Solving Equations Related to Linear Functions

7.2

FOCUSING QUESTION What does it mean to solve an equation related to a linear function?

LEARNING OUTCOMES

- I can write an equation that is related to a linear function in order to solve a real-world problem.
- I can apply mathematics to solve problems arising in everyday life, society, and the workplace.

ENGAGE

The Great Eastern Amusement Park charges \$12 admission and then sells ride tickets for \$0.50 each. Each ride costs 4 tickets. Write a function that represents $c(x)$, the total amount of money spent at the amusement park on admission and rides if a person rides x rides. Niha has \$30 to spend at the amusement park. How many rides can Niha ride?

c(x) = 12 + \$0.50(4x) OR c(x) = 12 + 2x
Niha can ride 9 rides.

EXPLORE

Naveem drives a car for a company that owns a ride-sharing app. The company charges a \$1.50 service fee for each ride, \$2.25 for the first mile, and \$0.35 for every $\frac{1}{5}$ mile after that.

1. If x represents the number of miles driven during one ride, write a function, $f(x)$, that relates the number of miles driven to the cost of the ride. Include any domain restrictions that are necessary from the real-world problem.
f(x) = 1.50 + 2.25 + 0.35(5(x – 1)) = 3.75 + 1.75(x – 1), {x | x ≥ 1}

2. Graph the function, $f(x)$.
See margin.

3. One of Naveem's recent rides had a total cost of \$30. Write an equation, related to the function $f(x)$, that you could solve to determine the number of miles Naveem drove this passenger.
30 = 3.75 + 1.75(x – 1)

TEKS

AR.6B Solve equations arising from questions asked about functions that model real-world applications, including linear and quadratic functions, tabularly, graphically, and symbolically.

MATHEMATICAL PROCESS SPOTLIGHT

AR.1A Apply mathematics to problems arising in everyday life, society, and the workplace.

ELPS

2D Monitor understanding of spoken language during classroom instruction and interactions and seek clarification as needed.

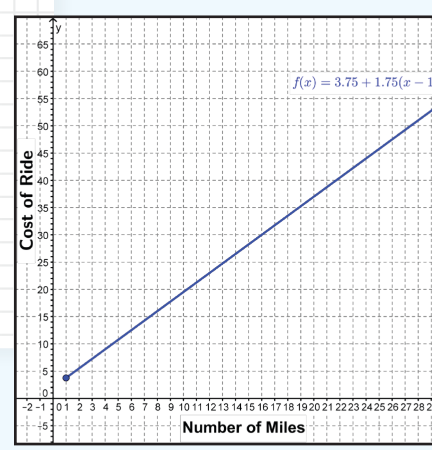
VOCABULARY

function, input value, output value, equation, domain, range, independent variable, dependent variable

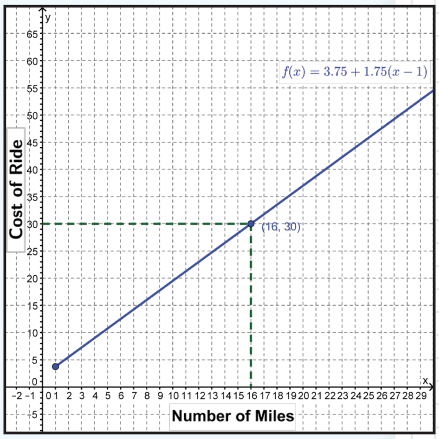
MATERIALS

- graphing technology

2.



4. *x = 16 miles*
Possible process: For this equation, f(x) = 30, so locate y = 30 along the y-axis. Read across this line until meeting the graph of f(x), then read down to the x-axis. The x-coordinate of this vertical line is the input value generating f(x) = 30.



INTEGRATING TECHNOLOGY

Use a graphing calculator to graph $Y1 = f(x)$.
To solve the equation using a graph, add the graph of $Y2 = n$, where n is the given output value (in question 3, $n = 30$). Then, calculate the coordinates of the intersection point of $Y1$ and $Y2$. The x-coordinate is the input value, or x-value, that generates the given output value, or y-value.

