## Math Learning Goals
- Model linear relations with equations using the initial value and rate of change.
- Solve problems that arise from a realistic situation represented by two or more linear relations.
- Write equations representing linear relations from descriptions.

## Materials
- Scenario Cards
- Smart Response Units
- BLM 1.1, 1.2
- Notebook™

## Whole Class → Discussion
Pose the following Open Questions (Notebook™ pp. 2-4) BLM 1.1:
- An expression has the value of 20 when you substitute 5 for the variable. What could the equation be?
- Another algebraic expression is a lot like $3x + 2 - x$. What might it be?
- When you “translate” an algebraic expression into words, you use the words “double,” “three more,” and “less.” What might the expression be? (Notebook™ p. 4)

## Large Groups → Get to Know Your Equation
Distribute the Equation Cards and corresponding Situation Cards made from BLM 1.2
Students separate into two groups: Situation or Equation; one group on each side of the room. Students take 3 minutes to find their match.
When all students are matched with their appropriate partner, they identify the number in the brackets found on their Situation Card and solve their equation substituting that value for the independent variable.
Each group of students comes up to the IWB and matches their calculated answer. (Notebook™ p. 5)

## Group → Share
When all teams have matched their “cards” on the IWB, a member from each pair reads their situation aloud and explains why their matching equation is correct.
Choose one group to demonstrate how they solved the equation by substituting the given variable (the number in brackets) (Notebook™ p. 5).

Curriculum Expectation/Demonstration/Mental Note: Assess how students apply their understanding of linear relations to real world situations.

## Consolidate
### Individual → Write an Equation
Students write an equation using their expression in Question 3 and create a scenario (written explanation) for their equation. (Notebook™ p. 22) Share with the class.

### Home Activity or Further Classroom Consolidation
1.1: Turn Your Mind On... Activity 1

Name:

Date:

1. An expression has the value of 20 when you substitute 5 for the variable. What could the equation be?

2. Another algebraic expression is a lot like $3x + 2 - x$. What could it be?

3. When you “translate” an algebraic expression into words, you use the words “double,” “three more,” and “less.” What might the expression be?

4. Write an equation using the expression you created in Question 3. Then create a written scenario to model your equation.
### 1.2: Get to Know Your Equation (Teacher)

<table>
<thead>
<tr>
<th>Equation</th>
<th>Written Situation</th>
</tr>
</thead>
<tbody>
<tr>
<td>( C = 100 + 15P )</td>
<td>You are researching a location for a special event; the local Lions Hall charges $100 for the day and an additional $15 for each person who attends a special event. (#175)</td>
</tr>
<tr>
<td>( C = 150 + 1P )</td>
<td>You are a photographer who has just graduated and wants to set up your own business. For photo shoots, you have decided to charge $150 for a sitting fee plus an extra dollar for every photo the client wishes to purchase. (#30)</td>
</tr>
<tr>
<td>( C = 100 - 10P )</td>
<td>The general cost of non-member admission to a private club is $100, however, for every “member friend” you have in the club you receive a $10 discount. (You have 4 member friends)</td>
</tr>
<tr>
<td>( C = 150 + 85H )</td>
<td>You and a friend rent a boat to go deepwater fishing. It costs $150 to secure the boat and $85.00 for each hour you have it. (6.5 hours)</td>
</tr>
<tr>
<td>( C = 100 – 3(20 – P) )</td>
<td>You run a local minigolf that charges a flat rate of $100 per group of 20 people. For every person less than 20, the minigolf offers a discount on the group rate of $3.00 per person. (15 people in a group)</td>
</tr>
</tbody>
</table>
### 1.2: Get to Know Your Equation

<table>
<thead>
<tr>
<th>Equation</th>
<th>Written Situation</th>
</tr>
</thead>
<tbody>
<tr>
<td>$10.50 = 2P + 1.5A$</td>
<td>You go to an expensive market and spend $10.50 on fruit. Each pear costs $2.00 while the apples cost $1.50. (You buy 3 pears, how many apples did you buy?)</td>
</tr>
<tr>
<td>$2 = 0.05N + 0.02B$</td>
<td>A 2 kg bag contains nuts and bolts; each nut weighs 0.05 kg; the bolts weigh 0.02 kg. (If the bag has 20 nuts, how many bolts does it have?)</td>
</tr>
<tr>
<td>$F = 2M + 0.06$</td>
<td>Your friend is twice your height plus 6 cm. (Your friend is 1.6 m tall, how tall are you?)</td>
</tr>
<tr>
<td>$100 = 2P + P + J$</td>
<td>In a “grab bag” of mixed goodies you have jelly beans, mints, and chocolates. There are 100 pieces of candies in total. You have twice as many chocolates as sour mints. (If you have 30 jelly beans how many of the other candies do you have?)</td>
</tr>
<tr>
<td>$100 = 3P + J$</td>
<td></td>
</tr>
<tr>
<td>$H = D − 0.25D$</td>
<td>You let a ball drop. It bounces back up to 75% of its initial height. (If it bounced back up to 2.25 m, what was its initial height?)</td>
</tr>
<tr>
<td>$H = 0.75D$</td>
<td></td>
</tr>
<tr>
<td>$R = 3F$</td>
<td>Two friends agree to split their rent. Janice pays twice as much as Freeda. (If Freeda pays $200 per month, what is the total amount of rent the girls pay?)</td>
</tr>
</tbody>
</table>
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Minds On...

