# Applications

**1.** Grace and Allie are going to meet at the fountain near their houses. They both leave their houses at the same time. Allie passes Grace's house on her way to the fountain.

- Allie's walking rate is 2 meters per second.
- Grace's walking rate is 1.5 meters per second.


**a.** How many seconds will it take Allie to reach the fountain?

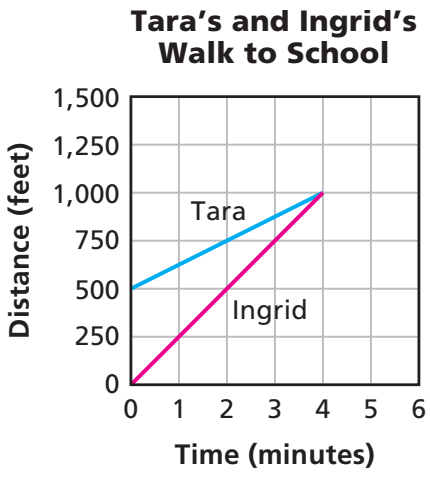
**b.** Suppose Grace's house is 90 meters from the fountain. Who will reach the fountain first, Allie or Grace? Explain your reasoning.

**2.** In Problem 2.2, Emile's friend, Gilberto, joins the race. Gilberto has a head start of 20 meters and walks at 2 meters per second.

**a.** Write an equation that gives the relationship between Gilberto's distance $d$ from where Emile starts and the time, $t$.

**b.** How would Gilberto's graph compare to Emile and Henri's graphs?

**3.** Ingrid stops at Tara's house on her way to school. Tara's mother says that Tara left 5 minutes ago. Ingrid leaves Tara's house, walking quickly to catch up with Tara. The graph below shows the distance each girl is from Tara's house, starting from the time Ingrid leaves Tara's house.




**a.** In what way is this situation like the race between Henri and Emile? In what way is it different?

**b.** After how many minutes does Ingrid catch up with Tara?

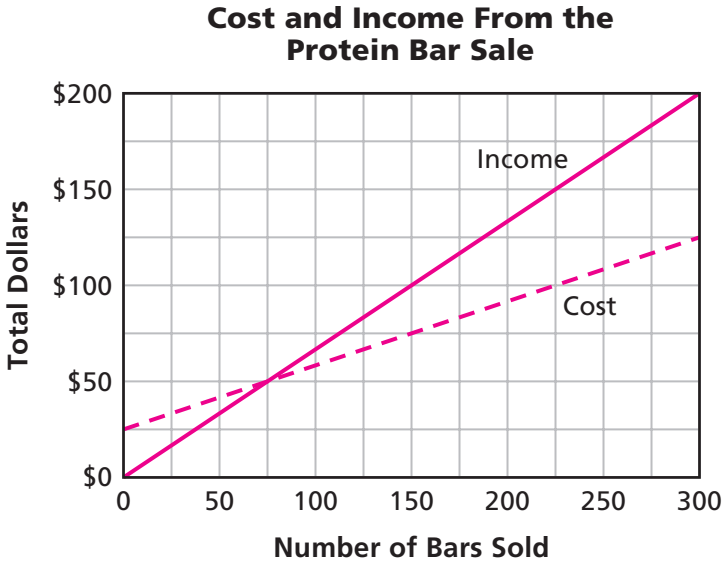
**c.** How far from Tara's house does Ingrid catch up with Tara?

**d.** Each graph intersects the distance axis (the *y*-axis). What information do these points of intersection give about the problem?

**e.** Which line is steeper? How can you tell from the graph? How is the steepness of each line related to the rate at which the person travels?

**f.** What do you think the graphs would look like if we extended them to show distance and time after the girls meet?

**4.** A band decides to sell protein bars to raise money for an upcoming trip. The cost (the amount the band pays for the protein bars) and the income the band receives for the protein bars are represented on the graph below.




