

Practice Activities

Interpreting Rate of Change and Initial Value in Context

1. A cell phone plan charges a flat monthly fee of \$25 plus \$10 for each gigabyte of data used. Which equation correctly models the total monthly cost C for g gigabytes of data?
 - a) $C = 25g + 10$
 - b) $C = 10g - 25$
 - c) $C = 10g + 25$
 - d) $C = 25g - 10$
2. The equation $S = 15w + 40$ models the total savings S (in dollars) of a student after w weeks of saving. What does the number 40 represent in this situation?
 - a) The amount saved each week
 - b) The total saved after 40 weeks
 - c) The starting balance before any weekly savings
 - d) The number of weeks needed to reach the goal
3. A swimming pool contains 8,000 gallons of water. A drainage pump removes water at a constant rate of 400 gallons per hour. Write an equation for W , the gallons of water remaining after t hours. Then identify and interpret the rate of change and initial value using correct units.
4. The table below shows the total cost a customer pays at a car wash depending on how many premium add-ons they choose.

Add-ons Selected	Total Cost
0	\$8.00
1	\$11.00
2	\$14.00
3	\$17.00
4	\$20.00

- a) What is the rate of change? What does it mean in this situation?
 - b) What is the initial value? What does it represent?
 - c) Write an equation for the total cost C when a customer selects n add-ons.
5. Jordan is already 120 miles from his hometown when he starts driving toward a national park. He drives at a steady speed of 65 miles per hour.

Write an equation for d , Jordan's total distance from his hometown after t hours of driving. What does the initial value tell you about the situation?

6. The equation $C = 22m + 30$ models the total cost C (in dollars) of a gym membership after m months.

Decide whether each statement is true or false. Explain your reasoning for each.

- a) After 5 months, the total cost is \$140.
- b) The number 22 represents a one-time enrollment fee.
- c) If someone cancels after zero months, they still owe \$30.

7. Maya opens a savings account with \$200 and withdraws \$35 each week for personal expenses. Alex opens a different account with \$50 and deposits \$40 each week from his paycheck.

- a) Write an equation for Maya's account balance B after w weeks.
- b) Write an equation for Alex's account balance B after w weeks.
- c) What is the rate of change for each account, and what does the sign of each rate tell you about the situation?

8. A candle that is 9 inches tall burns at a rate of 1.5 inches per hour. Which statement correctly interprets the rate of change of this situation?

- a) The candle starts at 1.5 inches and shrinks by 9 inches each hour.
- b) The candle loses 1.5 inches of height for every hour it burns.
- c) The candle gains 9 inches for every 1.5 hours it burns.
- d) The candle will reach zero height after 1.5 hours.

9. A food truck sells tacos for \$3.50 each and charges a fixed \$2.00 service fee per order. Complete the equation below and fill in the interpretation for each term.

$$C = \underline{\hspace{2cm}} \cdot t + \underline{\hspace{2cm}}$$

“The means the truck charges per taco, and the means every order includes a fixed service fee, regardless of how many tacos are purchased.”

10. Darius wrote the following equation to model a situation where a plumber charges \$75 per hour and a one-time supply fee of \$50:

$$C = 50h + 75$$

Is Darius's equation correct? If not, identify the error and write the correct equation. Explain what each number in the correct equation represents.

11. The graph of a linear equation passes through the points (0, 15) and (3, 6).
- What is the initial value of this relationship? How do you know?
 - Calculate the rate of change. What does the sign tell you about how the output is behaving?
 - Write the equation in the form $y = mx + b$.
12. A school fundraiser sells custom T-shirts. The school paid a one-time design fee of \$45 and spends \$8 to produce each shirt. The school sells each shirt for \$15.
- Write an equation for the school's total production cost C after printing n shirts.
 - Write an equation for the school's total revenue R after selling n shirts.
 - How many shirts must the school sell to cover its total production cost exactly? Show your work.
13. Two summer jobs offer different pay structures. Job A pays \$12 per hour with no signing bonus. Job B pays \$8 per hour but includes a \$40 signing bonus on the first day.

	Job A	Job B
Pay per hour	\$12/hour	\$8/hour
Signing bonus	\$0	\$40

- Write an equation for total earnings E after h hours for each job.
- After how many hours will both jobs have paid the same total amount? Show all work.
- If someone plans to work 15 hours total, which job pays more? By how much?

- 14.** A scientist begins an experiment with a sample that has a mass of 5.2 grams. The sample gains mass at a constant rate of 0.3 grams per day due to a chemical reaction.
- a)** Write an equation for M , the total mass in grams after d days.
 - b)** What is the mass of the sample after 10 days?
 - c)** On which day will the sample first exceed 8 grams? Show how you found your answer.
- 15.** Read the situation below and answer all parts.
- "A parking garage charges a flat entry fee of \$3.00 plus \$1.50 for each 30-minute period a car is parked."*
- a)** Identify the input and output variables for this situation. Include units.
 - b)** Write an equation that models the total parking cost C for p thirty-minute periods.
 - c)** A driver paid \$10.50 total. How many 30-minute periods did they park? Show all steps.
 - d)** Explain why the initial value in this equation is meaningful even when a driver parks for zero additional periods.