Individual → Problem Solving
Keep Your Mind Working! (BLM 1.3) is a printable handout for questions on Notebook™ p. 1. Possible teacher scaffolding questions:
- How many variables do you need?
- Where does the = sign go?
- What are the possible fees?
Relate the number values (i.e., 2, 5) to the fees.
Example student answers: Cost = 25; \( C = 20 + 0.25 m \); \( C = 0.50 m + 20 \)
Differentiate product based on learning preference: Students choose whichever question they want to answer. Encourage the skilled learner to try more than one question.

Whole Class → Lines and Slopes
Students explore each graph on Notebook™ p. 2, keeping a fixed \( y \)-intercept and changing the slope. They then compare the changes to the equation and to the line. They compare the changes to the graph and equation as they keep a fixed slope and change the \( y \)-intercept.
Use the parallel tasks (Notebook™ p. 3) asking students to graph lines with a rate of change of 2; a \( y \)-intercept of 4; a rate of change of 2 and \( y \)-intercept of 4. Ask if it is possible to draw more than one line for each task.
Students plot the graph for all cell phone plans, using BLM 1.3 or Notebook™ p. 3.
- Plan A: \( C = 40 \)
- Plan B: \( C = 20 + 0.25 m \)
- Plan C: \( C = 0.5 m \)
Volunteer draws an appropriate scale and axis on the grid paper. Three other students draw the three lines indicated by the three equations. Drag over the two possible answers.
Revisit Notebook™ p. 3 to decide as a class on the correct solution for each question. Use the graph of each function and indicate how the solution can be found graphically as well as algebraically.
Curriculum Expectation/Observations/Mental Note: Observe students’ ability to identify a variety of processes for determining and solving the equation of a linear relation.

Consolidate Debrief

Individual → Applying Learning
Students work at the three graphing questions, one case scenario (describe a cell phone plan and write the cost equation), and one comparison problem (Notebook™ p. 5).
Curriculum Expectations/Application/Checklist: Determine students’ ability to apply their learning to creating and solving problems.

Home Activity or Further Classroom Consolidation

Materials
- BLM 1.3-1.5
- Notebook™ 10
1.3: Keep Your Mind Working! Activity 2

Name:

Date:

1. A cell phone company has the digits 2 and 5 somewhere in its cost equation.
   a) Determine an equation that could model the cost for this company.

   b) What would your bill be if you used 50 minutes of talk time?

2. In one month you used 200 minutes of talk/text time and your bill was $50.00. Create a possible equation for the cell phone company.
### Activity 3

**Name:**

**Date:**

<table>
<thead>
<tr>
<th>Option 1</th>
<th>Option 2</th>
<th>Option 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graph a line with a rate of change of 2.</td>
<td>Graph a line with a $y$-intercept of 4.</td>
<td>Graph a line with a rate of change of 2 and a $y$-intercept of 4.</td>
</tr>
<tr>
<td><img src="image1.png" alt="Graph 1" /></td>
<td><img src="image2.png" alt="Graph 2" /></td>
<td><img src="image3.png" alt="Graph 3" /></td>
</tr>
<tr>
<td>Is it possible to draw more than one line that meets this criterion? Explain.</td>
<td>Is it possible to draw more than one line that meets this criterion? Explain.</td>
<td>Is it possible to draw more than one line that meets these criteria? Explain.</td>
</tr>
</tbody>
</table>
1.5: Graphing Challenge

Name:

Date:

1. Create an equation that models each situation and graph it.

<table>
<thead>
<tr>
<th>Plan X charges $19.95 per month plus 5 cents a minute or text message.</th>
<th>Plan Y is $89.50 a month with unlimited use.</th>
<th>Plan Z charges 7 cents per minute or text with no monthly fee.</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Graph" /></td>
<td><img src="image2.png" alt="Graph" /></td>
<td><img src="image3.png" alt="Graph" /></td>
</tr>
</tbody>
</table>

2. Create a new plan, for Mobile Service that for some amount of minutes has the same final cost as for Plan C \((C = 20 + 0.25 \text{ m})\) when used for 20 minutes in a month.

3. Compare your new plan to the plans above. If you had only $50 to spend, which of the 4 plans would allow you to talk/text the most?