4. Solve this equation using your graph. Explain the process that you used to determine your solution.
See margin.

5. Create a table of values like the one shown or use a graphing calculator to generate a table of values. Use $f(x)$ to calculate the function values for the given input values.

NUMBER OF MILES, x	3	3.2	3.4	3.6	3.8	4	4.2	4.4	4.6	4.8	5
TOTAL COST, $f(x)$	*$7.25*	*$7.60*	*$7.95*	*$8.30*	*$8.65*	*$9.00*	*$9.35*	*$9.70*	*$10.05*	*$10.40*	*$10.75*

6. Naveem picked up another passenger, and the total cost was $9.70. Use $f(x)$ to write an equation that could be used to determine the number of miles Naveem drove this passenger.
9.70 = 3.75 + 1.75(x – 1)

7. Use your table to solve the equation. Explain the process that you used to determine your solution.
See margin.

8. Naveem picked up another passenger, Ms. Johnson. The total cost of her shared ride was $22.65. Use $f(x)$ to write an equation that could be used to determine the number of miles that Mrs. Johnson rode with Naveem.
22.65 = 3.75 + 1.75(x – 1)

9. Use inverse operations to solve this equation for x.
See margin.

10. **ELPS Connection** Answer the reflect questions on your own. Then work with a partner. Select one of the reflect questions to discuss with your partner. Your partner should explain his answer, and use relevant mathematics vocabulary to justify his thinking. Listen carefully as he does so. Then, ask clarifying questions such as the following to make sure that you understand what your partner is saying.
- Could you please tell me what you mean by…?
- How did you know that you could…?
- How is that related to the domain or range of the function?

REFLECT

- **If you have a function or can write a function from a real-world problem, what information do you need to know in order to write a related equation that you can solve?**
See margin.

7. *x = 4.4 miles*

NUMBER OF MILES, x	3	3.2	3.4	3.6	3.8	4	4.2	4.4	4.6	4.8	5
TOTAL COST, $f(x)$	$7.25	$7.60	$7.95	$8.30	$8.65	$9.00	$9.35	$9.70	$10.05	$10.40	$10.75

Possible process: Look at the function values in the row for Total Cost, f(x). When the function value is $9.70, then f(x) = 9.70. Read up the column to determine the x-value that is paired with this function value.
According to the table, f(4.4) = 9.70, so x = 4.4.

RELECT ANSWER:

You need to know one output value of the function. Then, you can write an equation that you can solve for the input value that generates that output value.

9.

$$22.65 = 3.75 + 1.75(x - 1)$$
$$22.65 - 3.75 = 3.75 - 3.75 + 1.75(x - 1)$$
$$18.9 = 1.75(x - 1)$$
$$\frac{18.9}{1.75} = \frac{1.75(x-1)}{1.75}$$
$$10.8 = x - 1$$
$$10.8 + 1 = x - 1 + 1$$
$$11.8 = x$$

Mrs. Johnson rode 11.8 miles with Naveem.

- **Functions have a domain and range. To which set of real numbers does an output value belong?**
  See margin.

- **You can solve an equation that is related to a function using a graph, table, or symbolic representation. How are the processes for solving an equation in each representation similar?**
  See margin.

EXPLAIN

Linear functions relate a set of input values (domain of the independent variable) to a set of output values (range of the dependent variable) using a relationship with a constant rate of change. Within the domain and range of a linear function, each input value generates only one output value so that the input value and its corresponding output value are paired numbers.

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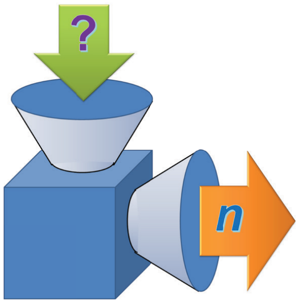
WRITING A RELATED EQUATION FROM A LINEAR FUNCTION

Functions relate values within the domain to certain values within the range. An equation, on the other hand, can be used to describe a specific case of the function where an output value is known, and you want to identify the input value that generates it. In this way, if you know an output value, you can write a related equation to any function, $f(x)$.



$$f(x) = n$$

If the output value is a real number, n, then you can write an equation, related to $f(x)$, as $f(x) = n$. Once you have the equation, you can solve the equation using a graph, table, or symbolic representation.