Answer Key

1. c) $C = 10g + 25$

The \$10 per gigabyte is multiplied by the number of gigabytes (rate of change), and the \$25 flat monthly fee is the initial value added separately.

2. c) The starting balance before any weekly savings.

The 40 is added independently of w . When $w = 0$ (before any weeks of saving), $S = 40$. This represents the amount already in the account at the start.

3. Equation: $W = -400t + 8,000$

Rate of change: -400 gallons per hour. The negative sign indicates the water level is decreasing — the pump removes 400 gallons for every hour it operates.

Initial value: 8,000 gallons. This is the amount of water in the pool when the pump first turns on, before any draining occurs.

4. a) Rate of change: \$3 per add-on. Each additional premium add-on increases the total cost by \$3.

b) Initial value: \$8. This is the base price of the car wash before any add-ons are selected (when $n = 0$).

c) $C = 3n + 8$

5. Equation: $d = 65t + 120$

The initial value is 120 miles. It means Jordan was already 120 miles from his hometown when he started driving — his trip did not begin from home, so the starting distance is not zero.

6. a) True. $C = 22(5) + 30 = 110 + 30 = \140 . ✓

b) False. The 22 represents the monthly membership fee (\$22 per month). The \$30 is the one-time enrollment fee.

c) True. When $m = 0$, $C = 22(0) + 30 = \$30$. The enrollment fee is owed at sign-up regardless of months attended.

7. a) Maya: $B = -35w + 200$

b) Alex: $B = 40w + 50$

c) Maya's rate of change is $-\$35$ per week. The negative sign means her balance is decreasing — she is spending money each week. Alex's rate of change is $+\$40$ per week. The positive sign means his balance is growing — he is adding money each week.

8. b) The candle loses 1.5 inches of height for every hour it burns.

The rate of change is -1.5 inches per hour, meaning 1.5 inches are lost with each hour of burning.

9. $C = 3.50 \cdot t + 2.00$

The “3.50” means the truck charges \$3.50 per taco, and the “2.00” means every order includes a fixed \$2.00 service fee, regardless of how many tacos are purchased.

10. Darius's equation is incorrect. He switched the values of m and b .

The correct equation is: $C = 75h + 50$

The 75 is multiplied by h (hours) because it is the rate of change — \$75 per hour of work. The 50 is the initial value — the one-time supply fee charged regardless of how many hours are worked.

11. a) Initial value: 15. The point $(0, 15)$ shows the output when the input equals zero — this is the y -intercept by definition.

b) Rate of change: $m = (6 - 15) \div (3 - 0) = -9 \div 3 = -3$.
The negative sign means the output is decreasing — for every 1-unit increase in input, the output drops by 3.

c) $y = -3x + 15$

12. a) $C = 8n + 45$

b) $R = 15n$

c) Set production cost equal to revenue:

$$15n = 8n + 45$$

$$7n = 45$$

$$n = 45 \div 7 \approx 6.43$$

Since partial shirts cannot be sold, the school must sell **7 shirts** to cover its total production cost.

Check: Revenue = $15(7) = \$105$. Cost = $8(7) + 45 = 56 + 45 = \$101$.

✓ Revenue exceeds cost at 7 shirts.

13. a) Job A: $E = 12h$ | Job B: $E = 8h + 40$

b) Set equations equal:

$$12h = 8h + 40$$

$$4h = 40$$

$$h = 10 \text{ hours}$$

Both jobs pay the same total after **10 hours**.

c) Job A: $E = 12(15) = \$180$ | Job B: $E = 8(15) + 40 = 120 + 40 = \160

Job A pays more by $\$180 - \$160 = \$20$.

14. a) $M = 0.3d + 5.2$

b) $M = 0.3(10) + 5.2 = 3 + 5.2 = \mathbf{8.2 \text{ grams}}$

c) Solve $0.3d + 5.2 > 8$:

$$0.3d > 2.8$$

$$d > 9.33\dots$$

The sample will first exceed 8 grams on **Day 10** (since d must be a whole number and 9.33 rounds up to 10).

15. a) Input: number of 30-minute periods parked (p), measured in 30-minute intervals. Output: total parking cost (C), measured in dollars.

b) $C = 1.50p + 3.00$

c) $10.50 = 1.50p + 3.00 \rightarrow 7.50 = 1.50p \rightarrow p = \mathbf{5 \text{ thirty-minute periods}}$ (2.5 hours total).

d) Even if a driver parks for zero additional periods ($p = 0$), they still owe the \$3.00 entry fee just for entering the garage. The initial value captures this unavoidable starting cost that exists before any time-based charges apply.