**a.** How many protein bars must be sold for the band's costs to equal the band's income?

**b.** What is the income from selling 50 protein bars? 125 bars?

**c.** Suppose the income is $200. How many protein bars were sold? How much of this income is profit?

Homework Help Online PHSchool.com
**For:** Help with Exercise 4
**Web Code:** ane-5204

**In Exercises 5 and 6, the student council asks for cost estimates for a skating party to celebrate the end of the school year.**

**5.** The following tables represent the costs from two skating companies: Rollaway Skates and Wheelie's Skates and Stuff.

**Rollaway Skates**

| Number of People | Cost |
|---|---|
| 0 | $0 |
| 1 | $5 |
| 2 | $10 |
| 3 | $15 |
| 4 | $20 |
| 5 | $25 |
| 6 | $30 |
| 7 | $35 |
| 8 | $40 |

**Wheelie's Skates and Stuff**

| Number of People | Cost |
|---|---|
| 0 | $100 |
| 1 | $103 |
| 2 | $106 |
| 3 | $109 |
| 4 | $112 |
| 5 | $115 |
| 6 | $118 |
| 7 | $121 |
| 8 | $124 |

**a.** For each company, is the relationship between number of people and cost linear? Explain.

**b.** For each company, write an equation describing each cost plan.

**c.** Describe how you can use the table or graph to find when the costs of the two plans are equal. How can this information help the student council decide which company to choose?

**6.** A third company, Wheels to Go, gives their quote in the form of the equation $C_W = 35 + 4n$, where $C_W$ is the cost in dollars for $n$ students.

**a.** What information do the numbers 35 and 4 represent in this situation?

**b.** For 60 students, which of the three companies is the cheapest? Explain how you could determine the answer using tables, graphs, or equations.

**c.** Suppose the student council wants to keep the cost of the skating party to $500. How many people can they invite under each of the three plans?

**d.** The points below lie on one or more of the graphs of the three cost plans. Decide to which plan(s) each point belongs.

**i.** (20, 115) **ii.** (65, 295) **iii.** (50, 250)

**e.** Pick one of the points in part (d). Write a question that could be answered by locating this point.

**7.** Suppose each of the following patterns continues. Which are linear relationships? Explain your answer. For each pattern that is linear, write an equation that expresses the relationship.

**a.**

| *x* | *y* |
|---|---|
| −10 | −29 |
| 0 | 1 |
| 10 | 31 |
| 20 | 61 |
| 30 | 91 |

**b.**

| *x* | *y* |
|---|---|
| 1 | 9 |
| 5 | 17 |
| 7 | 21 |
| 20 | 47 |
| 21 | 49 |

**c.**

| *x* | *y* |
|---|---|
| 1 | 1 |
| 2 | 4 |
| 3 | 9 |
| 4 | 16 |
| 5 | 25 |

**d.**

| *x* | *y* |
|---|---|
| 1 | 9 |
| 5 | 22 |
| 7 | 25 |
| 20 | 56 |
| 21 | 60 |

**8.** The organizers of a walkathon get cost estimates from two printing companies to print brochures to advertise the event. The costs are given by the equations below, where $C$ is the cost in dollars and $n$ is the number of brochures.

Company A: $C = 15 + 0.10n$

Company B: $C = 0.25n$

**a.** For what number of brochures are the costs the same for both companies? What method did you use to get your answer?

**b.** The organizers have \$65 to spend on brochures. How many brochures can they have printed if they use Company A? If they use Company B?

**c.** What information does the $y$-intercept represent for each equation?

**d.** What information does the coefficient of $n$ represent for each equation?

**9.** A school committee is assigned the task of selecting a DJ for the end-of-school-year party. Susan obtains several quotes for the cost of three DJs.

Tom's Tunes charges \$60 an hour.

Solidus' Sounds charges \$100 plus \$40 an hour.

Light Plastic charges \$175 plus \$30 an hour.