For example, a bicycle rental facility offers a 24-hour membership pass for $8 that includes unlimited rides 30 minutes or under. The second 30 minutes costs $1.50, and each additional minute costs $0.10. For rides that are longer than 60 minutes, if x represents the number of minutes of the ride, then $g(x)$ represents the total cost of the ride.

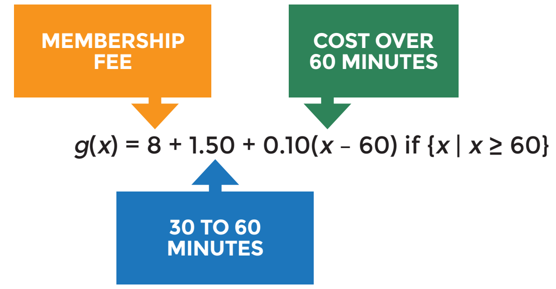
REFLECT ANSWERS:

An output value belongs to the range of a function.

Regardless of the representation (graph, table, or symbols), the given output value is matched to an input value using the linear functional relationship. In a table, the output value is located in the dependent variable (range) column or row and then matched with a corresponding input value. In a graph, the output (function) value is located along the vertical axis, a horizontal line is drawn to meet the graph of the function, and then a vertical line is drawn down to the horizontal axis to identify the corresponding input value. In a symbolic representation, inverse operations are used to solve the equation for the independent variable (input value).

SUPPORTING ENGLISH LANGUAGE LEARNERS

Students who are learning the English language need additional linguistic support. One way you can provide that support is by encouraging students to use a turn-and-talk strategy to practice speaking and listening the English language beyond reading and writing their answers to math questions. Students can use clarifying questions as needed to make sure they are understanding what the teacher or one of their peers is saying (**ELPS 2D**.)



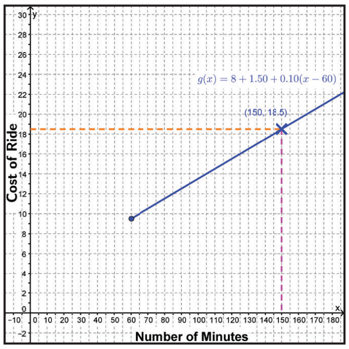
SOLVING LINEAR EQUATIONS GRAPHICALLY

With the bicycle company, suppose that Jeremy rented a bicycle for one day and paid $18.50. For how long did Jeremy rent the bicycle?

You can write a related equation and solve it graphically. $18.50 is the total cost of the rental, or the function value (output value) for $g(x)$. Use this function (output) value to write an equation related to $g(x)$.

$$18.50 = 8 + 1.50 + 0.10(x - 60)$$

Graph $g(x)$. Determine the point with a y-coordinate of 18.5 since the y-axis represents the function values. The ordered pair (150, 18.50) meets this requirement. Since $g(x)$ is a linear function, there is only one point with a y-coordinate of 18.5. The x-coordinate with this ordered pair is 150 which represents the solution to the equation $g(x) = 150$.



If Jeremy paid $18.50 for a bicycle rental, he used the bicycle for 150 minutes or 2.5 hours.

INTEGRATING TECHNOLOGY

You can use a graphing calculator or app to solve a linear equation graphically. Graph the function in $Y1$ and then graph $Y2 = n$, where n is the given output value or function value. Use the device or app's features to determine where the two graphs intersect. The x-coordinate of the point of intersection is the solution to the equation.

SOLVING LINEAR EQUATIONS TABULARLY

With the same bicycle company, Lin rented a bicycle for one day and paid $23.50. For how long did Lin rent the bicycle?

You can write a related equation, and solve it tabularly. $23.50 is the total cost of the rental, or the function value (output value) for $g(x)$. Use this function (output) value to write an equation related to $g(x)$.

$$23.50 = 8 + 1.50 + 0.10(x - 60)$$

Make a table of values for $g(x)$. Look in the column or row for the dependent variable for a value of $23.50. The time that is associated with $23.50 is the input value, or x-value, that generates the output value, or function value, of $23.50. In this case, a rental time of 200 minutes generates a rental cost of $23.50.

