labelled, and the graph has a title.	Does it with the arrangement in front of them.	Produces an answer without the arrangement or the reason.
Calculation	Each column's squares match its marks, and the marks match the number of people asked.	Does it with the arrangement in front of them.	Produces an answer without the arrangement or the reason.
Meaning	The child says what one square stands for before the graph is read.	Does it with the arrangement in front of them.	Produces an answer without the arrangement or the reason.
Explanation	The child names one question the graph answers and one it cannot.	Does it with the arrangement in front of them.	Produces an answer without the arrangement or the reason.

PRINT-READY STUDENT PAGES

CHECKPOINT 1 • GRADE 2

Account for all of them

Name

Date

Count each of the four regions on the mat and write the four numbers. Add them. Now count the deck. Do the two numbers agree? If not, find the card you counted twice.

CHECKPOINT 2 • GRADE 2

What is one square worth?

Name

Date

Say what one square is worth before you colour anything. Now plot four, six and nine. Then plot the same three amounts again on the second grid, where one square is worth two.

CULMINATING TASK • GRADE 2**Ask, record, build, and say what it shows**

Name _____

Date _____

Write one question with three answers people are allowed to give. Try it on your partner first. Ask at least twelve people and mark one answer per person as they say it. Build your columns from the record with one same-sized square per mark. Label every column and write your question across the top. Then show it to somebody who was not asked and see whether they can tell what most people said. Last, write one thing your graph cannot tell anyone.

TEACHER PLANNING AND HANDOFF

- Children who could not state a key before colouring in checkpoint 2 need lesson 5 again before Grade 3's scaled graphs.
- A category with a count of zero is not met in a lesson here; the checkpoint carries one, and it is worth an extra ten minutes if your class has not seen an empty bar.
- Running a real survey is the culminating task rather than a lesson, so leave a full session for it.

Known gaps in this unit

- A category with a count of zero is met only in the checkpoint, not in a lesson.

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