**a.** For each DJ, write an equation that shows how to calculate the total cost from the total number of hours.

**b.** What information does the coefficient of $x$ represent for each DJ?

**c.** What information does the $y$-intercept represent for each DJ?

**d.** Suppose the DJ will need to work eight and one half hours. What is the cost of each DJ?

**e.** Suppose the committee has only \$450 dollars to spend on a DJ. For how many hours could each DJ play?

**10.** A local department store offers two installment plans for buying a $270 skateboard.

Plan 1: A fixed weekly payment of $10.80

Plan 2: A $120 initial payment plus $6.00 per week

**a.** For each plan, how much money is owed after 12 weeks?

**b.** Which plan requires the least number of weeks to pay for the skateboard? Explain.

**c.** Write an equation to represent each plan. Explain what information the variables and numbers represent.

**d.** Suppose the skateboard costs $355. How would the answers to parts (a)–(c) change?

**For each equation in Exercises 11–14, answer parts (a)–(d).**

**a.** What is the rate of change between the variables?

**b.** State whether the $y$-values are increasing or decreasing, or neither, as $x$ increases.

**c.** Give the $y$-intercept.

**d.** List the coordinates of two points that lie on a graph of the line of the equation.



**11.** $y = 1.5x$

**12.** $y = -3x + 10$

**13.** $y = -2x + 6$

**14.** $y = 2x + 5$

**15.** Dani gets $7.50 per hour when she baby-sits.

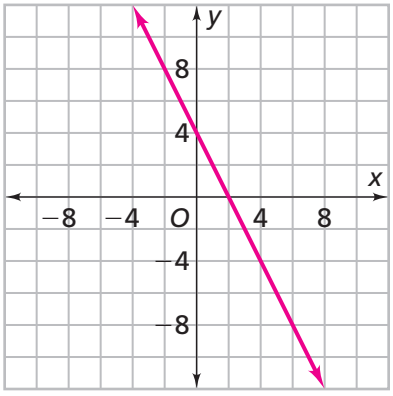
**a.** Draw a graph that represents the number of hours she baby-sits and the total amount of money she earns.

**b.** Choose a point on the graph. Ask two questions that can be answered by finding the coordinates of this point.

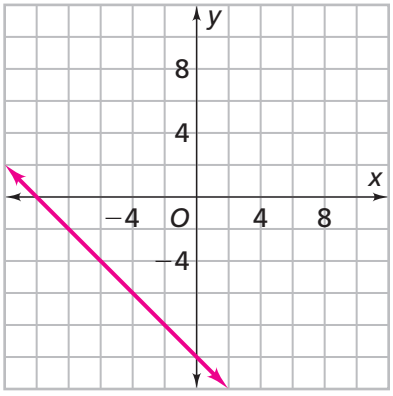
**16.** Match each equation to a graph.