TIME (MIN.), x	COST (DOLLARS), $g(x)$
180	21.50
185	22
190	22.50
195	23
200	23.50
205	24
210	24.50

If Lin paid $23.50 for a bicycle rental, she used the bicycle for 200 minutes or 3 hours 20 minutes.

INTEGRATING TECHNOLOGY

You can use a graphing calculator or app to solve a linear equation tabularly. Enter the function into $Y1$ of the function editor. In the table feature, scroll up and down until you see the given output value or function value. If you do not see the exact function value, then change the x-interval to a smaller number (e.g., 0.1 instead of 1), and look again. The x-value associated with the function value is the solution to the equation.

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SOLVING LINEAR EQUATIONS SYMBOLICALLY

With the same bicycle company, Durron rented a bicycle and paid \$11.70. For how long did Durron rent the bicycle?

You can write a related equation and solve it symbolically. \$11.70 is the total cost of the rental, or the function value (output value) for $g(x)$. Use this function (output) value to write an equation related to $g(x)$.

$$11.70 = 8 + 1.50 + 0.10(x - 60)$$

Use inverse operations to solve the equation for x.

An equation has two **members**, one on each side of the equal sign. The left member of an equation is like the left side of the equation in that it is the expression on the left side of the equal sign. The right member of an equation is the expression on the right side of the equal sign.

$11.70 = 8 + 1.50 + 0.10(x - 60)$	WRITE THE APPROPRIATE EQUATION.
$11.70 = 9.50 + 0.10(x - 60)$	COMBINE LIKE TERMS.
$2.20 = 0.10(x - 60)$	SUBTRACT 9.50 FROM BOTH MEMBERS OF THE EQUATION (ADDITIVE INVERSE).
$22 = x - 60$	DIVIDE BOTH MEMBERS OF THE EQUATION BY 0.10 (MULTIPLICATIVE INVERSE)
$82 = x$	ADD 60 TO BOTH MEMBERS OF THE EQUATION (ADDITIVE INVERSE).

If Durron paid \$11.70 for a bicycle rental, he used the bicycle for 82 minutes or 1 hour 22 minutes.

SOLVING EQUATIONS RELATED TO LINEAR FUNCTIONS

A linear function shows the relationship between two sets of numbers: the domain of the independent variable and the range of the dependent variable. An equation that is related to a given function, $f(x)$, is one in which the value of the dependent variable is known and you need to determine the value of the independent variable that generates it.

- Graphically, locate the point on the graph of $f(x)$ that has a y-coordinate equal to the given function value. The x-coordinate of this point is the x-value paired with that function value. This x-value is the solution to the equation. For a linear function, there will only be one point for which this is true.
- Tabularly, locate the function value in the dependent variable column or row. The value in the independent variable column or row associated with this function value is the solution to the equation. For a linear function, there will only be one point for which this is true.
- Symbolically, substitute the given function value for the dependent variable in the symbolic representation of $f(x)$. Use inverse operations to solve the equation for the independent variable, x.

EXAMPLE 1

Isabel is saving money for a used car. So far she has $700 in her savings account. She plans to deposit $15 each week from her part-time job and her grandparents give her $50 on her birthday each year. The goal is to earn $3,000 by the time she graduates from high school. Will she be able to meet that goal in three years?

STEP 1 **Write a function that models Isabel's savings.**

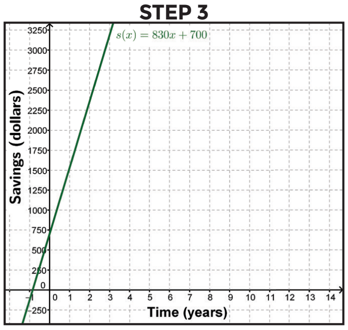
If x represents the number of years, then her savings will be the combination of the $700 she already has, her savings of $15 per week times 52 weeks per year, and an additional $50 per year from her grandparents. So $s(x) = 700 + 15(52)x + 50x$.

