

# Active Algebra: Strategies and Lessons for Successfully Teaching Linear Relationships

## A Lesson for Grades 7–10

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The lesson was adapted from the Math Solutions publications *Active Algebra: Strategies and Lessons for Successfully Teaching Linear Relationships*, Grades 7–10.

### Overview of Lesson

Lessons 1 through 4 focus on understanding the general formula for linear relationships,  $y = mx + b$ . In Lesson 1 students work with in-out tables and relate the table values to the formula  $y = mx + b$ . They see that  $b$  is the starting value ( $y$ -value when  $x$  is 0) and  $m$  is the rate of increase in  $y$  per unit of  $x$ .

### Skills

Working with  $y = mx + b$

Positive rates of change

### Mental Math Start-up

Figuring 5 percent, 10 percent, or 15 percent of a number

### Core Problems

1.1 Baby Madelyn's Weight

1.2 Arnold's Savings

1.3 Solving Equations

1.4 Realistic Equations

### Additional Problems

1.5 Baby Olivia's Weight

1.6 More Baby Data

1.7 More Equations



## Mental Math Start-up

### Figuring 5 Percent, 10 Percent, or 15 Percent of a Number

Note to the teacher: The mental math problems below are intended to be read aloud to students and need not be photocopied. Read each problem aloud twice, then allow students time to do the mental calculations and write down their answers. Then read the next problem. After all five problems have been read, put the problems up somewhere so students can see them, and give time for students to discuss the solutions. For more details, see Chapter 2, "Teaching Mental Math."

1. What is a 10% tip on a bill of \$30?
2. Find a 10% tip on a bill of \$65.
3. How much is a 5% service charge on \$120?
4. What is a 15% tip on a bill of \$80?
5. A 15% "late fee" is added on to a bill of \$70. How much is the late fee?

### Optional: More Mental Math

1. What is a 10% tip on a bill of \$5?
2. Find a 5% delivery charge for a pizza costing \$5.
3. Find a 15% "late fee" on a payment of \$5.
4. How much is a 20% tip on a bill of \$50?
5. At the Rich Rags store, employees get a 15% discount. How much is the discount on duds priced at \$80?

## Core Problems

### 1.1 Baby Madelyn's Weight

Little baby Madelyn weighed  $6\frac{1}{2}$  pounds at birth and gained  $\frac{1}{2}$  pound per week.

- a. Make an in-out table showing Madelyn's weight for each of her first 10 weeks.
- b. Find a formula that gives Madelyn's weight,  $y$ , in pounds as a function of her age,  $x$ , in weeks.
- c. If the trend continues, how many weeks until Madelyn weighs 20 pounds?

### 1.2 Arnold's Saving

Arnold wants to have \$90 to buy his Mom's birthday present. He puts the same amount of money into a jar each evening. The table shows how much money is in the jar each evening for the first week.

|                 |        |        |         |         |         |         |         |
|-----------------|--------|--------|---------|---------|---------|---------|---------|
| $x$ , Evening   | 0      | 1      | 2       | 3       | 4       | 5       | 6       |
| $y$ , \$ in Jar | \$9.00 | \$9.75 | \$10.50 | \$11.25 | \$12.00 | \$12.75 | \$13.50 |

- a. Find a formula that tells how much money,  $y$ , is in the jar on evening  $x$ .
- b. How much will Arnold have in his jar on evening 7? On evening 20? Discuss with a partner efficient ways to use a graphing calculator to get these answers. Be prepared to share at least one of your methods with the class.
- c. How many weeks until there is \$90 in the jar?

**Note:** To answer question c, you can find the value of  $x$  so that  $75x + 9 = 90$ .



### 1.3 Solving Equations

Example: Solve  $3x + 5 = 17$ .

Here is Arnold's logic:

| Arnold thinks...   | Arnold writes... |
|--|------------------|
| I'll copy the equation.  | $3x + 5 = 17$    |
| What number plus five gives seventeen? Twelve plus five is seventeen, so the $3x$ must equal 12. | $3x = 12$        |
| What number times three gives twelve? Three times four is twelve, so $x$ must be 4.              | $x = 4$          |

Solve the following equations. Keep track of your thinking by writing down your steps like Arnold did.

a.  $9x + 4 = 40$    b.  $7x - 11 = 10$    c.  $24 = 9 + 3x$    d.  $16x - 3 = 5$

### 1.4 Realistic Equations

Realistic equations—from banking, chemistry, architecture, statistics, and so forth—often involve decimals and/or fractions.

Solve  $7x + 2.6 = 11.7$ .

Here is Berea's thinking:

| Berea thinks...  | Berea writes...   |
|--|-------------------|
| I'll copy the equation.  | $7x + 2.6 = 11.7$ |
| What number plus two point six gives eleven point seven? The number must be two point six less than eleven point seven. I'll get a calculator. Input 11.7 then subtract 2.6 gives 9.1.                                   | $7x = 9.1$        |
| What number times seven gives nine point one? I'll use a calculator to divide 9.1 by 7. I get 1.3. Seems like a weird answer. I'll check it. Input $7(1.3) + 2.6$ and press ENTER. I get 11.7. Yes! I'm right, as usual! | $x = 1.3$         |

Solve the following equations. Keep track of your thinking by writing down your steps like Berea did.

a.  $524x + 87 = 349$    b.  $.75x + 9 = 90$    c.  $2.3 = 16x - 5.7$    d.  $.25x - 1.4 = 0.6$



## 1.5 Baby Olivia's Weight

Baby Olivia weighed 6 pounds at birth and gained  $\frac{2}{3}$  pound per week.

- Make an in-out table showing Olivia's weight for each of her first 10 weeks.
- Find a formula that gives Olivia's weight,  $y$ , in pounds as a function of her age,  $x$ , in weeks.
- How many weeks until Olivia weighs 20 pounds?

## 1.6 More Baby Data

Data for three more babies is shown in the next table. Assume the rate of weight gain per week stays constant. Copy the table and fill in the missing blanks for each baby.

| Age in weeks $x$ | 0 | 1 | 2 | 3 | 4  | 5 | 6 | 7 | 8  | 9 | 10 | Extra information                   |
|------------------|---|---|---|---|----|---|---|---|----|---|----|-------------------------------------|
| Kalusha          | 7 |   |   |   |    |   |   |   |    |   |    | Formula:<br>$y = \frac{1}{2}x + 7$  |
| Annie            |   |   |   |   | 10 |   |   |   |    |   |    | Gains $\frac{1}{3}$ lb.<br>per week |
| Imani            |   |   |   |   | 8  |   |   |   | 11 |   |    | NO other information                |

- Which baby weighs the most at 10 weeks?
- Which baby has the fastest rate of growth?
- How long will it take until all three babies weigh more than 20 pounds?

## 1.7 More Equations

Solve the following equations. Keep track of your thinking by writing down your steps.

- $12x - 28 = 68$
- $24x + 43 = 49$
- $4.6x + 42.3 = 57.02$
- $1169 = 2155x - 555$

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