**a.** $y = 3x + 5$ **b.** $y = x - 7$ **c.** $y = -x - 10$

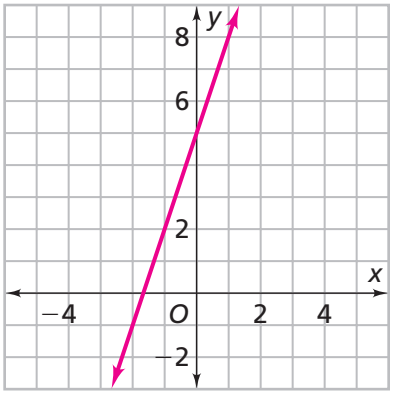
**Graph 1**



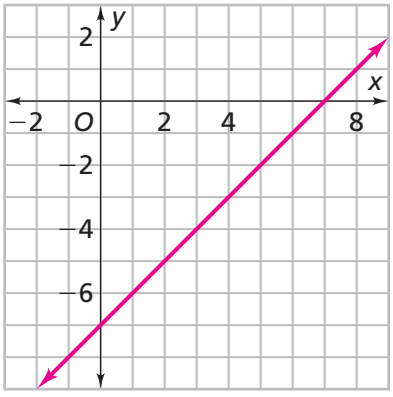

**Graph 2**




**Graph 3**




**Graph 4**




**d.** Write an equation for the graph that has no match.

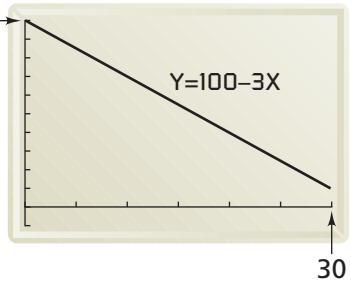
**17.** Mary wants to use her calculator to find the value of $x$ when $y = 22$ in the equation $y = 100 - 3x$. Explain how she can use each table or graph to find the value of $x$ when $100 - 3x = 22$.

**a.**

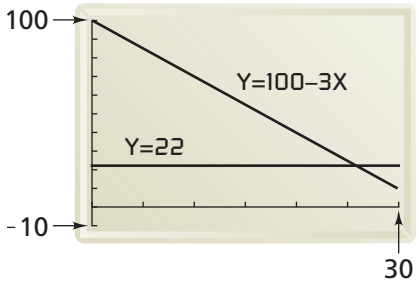
| X | $Y_1$ |
|---|---|
| 21 | 37 |
| 22 | 34 |
| 23 | 31 |
| 24 | 28 |
| 25 | 25 |
| 26 | 22 |

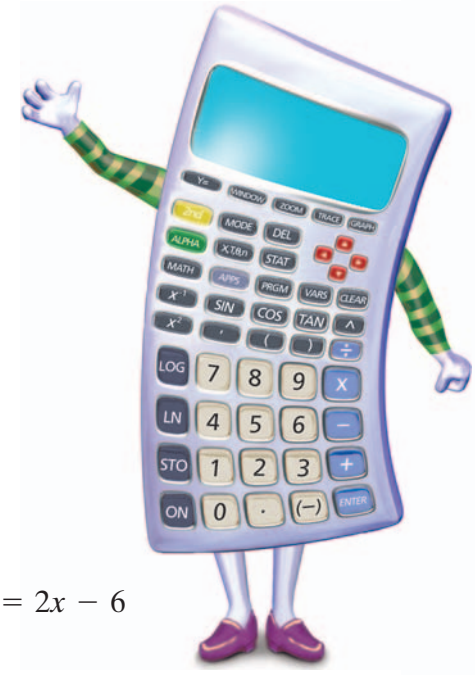
$Y_1=100-3X$

**b.**




**c.**



**For each equation in Exercises 18–21, give two values for $x$ for which the value of $y$ is negative.**

**18.** $y = -2x - 5$

**19.** $y = -5$

**20.** $y = 2x - 5$

**21.** $y = \frac{3}{2}x - \frac{1}{4}$

**For Exercises 22–28, consider the following equations:**

**i.** $y = 2x$ **ii.** $y = -5x$ **iii.** $y = 2x - 6$

**iv.** $y = -2x + 1$ **v.** $y = 7$

**22.** Which equation has a graph you can trace to find the value of $x$ that makes $8 = 2x - 6$ a true statement?

**23.** How does finding a solution to $8 = 2x - 6$ help you find the coordinates of a point on the line of the equation $y = 2x - 6$?

**24.** Which equation has a graph that contains the point $(7, -35)$?

**25.** The following two points lie on the graph that contains the point $(7, -35)$. Find the missing coordinate for each point.