STEP 2 **Simplify the function $s(x) = 700 + 15(52)x + 50x$.**

$s(x) = 700 + 15(52)x + 50x$
$s(x) = 700 + 780x + 50x$
$s(x) = 700 + 830x$
$s(x) = 830x + 700$

STEP 3 **Using the function $s(x) = 830x + 700$, make a graph of Isabel's savings.**

STEP 3



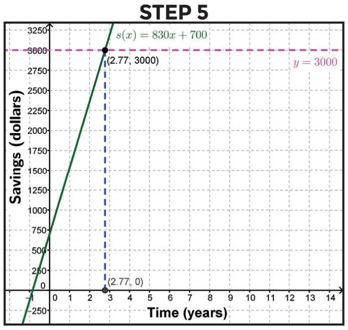
STEP 4 **Write an equation for the amount of savings, $3000, which Isabel has for a savings goal.**

$y = \$3000$

STEP 5 **Graph both equations on the same grid to determine when Isabel will have $3,000 in savings.**

The line of $y = 3000$ intersects the graph of the function $s(x) = 830x + 700$ at 2.77 years. Isabel will indeed meet her goal in slightly less than 3 years.

STEP 5



ADDITIONAL EXAMPLE

Ben is running a marathon. Marathons are 26.2 miles long. He runs each mile at an average time of eight minutes, twelve seconds. At this marathon, Ben's friends are coming to cheer for him. They are arriving at the marathon 2 hours after it starts. They will be waiting with signs and noisemakers to cheer for Ben as he runs by. Write a function to represent Ben's distance, and make a table of function values. Then write an equation with the output value of 2 hours. Graph both to determine how long after Ben starts running that he will see his cheering section.

The function, where x is the number of minutes Ben has run, is $f(x) = \frac{\left(8 + \frac{12}{60}\right)}{60}x = \frac{\left(\frac{41}{5}\right)}{60}x = \frac{41}{300}x$. *The equation for his friends' location is* $y = 2$. *The graphs intersect at (14.63, 2), meaning Ben will be a little more than halfway between his 14th and 15th mile when his friends arrive.*

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YOU TRY IT! #1

A flooded river is 14 feet above its normal level. The water is receding at a rate of 8 inches each day. When the river is within 3 feet of normal level, the residents in the area will be able to use the roads around it. Write a function to represent current levels, and make a table of function values. Then write an equation with the output value of 3 feet. Graph both to determine how many days it will take for the roads to be safe to use again.

See margin.

YOU TRY IT! #1 ANSWER:

The function, where x is the number of days, is $f(x) = 14 - (\frac{8}{12})x = 14 - \frac{2}{3}x$. The equation for the water to be 3 feet above the normal level is $y = 3$. The graphs intersect at the point (16.5, 3), meaning after 16 and a half days, the roads will be safe to use again.

EXAMPLE 2

Lia won $45,500 for her prize steer at the state fair. She is going to use the money to buy a used car for $3,700 and to go to a state university away from home. Her yearly expenses will be $4,800 for tuition and books and $5,800 for room and board. Lia estimates that she will spend another $3,000 for gasoline, insurance, and incidentals each year. Will her prize money last throughout the 4 years of college? Write a function, $f(x)$, to represent how much money Lia will have left after each year, x, and make a table of function values. Then write a related equation with the output value of zero to find out when she will be out of money and solve the problem tabularly

STEP 1 **Write a function to represent the money Lia will have left after each year of college.**

The function shows an amount of money, $45,500 less the one-time expenditure of $3,700 for a car. She has yearly expenditures of $4,800 for tuition and books, $5,800 for room and board, and $3,000 for personal expenses.

$f(x) = 45{,}500 - 3{,}700 - (4{,}800 + 5{,}800 + 3{,}000)x$
$f(x) = 41{,}800 - 13{,}600x$ (after buying the car and combining yearly expenditures.)

