

Coordinates and Patterns

Unit 14 Overview: 9 lessons

Students learn the first quadrant of the coordinate plane: the x-axis, the y-axis, the origin and ordered pairs. They read and plot points, join points into shapes and find lengths along grid lines, and tell what a point means on a map or a graph. Then they make two number patterns from two rules, compare the terms that line up, and graph the pairs. Three lessons are taught in 5th grade in some states: input-output rules written with n , telling adding patterns from multiplying ones, and patterns with fractions and decimals. Say “across, then up” every day.

THE UNIT, DAY BY DAY

Day 1	Pre-Check	What students already know, before the first lesson.
Day 2	14.1 The coordinate plane	I can read the ordered pair of a point.
Day 3	14.2 Plot points	I can plot a point from its ordered pair.
Day 4	14.3 Join points; lengths on the grid	I can join points and find a length along a grid line.
Day 5	14.4 Points that tell a story	I can tell what a point on a map means.
Day 6	14.5 Two patterns from two rules	I can make two patterns and compare their terms.
Day 7	14.6 Graph the pairs of two patterns	I can graph the pairs of two patterns.
Day 8	14.7 Input-output tables ★	I can write the rule of a table as an expression.
Day 9	14.8 Add or multiply? ★	I can tell an adding pattern from a multiplying one.
Day 10	14.9 Patterns with fractions and decimals ★	I can extend patterns with fractions and decimals.
Day 11	Unit Review	The review, to go over together.
Day 12	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

- Coordinate grid paper (Coordinate Grid Paper, or the Graph Paper maker)
- Masking tape for a floor grid, and sticky dots
- Rulers and colored pencils
- Whiteboards and dry erase markers for tables
- Chart paper for anchor charts: an ordered pair, two patterns, find the rule

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



Coordinates and Patterns

Lesson 14.1: The coordinate plane

GOAL Students name the x-axis, the y-axis and the origin, and read the ordered pair of a point: how far across from the origin, then how far up.

About 45 minutes

I can read the ordered pair of a point.

THE LESSON

- 1 Warm up** (5 min) On the floor grid, a student starts at the corner, walks 7 squares across and 9 up. How could we write where the student is?
- 2 Teach** (10 min) Draw a grid from 0 to 10. The line across is the x-axis, the line going up is the y-axis, and they meet at the origin, (0, 0). Put point A 4 across and 4 up: (4, 4). Point B is 10 across and 8 up: (10, 8), not (8, 10), which is another point. Point C sits on the x-axis at 1: (1, 0). Every point on the x-axis has a y-coordinate of 0.
Say: "I start at the origin. The first number tells me how far across, the second how far up."
- 3 Try it together** (10 min) Partners take turns: one puts a sticky dot on a big grid and the other says its ordered pair, across first. Each puts one dot on an axis.
- 4 Practice** (15 min) Students name the origin and the axes and write the ordered pairs of points on sheet 1 of Graphing on the Coordinate Plane.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 14.1** and circle a face beside the "I can" line. On question 1, look for A (6, 1), B (1, 6) and C (0, 5); (1, 6) for A means the numbers were switched. On question 2, look for (3, 0); (0, 3) is on the y-axis.

Need help? Walk the floor grid: along the x-axis first, then up, saying each number aloud.

Ready for more? Name three points whose two numbers add up to 10. Plot them. What do you notice?

GET READY

- A floor grid of masking tape
- Coordinate grid paper
- Sticky dots

WORDS TO USE

origin: the point (0, 0), where the axes meet

x-axis: the number line going across

y-axis: the number line going up

ordered pair: two numbers in order: across, then up

ASK

- Where is the origin?
- Which number tells how far across?
- What is the same about every point on the x-axis?

WATCH FOR

Switches the numbers. Put a finger on the origin and say "across, then up" as you move it.

Counts squares, not lines, and is off by one. Points sit where lines cross: count the lines from 0.