$(-1.2, \blacksquare)$ $(\blacksquare, -15)$

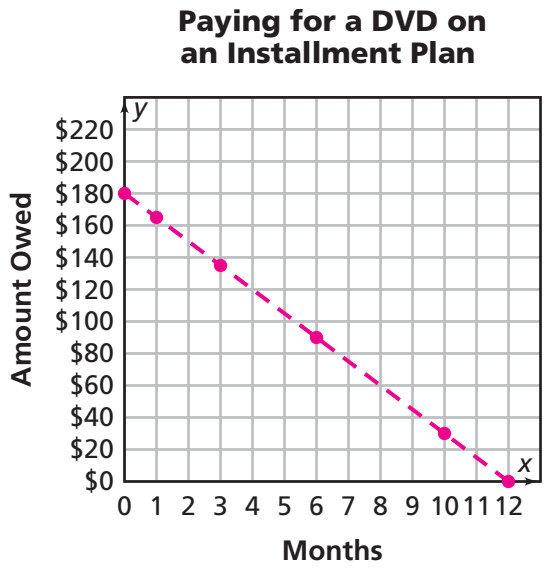
**26.** Which equations have a positive rate of change?

**27.** Which equations have a negative rate of change?

**28.** Which equations have a rate of change equal to zero?

# Connections

**29.** The Ferry family decides to buy a new DVD player that costs $215. The store has an installment plan that allows them to make a $35 down payment and then pay $15 a month. The graph below shows the relationship between the number of months the family has had a DVD player and the amount they still owe.

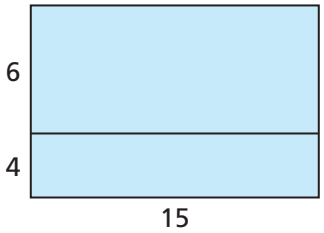



**a.** Write an equation that represents the relationship between the amount the Ferry family still owes and the number of months after the purchase. Explain what information the numbers and variables represent.

**b.** The point where the graph of an equation intersects the $x$-axis is called the ***x*-intercept.** What are the $x$- and $y$-intercepts of the graph for this payment plan? Explain what information each intercept represents.

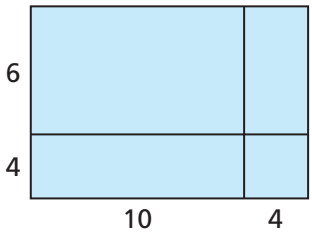
**30.** Use the Distributive Property to write two expressions that show two different ways to compute the area of each rectangle.

**a.**

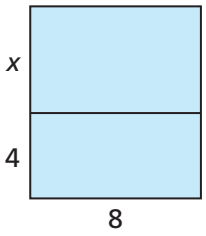



**b.**

**c.**




**d.**




**31.** Use the distributive property to write an expression equal to each of the following:

**a.** $x(-2 + 3)$ **b.** $(-4x) + (2x)$ **c.** $(x) - (4x)$

**32.** Decide whether each statement is true or false:

**a.** $15 - 3x = 15 + -3x$

**b.** $3.5x + 5 = 5(0.7x + 5)$

**c.** $3(2x + 1) = (2x + 1) + (2x + 1) + (2x + 1)$

**33.** Shallah Middle School is planning a school trip. The cost is \$5 per person. The organizers know that three adults are going on the trip, but they do not yet know the number of students who will go. Write an expression that represents the total cost for $x$ students and three adults.

**34.** Harvest Foods has apples on sale at 12 for \$3.

**a.** What is the cost per apple?

**b.** Complete the rate table to show the costs of different numbers of apples.

**The Cost of Apples**

| Number of Apples | 12 | ■ | 1 | 48 | 10 | ■ |
|---|---|---|---|---|---|---|
| Cost | \$3 | \$1.50 | ■ | ■ | ■ | \$4.50 |

**c.** How many apples can you buy for \$1?

**d.** Is the relationship between number of apples and cost linear? Explain.

Connections

**35.** Ms. Peggy bought some bagels for her friends. She paid $15 for 20 bagels.

**a.** How much did Ms. Peggy pay per bagel?

**b.** Write an equation relating the number of bagels, $n$, to the total cost, $c$.

**c.** Use your equation to find the cost of 150 bagels.

**36.** Ali says that $x = -1$ makes the equation $-8 = -3 + 5x$ true. Tamara checks this value for $x$ in the equation. She says Ali is wrong because $-3 + 5 \times (-1)$ is $-2$, not $-8$. Why do you think these students disagree?