STEP 2 **Create a table with the values for the function.**

NUMBER OF YEARS, x	0	1	2	3	4
MONEY REMAINING, $f(x)$	$41,800	$28,200	$14,600	$1,000	-$12,600

STEP 3 **Write an equation for the amount of money Lia expects to have at the end of her 4th year.**

$y = 41{,}800 - 13{,}600x$

ADDITIONAL EXAMPLE

Jackie is driving to Austin, Texas. She starts at her home in Lewisville, Texas, 221 miles from Austin. Jackie drives 65 miles per hour on average. She stops for 40 minutes for lunch, and she takes two 15-minute rest stops along the way. Jackie's friend estimated that Austin is about 3 hours from Lewisville. Will Jackie make it there in 3 hours? Write a function, $f(x)$, to represent how far Jackie has left to drive to get to Austin after x hours, and use it and a table of values to determine how long it will take Jackie to drive to Austin.

The function, where x is the number of hours Jackie has driven, is $f(x) = 221 - 65x + 65\left(\frac{40 + 30}{60}\right) = 296.83 - 65x$. Using the table of values, Jackie will arrive in Austin 4.57 hours after she starts driving. She will be 101.83 miles from Austin after driving for 3 hours, so she will not make it from Lewisville to Austin in 3 hours

STEP 4 **Looking at the table, Lia will not have enough money left after her 3rd year of college. To verify when this will happen, solve the equation for the output value of 0.**

$$0 = 41{,}800 - 13{,}600x$$
$$0 - 41{,}800 = 41{,}800 - 41{,}800 - 13{,}600x$$
$$-41{,}800 = -13{,}600x$$
$$\frac{-41800}{-13600} = \frac{-13600x}{-13600}$$
$$x \approx 3.07 \text{ years}$$

Lia's prize money will run out a little after her 3rd year. She will not have enough money to fully pay expenses for four years of college.

YOU TRY IT! #2

All the items in a store that is going out of business are marked \$15. Write a function for the savings, q, on items with an original price of p. What item would give a savings of \$32 with the marked down price? Write a function representing savings based on the original price of items and make a table with the function values. Then write an equation for the savings of \$32 and solve it using the table.

See margin.

EXAMPLE 3

A science museum offers specially priced tickets for group tours. Each student admission is \$6.50. An adult sponsor is required for every ten students, and an adult admission is \$8.50. A \$25 booking fee is added to the cost. If there is a budget of \$500 for the tour, how many students will be able to go to the museum? Write a function, $t(x)$, representing the total cost for x students, and a related equation for the total cost of \$500. Solve the equation to determine the number of students who can go.

STEP 1 **Write a function representing the total cost for x students.**

$$t(x) = 6.50x + 8.50\left(\frac{x}{10}\right) + 25 = 6.50x + 0.85x + 25$$
$$t(x) = 7.35x + 25.$$

ADDITIONAL EXAMPLE

Ana created a budget for herself. Her car payment is \$250 a month, and her car insurance costs \$50 a month. On top of those bills, she pays \$45 every 2 weeks for her dance classes. Any money leftover from her paycheck, she can use for eating out, going to the movies, or any other fun activity she would like to do. She splits the leftover money among the weeks until her next paycheck. February 1st, Ana gets a paycheck for \$510. Her next paycheck will come on March 1st. After Ana pays her bills, how much money will she have to spend as she wishes each week? Write a function, $f(x)$, representing the money Ana has leftover to spend per week, x, each month. Solve the equation to determine how much money Ana has for discretionary spending in the month of February.

The function, where x is the number of weeks in the month, is $f(x) = 250 + 50 + 2(45) + 4x = 390 + 4x$. Solving the equation $510 = 390 + 4x$, Ana will have \$30 of leftover money to spend as she wishes each week in the month of February.

YOU TRY IT! #2 ANSWER:

The function is $q(p) = p - 15$. The table of values shows that a savings of \$32 occurs in an item priced between \$45 and \$55. The equation is $32 = p - 15$, and solving it results in $p = \$47$.

ORIGINAL PRICE, p	15	25	35	45	?	55
SAVINGS, $q(p)$	0	10	20	30	32	40

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STEP 2 Write an equation for the output value of $500.

$$y = 7.35x + 25$$
$$500 = 7.35x + 25$$
$$500 - 25 = 7.35x + 25 - 25$$
$$475 = 7.35x$$
$$\frac{475}{7.35} = \frac{7.35x}{7.35}$$
$$x \approx 64.6$$

STEP 3 Interpret the results of solving the equation.

