Bike Shop Pricing with y = mx + b

Teacher		**Class**	Grade 8
Subject	Math	**Topic**	Functions and slope
Date		**Room**	
Lesson length	60 minutes	**Country**	United States

Students learn rate of change and starting value in linear functions. They invent a bike-repair price and model it with a table, graph, and equation.

Curriculum links

- Construct a function to model a linear relationship between two quantities [2]
- Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values [2]
- Interpret the rate of change and initial value of a linear function in terms of the situation it models [2]

Learning objectives

- Students will construct y = mx + b to model a linear relationship in context.
- Students will find rate m and starting value b from words, tables, or graphs.
- Students will explain what m and b mean for the situation, table, and graph.

Success criteria

- I can write y = mx + b from a story, table, or graph.
- I can find m from two points and b where x = 0.
- I can explain what m and b mean in real life and on graphs.

What students already know

Ask: A lemonade stand charges $2 per cup with no fee. If x = cups and y = dollars, what is y when x = 0, 1, 2? Listen for 0, 2, 4 and steady +$2 per cup.

Key words

function	a rule that gives exactly one output for each input [2]
rate of change	how much y grows when x goes up by one [1]
initial value	the y amount when x equals zero, shown at (0, b) [6]
slope	a number that tells steepness by rise over run [3]

Materials

- paper
- markers
- rulers
- graph paper
- printed copies of Worksheet Task B
- slides 1-12 with projector and whiteboard
- mini-whiteboards

Before the lesson

- Print Worksheet Task B for pairs and graph paper for posters
- Test Slides 1-12 and Video clip 3 (1:00-6:00) and Video clip 2 (1:00-6:00)
- Set out paper, markers, and rulers; make a half-filled table starter for $15 plus $10 per bike
- Draw example axes on board for modeling y = mx + b

Lesson outline

0–5 min **Starter** 5 min · Whole class

Activate steady-change thinking and launch the bike-shop challenge.

YOU DO

1. Show Slides 1-2 and read objectives in student words.
2. Say the hook and show Slide 4 mindmap of y = mx + b parts.
3. Show Slide 5 question about $8 to start plus $4 per hour and take quick answers.
4. Record 3-hour cost and ask what stays the same and what grows.

STUDENTS DO

1. Call out 3-hour cost and explain starting $8 and $4 per hour.
2. Tell a partner in one sentence what stays the same and what grows.
3. Preview success: we will build this kind of rule ourselves.

Say: You run a tiny business fixing bikes. How will you charge so a customer gets it in ten seconds? Think of the bike rental: $8 to start plus $4 per hour. After 3 hours, what do you pay, and what part stays the same?

Worked example: Bike rental: start b = $8 at 0 hours, rate m = $4 per hour. For 3 hours: y = 4x + 8, so y = 4*3 + 8 = 12 + 8 = $20. The $8 stays the same, the $4 per hour grows with hours.

Ask: After 3 hours at $8 plus $4 per hour, what do you pay? ($20, because 4x3 + 8 = 20.) · What stays the same and what grows? ($8 start stays the same; $4 for each extra hour grows.)

Check understanding: Mini-whiteboards up with 20. If many show 12, re-model 4*3 then add 8 before moving on.

Support: Show a 0-3 hour table with y filled for 0 and 1 so students add $4 each row. **Stretch:** Ask what you would pay for 10 hours and how you knew without listing all rows.

Use: Slides 1–2, 4–5

5–17 min **Teaching** 12 min · Whole class

Model how to build y = mx + b from words and two points.

YOU DO

1. Show Slide 3 chain: story shows steady change, m is change in y over change in x, b is y when x = 0.
2. Model the repair story: $15 to start plus $10 per hour with table, graph, and equation.
3. Play Video clip 3 (1:00-6:00) on Slide 6 and pause to label m as per and b at x = 0.
4. Graph the line and show it is a straight line whose slope is constant rate of change [1].