**37.** Determine whether the following mathematical sentences are true or false.

**a.** $5 + 3 \times 2 = 16$

**b.** $3 \times 2 + 5 = 16$

**c.** $5 + 3 \times 2 = 11$

**d.** $3 \times 2 + 5 = 11$

**e.** $\frac{3}{2} \div \frac{4}{3} - \frac{1}{8} = 1$

**f.** $\frac{1}{2} + \frac{3}{2} \div \frac{1}{2} = 2$

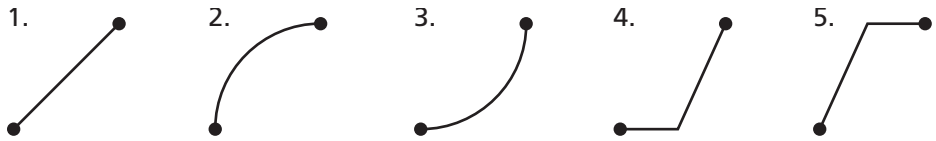
**38.** Moesha feeds her dog the same amount of dog food each day from a very large bag. On the 3rd day, she has 44 cups left in the bag, and, on the 11th day, she has 28 cups left.

**a.** How many cups of food does she feed her dog a day?

**b.** How many cups of food were in the bag when she started?

**c.** Write an equation for the total amount of dog food Moesha has left after feeding her dog for $d$ days.

**39. a.** Match the following connecting paths for the last 5 minutes of Daren's race.




**i.** Daren finishes running at a constant rate.

**ii.** Daren runs slowly at first and gradually increases his speed.

**iii.** Daren runs fast and then gradually decreases his speed.

**iv.** Daren runs very fast and reaches the finish line early.

**v.** After falling, Daren runs at a constant rate.

**b.** Which of the situations in part (a) was most likely to represent Daren's running for the race? Explain your answer.

**40.** In *Stretching and Shrinking*, you plotted the points (8, 6), (8, 22), and (24, 14) on grid paper to form a triangle.

**a.** Draw the triangle you get when you apply the rule $(0.5x, 0.5y)$ to the three points.

**b.** Draw the triangle you get when you apply the rule $(0.25x, 0.25y)$ to the three points.

**c.** How are the three triangles you have drawn related?

**d.** What are the areas of the three triangles?

**e.** Do you notice any linear relationships among the data of the three triangles, such as area, scale factor, lengths of sides, and so on?

**41.** In *Covering and Surrounding*, you looked at perimeters of rectangles.

**a.** Make a table of possible whole number values for the length and width of a rectangle with a perimeter of 20 meters.

**b.** What equation represents the data in this table? Make sure to define your variables.

**c.** Is the relationship between length and width linear in this case?

**d.** Find the area of each rectangle.

# Extensions

**42.** Decide whether each equation represents a linear situation. Explain how you decided.

**a.** $y = 2x$ **b.** $y = \frac{2}{x}$ **c.** $y = x^2$

**43. a.** Write equations for three lines that intersect to form a triangle.

**b.** Sketch the graphs and label the coordinates of the vertices of the triangle.

**c.** Will any three lines intersect to form a triangle? Explain your reasoning.

**44. a.** Which one of the following points is on the line $y = 3x - 7$: $(3, 3)$, $(3, 2)$, $(3, 1)$, or $(3, 0)$? Describe where each of the other three points is in relation to the line.

**b.** Find another point on the line $y = 3x - 7$ and three more points above the line.

**c.** The points $(4, 5)$ and $(7, 14)$ lie on the graph of $y = 3x - 7$. Use this information to find two points that make the inequality $y < 3x - 7$ true and two points that make the inequality $y > 3x - 7$ true.