Since x equals approximately 64.6 students, only 64 students can go on the tour since 65 students would put them over budget.

YOU TRY IT! #3

Maddie sells $12 T-shirts at sporting events. The T-shirt company pays her a base pay of $45 for each event plus a 15% commission on the sales revenue from the T-shirts that she sells. How many T-shirts would she have to sell at an event to triple her base pay? Write a function representing the total pay p for s T-shirts sold and a related equation for the total pay of 3 times $45, or $135. Solve the equation to determine the number of t-shirts she would have to sell.

See margin.

PRACTICE/HOMEWORK

Use the situation described below to answer questions 1 – 5.

FINANCE

Yvonne is saving money for college, and currently has $1200 in a savings account. She plans to deposit $30 each week from her part-time job and then deposit birthday money from her Aunt Marlene ($40 each birthday). Her goal is to have saved $6,000 by the time she graduates from high school in three years.

1. Write a function that models Yvonne's savings.
See margin.

2. Simplify your function.
See margin.

3. Use your function to create a graph of Yvonne's savings.
See margin.

YOU TRY IT! #3 ANSWER:

The function is
$p(s) = 45 + 0.15(12s) = 45 + 1.80s.$
The related equation is
$135 = 45 + 1.80s.$
Solving this equation, you find that Maddie needs to sell 50 t-shirts.

1. *If x represents the number of years, then her savings will be the combination of the $1200 she already has, her savings of $30 per week (times 52 weeks per year), and an additional $40 per year from her grandparents.*

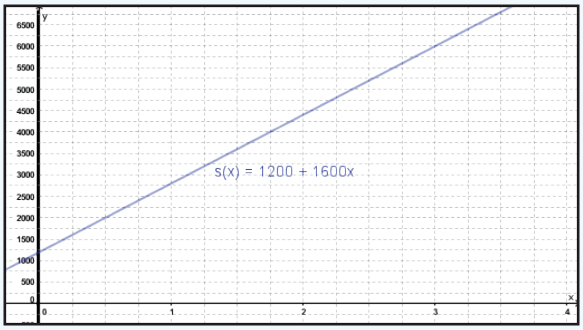
So the function $s(x) = 1200 + 30(52)x + 40x$ *models Yvonne's savings.*

2. $s(x) = 1200 + 30(52)x + 40x$

$s(x) = 1200 + 1560x + 40x$

$s(x) = 1200 + 1600x$

3.



4. Write an equation for Yvonne's savings goal, \$6000.
y = \$6000

5. Graph both equations on the same grid to determine when Yvonne will have her goal of \$6,000 in savings. Will she reach her goal in the desired 3 years? Explain.
See margin.

Use the situation described below to answer questions 6 – 8.

FINANCE

Tommy works at a jewelry store. He earns \$2100 a month and a yearly bonus of \$500. He also earns a 9% commission on the jewelry he sells.

6. Write a function that models Tommy's total earnings, $t(n)$, in a year he sells n dollars of jewelry.
t(n) = 2100(12) + 500 + 0.09n
t(n) = 25,700 + 0.09n

7. Write an equation with an output value of \$32,000.
y = 32,000

8. Graph both to determine the value of jewelry he must sell in order to earn \$32,000 in the year.
See margin.

Use the situation described below to answer questions 9 – 12.

FINANCE

Christa is attending a county fair that charges a \$12 entry fee. The entry fee includes 10 free rides, but any additional rides cost \$1.50 each.

9. Write a function that models Christa's county fair expenses, $c(r)$, when she rides r rides.
c(r) = 12 + 1.5(r – 10) when {r|r ≥ 10}

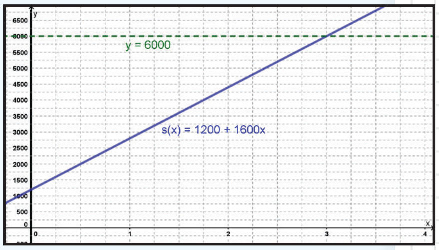
10. Create a table of values for the function (one has been started for you).