Thinks a point on an axis has no ordered pair. It does: one of its numbers is 0.

ON ANIMAL MATH

PRINTABLE

Graphing on the Coordinate Plane: sheet 1

MAKER

Graph Paper: Paper Type Coordinate Grid: First Quadrant, Axis Range 0 to 10

QUIZ

Coordinate Plane Quiz: the Read Points level

EXIT TICKET

5th Grade Coordinate Plane and Patterns Exit Tickets: Exit Ticket 14.1

Coordinates and Patterns

Lesson 14.2: Plot points

GOAL Students plot and label a point from its ordered pair, going across the first number and then up the second, and say how far to go along each axis.

About 45 minutes

I can plot a point from its ordered pair.

THE LESSON

- 1 Warm up** (5 min) Call out an ordered pair. Students trace the path on a grid with a finger: across, then up.
- 2 Teach** (10 min) To plot P (7, 9), start at the origin, go 7 across, then 9 up, and draw a dot where the lines cross, its letter beside it. Q (10, 0) is 10 across and 0 up, so it sits on the x-axis. To say how far to go for (8, 10): 8 along the x-axis, then 10 along the y-axis. (10, 8) is a different point.
| Say: "Across first, then up. A 0 means I do not move that way."
- 3 Try it together** (10 min) Partners write three ordered pairs for each other, one of them on an axis, then plot and label them and check by reading the pairs back.
- 4 Practice** (15 min) Students plot and label points and say how far to go along each axis on sheet 2 of Graphing on the Coordinate Plane.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 14.2** and circle a face beside the "I can" line. On question 1, look for P at (5, 6), Q at (7, 4) and R at (0, 2), on the y-axis; R at (2, 0), on the x-axis, means the numbers were switched. On question 2, look for 9 right and 4 up; 4 right and 9 up is the same mistake.

Need help? Run one finger along the x-axis to the first number, then straight up to the second.

Ready for more? Plot four points that make a square with sides of 4 units, and write their ordered pairs.

GET READY

- Coordinate grid paper and rulers
- A big grid on the board
- Sticky dots

WORDS TO USE

plot: draw a dot where an ordered pair says

x-coordinate: the first number: how far across

y-coordinate: the second number: how far up

ASK

- Which way do you go first?
- Where does a point with a 0 land?
- How do you know your dot is on the right spot?

WATCH FOR

Goes up first. Say the rule aloud: across, then up, like walking to the stairs before climbing them.

Puts (0, 6) on the x-axis. Go 0 across: you stay on the y-axis, then go up 6.

Plots between grid lines. Points go where lines cross; follow the lines with a ruler.

ON ANIMAL MATH

PRINTABLE

Graphing on the Coordinate Plane: sheet 2

MAKER

Graph Paper: Paper Type Coordinate Grid: First Quadrant, Axis Range 0 to 10

QUIZ

Coordinate Plane Quiz: the Plot Points level

EXIT TICKET

5th Grade Coordinate Plane and Patterns Exit Tickets: Exit Ticket 14.2

Coordinates and Patterns

Lesson 14.3: Join points; lengths on the grid

GOAL Students plot points in order and join them to make a shape or a picture, and find the length of a side along a grid line by subtracting the coordinates that change.

About 45 minutes

I can join points and find a length along a grid line.