STUDENTS DO

1. Copy table for x = 0,1,2 with y = 15,25,35 and mark +10 per step.
2. Chime m = 10 and b = 15 and where each shows in equation and graph.
3. Sketch the line with teacher and label where it crosses the y-axis.

Say: Steady change means the same dollars per hour every time. We find rate m with change in y over change in x, and start b is what y is when x is 0. Then we write y = mx + b and check both on the table and graph.

Worked example: Story: $15 start plus $10 per hour. Let x = hours, y = dollars. Rate m = (25-15)/(1-0) = 10/1 = 10 dollars per hour, rise over run [3]. Start b = 15 at point (0, 15) [6]. Model: y = 10x + 15. Check: x=2 gives y = 10*2+15 = $35, and the graph is a straight line [2].

Ask: How do you find m from two points? (m = (y2-y1)/(x2-x1), rise over run [3].) · Where do you read b on a table and graph? (y when x = 0, at (0, b) where the line crosses the y-axis [6].)

Check understanding: Thumbs up for y = 10x + 15. If mixed with y = 15x + 10, circle per-hour vs to-start words and re-match.

Support: Underline per hour for m and circle to start for b, then match to 10 and 15. **Stretch:** Ask students to predict y for 6 hours and explain change as m times A, if x changes by A, y changes by m x A [1].

Use: Slides 3–6, Video clip 3 (1:00–6:00)

17–30 min **Guided practice** 13 min · Pairs

Practice finding m and b from graphs, tables, and stories together.

YOU DO

1. Show Slide 7 hill photo and link steepness as percent to rise over run.
2. Play Video clip 2 (1:00-6:00) on Slide 8 to link table steps to steepness and units like dollars per hour.
3. Hand out Worksheet Task B and do first equation and first two-point problem together.
4. Circulate as pairs finish tables and stories, stressing tabular and graphical views may be partial [1].

STUDENTS DO

1. Watch video and note how to track units with slope.
2. Work Task B in pairs: find m and b from equations, points, tables, and stories.
3. Compare answers and point to m and b on a quick sketch.

Say: Slope is steepness. On a graph we count rise over run between grid points. In a table we look for the steady step when x goes up by 1. Always keep units, like dollars per hour.

Worked example: Points (0,5) and (2,13): m = (13-5)/(2-0) = 8/2 = 4 [3]. So b = 5 at x = 0, model y = 4x + 5. Table check: 5, 9, 13 goes up by 4 each time, a constant rate of change [1].

Ask: From (0,5) and (2,13), what is m and how do you know? (m = 4, because (13-5)/(2-0) = 4.) · In y = 4x + 5, what do 4 and 5 mean in words? ($4 per unit and $5 to start, at x = 0.)

Check understanding: Cold-call pairs to show m and b for one table and one graph. If steps vary, re-subtract down the y-column to show constant change.

Support: Circle two clear grid points and label rise and run arrows before dividing [3]. **Stretch:** Give a table starting at x = 3 and ask pairs to step back to x = 0 for hidden b.

Use: Slides 7–8, Video clip 2 (1:00–6:00), Worksheet Task B

30–50 min **Main activity** 20 min · Pairs

Have pairs invent a bike pricing story and model it with table, graph, and equation.

YOU DO

1. Show Slide 9 task frame and set goal: clear price in ten seconds.
2. Give starter frame of $15 starting fee plus $10 per bike and half-filled table to finish.
3. Direct pairs to build x-y table for 0-4 bikes, graph the straight line [2], write y = mx + b, and label what m and b mean.
4. Host 3-minute poster share where pairs point to per-bike rate and fee on table and graph.

STUDENTS DO

1. Choose fee and per-bike rate and complete table for 0-4 bikes.
2. Graph points on graph paper, draw straight line, write y = mx + b with m and b labeled.
3. Post mini-poster and explain how to read m and b from table and y-axis.

Say: Pick your fee and your per-bike charge. Build the table, graph the points, and write the equation. Label what the slope means for the customer and what the starting fee means on the graph.