NUMBER OF RIDES, r	10	11	12	13	14	15	16	17
EXPENSE IN DOLLARS, $c(r)$	12	13.50	15	16.50	18	19.50	21	22.50

11. Write an equation for the number of rides Christa rode if she spent \$21.
21 = 12 + 1.5(r – 10)

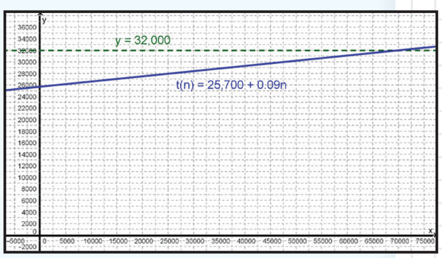
12. Use your table to determine the number of rides Christa rode if she spent \$21. To verify, solve the equation for the output value of 21.
See margin.

5. *The line of y = 6000 intersects the graph of the function s(x) = 1200 + 1600x at 3. Yes, she will reach her goal in exactly 3 years.*



8. *The line of y = 32,000 intersects the graph of the function t(n) = 25,700 + 0.09n at 70,000.*

To earn \$32,000 for the year, he must sell \$70,000 of jewelry.



12. *In the table, when the output value is 21, the input value is 16. This means that if Christa spent \$21, she rode 16 rides.*

Verify:

21 = 12 + 1.5(r – 10)
21 = 12 + 1.5r – 15
21 = -3 + 1.5r
24 = 1.5r
16 = r

748 CHAPTER 7: SOLUTIONS OF EQUATIONS

Use the situation described below to answer questions 13 – 16.

FINANCE

Vishal is joining a gym that has a $80 joining fee, and a monthly fee of $65. He has a coupon that gives him a 25% discount on the joining fee.

13. Write a function that models Vishal's gym costs, $c(m)$, for m months of membership.
See margin.

14. Create a table of values for the function (one has been started for you).

NUMBER OF MONTHS, m	6	8	10	12	14	16	18	20
GYM COSTS, $c(m)$	450	***580***	***710***	***840***	***970***	***1100***	***1230***	***1360***

15. Write an equation for the number of months Vishal has gym membership if the costs are $970.
970 = 60 + 65m

16. Use your table to determine the number of months he has gym membership if the costs are $970. To verify, solve the equation for the output value of 970.
See margin.

Use the situation described below to answer questions 17 – 18.

FINANCE

A local parking garage charges $15 for parking for up to 4 hours. They charge $3 for each additional hour of parking.

17. Write a function that models the parking fees, $p(h)$, for h hours of parking. Write a related equation for the number of hours of parking if the costs are $33.
p(h) = 15 + 3(h – 4) when {h | h ≥ 4}
33 = 15 + 3(h – 4)

18. Find the number of parking hours if the costs are $33. Solve your equation using a graph, table, or algebraically.
h = 10, so the number of hours one can park for $33 is 10 hours.

Use the situation described below to answer problems 19 – 20.

FINANCE

Tiffani wants to rent a jet ski to use while at the beach. She found a company that charges a $10 non-refundable deposit, plus $75 an hour. She had a coupon for $25 off her total cost. If h represents the number of hours she rents the jet ski, then $t(h)$ represents her total cost.

19. Write a function that models her rental fees, $t(h)$, for h hours of jet ski rental. Write a related equation for the number of hours she rented the jet ski if here costs are $285.
See margin.

20. Find the number of hours Tiffani rented the jet ski if her costs are $285. Solve your equation using a graph, table, or algebraically.
h = 4, so Tiffani rented the jet ski for 4 hours.

13. *$c(m) = 80 + 65m – 0.25(80)$*
$c(m) = 80 + 65m – 20$
$c(m) = 60 + 65m$

16. *In the table, when the output value is 970, the input value is 14. This means that if Vishal spent $970, he had 14 months of membership.*

Verify:

$970 = 60 + 65m$
$910 = 65m$
$14 = m$

19. *Function:*
$t(h) = 10 + 75h – 25$
$t(h) = 75h – 15$

Equation:
$285 = 75h – 15$