THE LESSON

- 1 **Warm up** (5 min) On a number line, how far is it from 3 to 10? From 12 back to 4? How do you know without counting?
- 2 **Teach** (10 min) On a grid to 12, plot A (6, 11), B (11, 11), C (11, 7) and D (6, 7) in order, join them, then join D back to A: a rectangle. A and B have the same y-coordinate, so AB runs along a grid line, and its length is $11 - 6 = 5$ units. B and C have the same x-coordinate: BC is $11 - 7 = 4$ units. Count the squares to check. A slanted line, like A to C, is not along a grid line.
Say: "When two points share a number, the side runs along a grid line. I subtract the numbers that change."
- 3 **Try it together** (10 min) Partners each write five ordered pairs that make a picture when joined in order. They trade, plot and join, then find the length of each side along a grid line.
- 4 **Practice** (15 min) Students plot and join the points of the mystery picture on sheet 3 of Graphing on the Coordinate Plane, then draw a picture of their own on Coordinate Grid Paper and list its points.
- 5 **Exit ticket** (5 min) Students do **Exit Ticket 14.3** and circle a face beside the "I can" line. On question 1, look for the triangle A (1, 7), B (1, 3), C (4, 3), joined back to A. On question 2, look for $AB = 4$ and $BC = 3$; 10 for AB means the numbers were added, not subtracted.

Need help? Highlight the number that changes between two points and count the squares between them with a finger.

Ready for more? Plot a rectangle with an area of 24 square units and one corner at (4, 4). Write the other corners.

GET READY

- A grid to 12 on the board
- Coordinate grid paper, rulers and colored pencils

WORDS TO USE

join: draw a straight line from one point to the next

unit: the length of one square's side

along a grid line: straight across or straight up, never on a slant

ASK

- Which number is the same for both points?
- How do you find the length from the numbers?
- How can you check by counting?

WATCH FOR

Adds the coordinates instead of subtracting. A length is a difference: count the squares from one point to the other.

Forgets to join the last point to the first. Read the last step: close the shape.

Finds a slanted side the same way. Only a side along a grid line has its length from one subtraction.

ON ANIMAL MATH

PRINTABLE

Graphing on the Coordinate Plane: sheet 3

PRINTABLE

Coordinate Grid Paper: First Quadrant and Four Quadrants: sheets 1-2

QUIZ

Coordinate Plane Quiz: the Shapes and Distance level

EXIT TICKET

5th Grade Coordinate Plane and Patterns Exit Tickets: Exit Ticket 14.3

Coordinates and Patterns

Lesson 14.4: Points that tell a story

GOAL Students use coordinates on a map and on a graph and say what each number of a point means in the story: blocks right and up, or hours and miles.

About 45 minutes

I can tell what a point on a map means.

THE LESSON

- 1 Warm up** (5 min) Show a map of the school with a grid on it. Ask: how would you tell a friend exactly where the gym is?
- 2 Teach** (10 min) On a map where each unit is 1 block, put the Bakery at (4, 4), the Garden at (7, 9) and the Fire Station at (10, 0). The Garden's 7 means 7 blocks right of the corner, and its 9 means 9 blocks up. Then graph a car trip of 50 miles each hour, hours across and miles up, the y-axis counting by 50s: (1, 50), (2, 100), (3, 150). The point (2, 100) means after 2 hours the car has gone 100 miles, and (0, 0) means it has not started.
Say: "Each number of a point means something in the story. The axis labels tell me what."
- 3 Try it together** (10 min) Partners draw a map of their own with four places on grid paper, then trade and answer: where is each place, what is at a given point, and how many blocks apart are two places on the same street?
- 4 Practice** (15 min) Students use a town map and a graph of a hike on sheet 5 of Graphing on the Coordinate Plane, then make a line graph from a table on sheet 2 of Line Graphs and say what one point means.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 14.4** and circle a face beside the "I can" line. On question 1, look for the Farm at (2, 1) and the Mall at (3, 3); (1, 2) means the numbers were switched. On question 2, look for 4 blocks up; 4 blocks right means the second number was read as across.

Ready for more? On the car graph, where will the point for 5 hours be? What will it mean?

GET READY

- A town map on a grid
- Coordinate grid paper
- Rulers and colored pencils

WORDS TO USE

coordinate: one number of an ordered pair

axis label: the words on an axis that say what its numbers mean

map: a picture of places seen from above

ASK

- What does the first number mean on this map? The second?
- What does the point (0, 0) mean in the story?
- How many blocks apart are two places on the same street?