Worked example: Starter: b = $15 fee, m = $10 per bike, so y = 10x + 15. Table: (0,15), (1,25), (2,35), (3,45), (4,55). Graph crosses y-axis at (0,15) [6] and rises 10 for each run of 1 [3]. Meaning: $10 per bike, $15 even for zero bikes.

Ask: Where do we see your per-bike rate in table and graph? (Plus that amount each row; rise over run on the line [3].) · Where do we see your starting fee? (y when x = 0, where line crosses y-axis [6].)

Check understanding: Check posters for correct table step, straight line, and equation match. If mismatch, have pair test x=2 in equation vs table.

Support: Provide a starter frame of $15 starting fee plus $10 per bike and a half-filled table to finish [1]. **Stretch:** Add a second cheaper-per-bike but higher-fee option and explain which business is better for one bike and which is better for ten bikes.

Use: Slide 9

50–60 min **Plenary** 10 min · Whole class

Lock in meaning of m and b and check all can build the model.

YOU DO

1. Show Slide 10 statement and have class repeat: m tells speed, b tells start.
2. Run Slide 11 vote on what matters more for planning money and take two reasons.
3. Do Slide 12 quick quiz on whiteboards for (0,5) and (2,13) and y = 4x + 5.
4. Collect exit tickets and preview comparing two plans next time.

STUDENTS DO

1. Vote and justify rate, start, both, or depends in one sentence.
2. Solve quiz on boards: m = 4, b = 5.
3. Complete exit ticket with equation and meanings.

Say: Big idea: m tells how fast it changes, b tells where it starts. Vote and defend your pick. Then show me you can find m, find b, and say what they mean.

Ask: For planning money, which helps more, rate or start? (Depends: start matters short-term, rate matters over many hours; both matter [1].) · How are m and b seen differently on graph vs table? (Graph: steepness and y-cross; table: step per 1 and y at x=0 [2].)

Check understanding: Exit tickets: all three correct signals ready to move on; if b missed, extend line back to x=0 tomorrow.

Support: Let students write m formula and b = y at x=0 on ticket as aids. **Stretch:** Ask which plan wins for 1 hour vs 10 hours if y = 4x + 5 vs y = 2x + 12.

Use: Slides 10–12

Common mistakes

Mistake	How to spot it	How to fix it
Swapping m and b, using starting fee as rate	Equation like y = 15x + 10 for $15 start plus $10 per hour	Underline per for m and circle to start for b, then check y at x = 0 is b at (0, b) [6]
Finding slope upside down as run over rise	m = (x2-x1)/(y2-y1) or counting across then up incorrectly	Keep order y2-y1 over x2-x1 with same point order, rise over run [3]
Reading b straight from a table that does not start at 0	Calling y at x = 3 the starting value	Step back by m for each x to 0 and extend line to y-axis; tables can be partial views [1]

Support

- Provide a starter frame of $15 starting fee plus $10 per bike and a half-filled table to finish [1].
- Pre-circle two grid points and pre-label rise/run arrows for slope steps [3].
- Offer word bank: per, to start, when x = 0, dollars per hour.

Stretch

- Add a second cheaper-per-bike but higher-fee option and explain which business is better for one bike and which is better for ten bikes.
- Ask after how many bikes the other option pays more and how to see it on a graph.
- Challenge with negative rate tank story and fractional slope 3/2 steps.

For the LSE or teaching assistant

Sit with target pairs in guided and main tasks; prompt subtract down y-column for m, point to (0,b), and scribe meanings if writing is slow.

Check for understanding

Question	Answer
Points (0,5) and (2,13). What is m? Show work.	m = (13-5)/(2-0) = 4
For y = 4x + 5, what is b and what does it mean?	b = 5, dollars when x = 0 hours/bikes, at (0,5)

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Bike fix y = 10x + 15. What do 10 and 15 mean for customer and graph?	10 = $10 per bike, steepness; 15 = $15 fee at start, y-cross

Homework

Write y = mx + b for $12 fee plus $6 per lawn and explain m and b.

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