WATCH FOR

Reads the second number as across. Point to the axis label for each number before saying what it means.

Counts blocks along a slant. Blocks run along the streets, the grid lines: count across, then up.

Need help? Label the axes in words (blocks right, blocks up, or hours and miles) before reading any point.

ON ANIMAL MATH

PRINTABLE

Graphing on the Coordinate Plane: sheet 5

PRINTABLE

Line Graphs: sheet 2

QUIZ

Coordinate Plane Quiz: the Maps and Graphs level

EXIT TICKET

5th Grade Coordinate Plane and Patterns Exit Tickets: Exit Ticket 14.4

Coordinates and Patterns

Lesson 14.5: Two patterns from two rules

GOAL Students make two number patterns from two rules that start at the same number, line them up in a table, and say how the terms in each column are related.

About 45 minutes

I can make two patterns and compare their terms.

THE LESSON

- 1 Warm up** (5 min) Count by 10s from 0, then by 100s from 0, and write the two lists one above the other. What do you notice about each pair?
- 2 Teach** (10 min) Pattern A starts at 0 and adds 8: 0, 8, 16, 24, 32. Pattern B starts at 0 and adds 24: 0, 24, 48, 72, 96. Put them in a table, A above B, and look down each column: 8 and 24, 16 and 48. Each B term is 3 times its A term, because B adds 3 times as much each step. It is not “16 more”: the difference keeps growing, but 3 times works for every column.
Say: “I make each pattern from its own rule, then compare the terms in each column. The relationship has to work for every column.”
- 3 Try it together** (10 min) Partners make two patterns that start at 0, one adding 9 and one adding 45, fill in five terms of each, and write a sentence about the columns. Then each makes up a pair of rules for the other.
- 4 Practice** (15 min) Students make two patterns from two rules, fill in the table and say how the terms are related in problem 1 of sheet 4 of Graphing on the Coordinate Plane (its graph waits for the next lesson), then make up two rules and a table of their own.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 14.5** and circle a face beside the “I can” line. On question 1, look for 0, 4, 8, 12, 16 and 0, 44, 88, 132, 176. On question 2, look for 11 times; 40 means one column’s difference was written, not how many times.

Ready for more? Pattern A starts at 0 and adds 12. What rule for B makes every B term 4 times its A term? Check five columns.

GET READY

- Two-row tables to fill in
- Whiteboards and markers
- Connecting cubes

WORDS TO USE

term: one number in a pattern

rule: what to do to get the next term

column: the two terms that line up, one above the other

ASK

- What does each pattern add?
- How many times as big is the bottom term?
- Does it work for every column?

WATCH FOR

Compares terms along a row, not down a column. Point to one column at a time: the A term and the B term under it.

Says “16 more” from one column. Test another column: the difference changes, but the times stays.

Uses one rule for both patterns. Write each rule beside its row and use only that one.

Need help? Build the first terms with cube trains: each step, B adds a train 3 times as long as the one A adds.

ON ANIMAL MATH

PRINTABLE

Graphing on the Coordinate Plane: sheet 4

QUIZ

Coordinate Plane Quiz: the Two Patterns level

EXIT TICKET

5th Grade Coordinate Plane and Patterns Exit Tickets: Exit Ticket 14.5

Coordinates and Patterns

Lesson 14.6: Graph the pairs of two patterns

GOAL Students make ordered pairs from the terms of two patterns, graph them, see that the points line up, and use the rules to find the next pair.

About 45 minutes

I can graph the pairs of two patterns.

THE LESSON

- 1 Warm up** (5 min) Show a table of x 5, 6, 7 and y 3, 5, 7. Students write each column as an ordered pair.
- 2 Teach** (10 min) Make a table: x starts at 3 and adds 2; y starts at 2 and adds 3. The columns give the pairs (3, 2), (5, 5) and (7, 8). Plot them on a grid to 12: they line up. The rules give the next pair without the graph: x adds 2 to make 9 and y adds 3 to make 11, so (9, 11), on the same line. The line climbs 3 for every 2 across, because y adds 3 while x adds 2.
Say: "Each column of the table is one ordered pair, x first. The rules tell me the next pair."
- 3 Try it together** (10 min) Partners make a table where x starts at 2 and adds 3 and y starts at 12 and subtracts 1, graph the pairs, find the next pair from the rules and check that it lands on the line.
- 4 Practice** (15 min) Students graph the pairs of problem 1 on sheet 4 of Graphing on the Coordinate Plane, then make a table from two rules of their own and graph it on sheet 2 of Coordinate Grid Paper.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 14.6** and circle a face beside the "I can" line. On question 1, look for x 2, 4, 6 and y 0, 3, 6, graphed at (2, 0), (4, 3) and (6, 6); a dot at (0, 2) means y was plotted first. On question 2, look for (8, 9); (8, 8) means y was given the x rule.

Need help? Shade the x row and the x -axis in one color, and the y row and the y -axis in another.

Ready for more? Make two rules whose points line up going down as they go right. What must be true about the rules?

GET READY

- Tables of x and y to fill in
- Coordinate grid paper to 12 or 20
- Rulers and colored pencils

WORDS TO USE

ordered pair: an x and a y from the same column, written (x , y)

graph: plot the pairs on a grid

next pair: the pair the rules make after the last one

ASK

- Which row gives the first number of each pair?
- What do the points do on the graph?
- How do the rules give the next pair?

WATCH FOR

Plots y first. Write each column as (x , y) before plotting, and say "across, then up".

Gives both rows the same rule. Write each rule beside its row and check every step.

Guesses the next pair from the graph. Use the rules: add to each number of the last pair.

ON ANIMAL MATH

PRINTABLE

Graphing on the Coordinate Plane: sheet 4

PRINTABLE

Coordinate Grid Paper: First Quadrant and Four Quadrants: sheet 2

QUIZ

Coordinate Plane Quiz: the Two Patterns level

EXIT TICKET

5th Grade Coordinate Plane and Patterns Exit Tickets: Exit Ticket 14.6

Coordinates and Patterns

Lesson 14.7: Input-output tables

GOAL Students find the rule of an input-output table, test it on every pair, write it as an expression with n ($n + 12$, $n \times 10$), and use it to fill in missing outputs and inputs.
I can write the rule of a table as an expression.

About 45 minutes
 ★ Taught in 5th grade in some states

THE LESSON

- 1 Warm up** (5 min) Guess my rule: students call out inputs and the teacher says each output (the secret rule multiplies by 10). After four tries, students write the rule with n .
- 2 Teach** (10 min) Show a table: in 2, 5, 8, 11 and out 14, 17, 20, 23. Each output is 12 more than its input: the rule is $n + 12$. Test it on every pair. Then in 3, 4, 6, 9 and out 30, 40, 60, 90: $n \times 10$. A table can fool you: in 2, out 6 fits $n + 4$ and $n \times 3$, so test every pair. To find a missing input, undo the rule: for $n \times 10$, an output of 70 comes from 7.
Say: "A rule must work for every pair. I write it with n , test it, and undo it to find an input."
- 3 Try it together** (10 min) Pairs make a table of five pairs with a secret rule of one operation, leave one output and one input blank, and trade. The partner finds the rule, writes it with n and fills in the blanks.
- 4 Practice** (15 min) Students find rules and write them with n , and solve the story with a table, on sheet 5 of Variables and Equations. For a step back, they find rules and fill in missing numbers on sheets 3-4 of Input and Output Tables.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 14.7** and circle a face beside the "I can" line. On question 1, look for $n \times 9$ ($9 \times n$ is right too) and 90 for the missing output; $n + 24$ means only the first pair was tested. On question 2, look for $n - 14$; $n + 14$ means the rule was read from output to input.

Ready for more? Find the rule for in 1, 2, 3, 4 and out 5, 8, 11, 14. It takes two steps: write it with n .

GET READY

- Input-output table cards
- Whiteboards and markers
- A function machine drawn on the board

WORDS TO USE

input: the number that goes in, n

output: the number that comes out

expression: the rule written with n , like $n + 12$

ASK

- Does your rule work for every pair?
- Could another rule fit the first pair?
- How do you find a missing input?

WATCH FOR

Uses a rule that fits only the first pair. Test the rule on every pair before writing it.

Writes $11 - n$ for a rule that takes 11 away. Read it as "the input take away 11": n comes first.

Uses the rule forward to find a missing input. For an input, undo the rule: multiplying becomes dividing.

Need help? Write the change from each input to its output under the table before naming the rule.

ON ANIMAL MATH

PRINTABLE

Variables and Equations: sheet 5

PRINTABLE

Input and Output Tables: sheets 3-4 (3rd and 4th grade), a step back

QUIZ

Coordinate Plane Quiz: the Two Patterns level

EXIT TICKET

5th Grade Coordinate Plane and Patterns Exit Tickets: Exit Ticket 14.7

Coordinates and Patterns

Lesson 14.8: Add or multiply?

GOAL Students tell an adding pattern from a multiplying one in a table and on a graph: when $y - x$ is the same for every pair the rule adds, and when $y \div x$ is the same it multiplies.
I can tell an adding pattern from a multiplying one.

About 45 minutes
 ★ Taught in 5th grade in some states

THE LESSON

- 1 Warm up** (5 min) Write $y = x + 6$ and $y = 6 \times x$. Ask: when x is 1, which gives more? When x is 5?
- 2 Teach** (10 min) Table A: x 2, 3, 5, 7 and y 8, 9, 11, 13. Find $y - x$ for each pair: 6 every time, so the rule adds: $y = x + 6$. Table B: x 2, 3, 5, 7 and y 12, 18, 30, 42. Now $y - x$ changes (10, 15, 25, 35), but $y \div x$ is always 6: $y = 6 \times x$. Reading down the y row does not tell you; look across from each x to its y . On a graph, multiplying points line up toward the origin, and adding points toward (0, 6) on the y -axis.
Say: "I look from each x to its own y . The same difference means add; the same number of times means multiply."
- 3 Try it together** (10 min) Partners sort table cards into adding and multiplying, write each rule, and graph one table of each kind on the same grid to compare the lines.
- 4 Practice** (15 min) Students tell adding rules from multiplying ones and write each rule on sheet 4 of Graphing on the Coordinate Plane (its last row) and in the middle of sheet 5 of Variables and Equations.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 14.8** and circle a face beside the "I can" line. On question 1, look for multiply and $y = 12 \times x$ ($x \times 12$ is right too); $y = x + 22$ means only the first pair was checked. On question 2, look for add and $y = x + 15$; a rule of add 3 means the y row was read down instead of across from each x .

Need help? Write $y - x$ and $y \div x$ under each column of the table, then circle the row that stays the same.

Ready for more? For which x do $y = x + 4$ and $y = 2 \times x$ give the same y ? Make a table for both to find out.

GET READY

- Table cards of both kinds
- Coordinate grid paper
- Whiteboards and markers

WORDS TO USE

adding pattern: each y is its x plus the same number

multiplying pattern: each y is its x times the same number

difference: what you get when you subtract, like $y - x$

ASK

- What is $y - x$ for each pair? Is it always the same?
- What is $y \div x$? Is it always the same?
- Where would the line of points meet the y -axis?

WATCH FOR

Reads down the y row and calls it adding. Look across from each x to its own y .

Checks only the first pair. A rule must work for every pair: test them all.

ON ANIMAL MATH

PRINTABLE

Graphing on the Coordinate Plane: sheet 4

PRINTABLE

Variables and Equations: sheet 5

EXIT TICKET

5th Grade Coordinate Plane and Patterns Exit Tickets: Exit Ticket 14.8

Coordinates and Patterns

Lesson 14.9: Patterns with fractions and decimals

GOAL Students extend patterns that add or subtract a decimal or a fraction, find the rule from the terms, and solve pattern stories with a table.

I can extend patterns with fractions and decimals.

About 45 minutes

★ Taught in 5th grade in some states

THE LESSON

- 1 Warm up** (5 min) Count by halves from 0 to 5 together, first as fractions ($\frac{1}{2}$, 1, $1\frac{1}{2}$) and then as decimals (0.5, 1, 1.5).
- 2 Teach** (10 min) Start at 1.2 and add 0.6: 1.2, 1.8, 2.4, 3. Line up the decimal points to add, and show the jumps on a number line in tenths. Then 3.5, 3.35, 3.2, 3.05: each term is 0.15 less, so the rule is subtract 0.15. With fractions, $\frac{3}{8}$, 1, $1\frac{5}{8}$, $2\frac{1}{4}$ adds $\frac{5}{8}$ each time: $\frac{3}{8} + \frac{5}{8} = \frac{8}{8} = 1$, and $\frac{13}{8} = 1\frac{5}{8}$. Test the rule on every pair of terms.
Say: "I find what changes from one term to the next, test it on every pair, then use it to keep going."
- 3 Try it together** (10 min) Solve a story as a class: a tree is 4 feet tall in year 1 and grows $1\frac{1}{2}$ feet each year. Make a table to year 5 (4, $5\frac{1}{2}$, 7, $8\frac{1}{2}$, 10) and find the year it passes 12 feet. Then pairs write a decimal pattern for each other.
- 4 Practice** (15 min) No Animal Math sheet has patterns with fractions or decimals, so start with whole numbers: students make and continue patterns on sheets 1-2 of Number Patterns for 4th Grade and solve its pattern stories on sheet 5, then rewrite two of its rules with a step of 0.7 or $\frac{3}{8}$ and continue them.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 14.9** and circle a face beside the "I can" line. On question 1, look for 3.5 and 3.25 and the rule subtract 0.25 (or subtract $\frac{1}{4}$); 3.35 means 3.5 was not written as 3.50 before subtracting. On question 2, look for $3\frac{1}{2}$ and $4\frac{1}{4}$ (or equal fractions); $2\frac{6}{8}$ means the denominators were added too.

Need help? Show each jump on a number line in tenths, or with fraction bars, before writing the next term.

Ready for more? Start at 5 and subtract 0.35 again and again. What is the first term below 3?

GET READY

- Number lines in tenths, or the Number Line tool
- Fraction bars or strips drawn on paper
- Whiteboards and markers

WORDS TO USE

term: one number in a pattern

rule: what to add or subtract to get the next term

mixed number: a whole number and a fraction, like $2\frac{1}{4}$

ASK

- What is added or taken away each time? Does it work for every pair?
- How do you line up the decimal points?
- Can you write that term as a mixed number?

WATCH FOR

Adds $1.8 + 0.6$ and writes 1.14. Line up the decimal points: tenths with tenths, so 2.4.

Adds the denominators: $\frac{3}{8} + \frac{5}{8} = \frac{8}{16}$. The size of the parts stays the same: $\frac{8}{8}$, or 1.

Finds the rule from the first two terms only. Test the rule on every pair.

ON ANIMAL MATH

PRINTABLE

Number Patterns for 4th Grade: sheets 1-2 and 5 (4th grade, whole numbers), a step back

TOOL

Number Line: Start 0, End 3, Interval 0.1, Mode Jump

EXIT TICKET

5th Grade Coordinate Plane and Patterns Exit Tickets: Exit Ticket 14.9

