Variables and Patterns Practice Answers

Investigation 1 Additional Practice
1. a. Day is the independent variable and "number of cans" is the dependent variable; the number of cans depends on the day.
   b. Day 1 collected the most cans of food, about 75.
   c. Possible answer: $75 + 60 + 60 + 35 + 70 = 300$ cans of food.
   d. No. There are no points that would occur in between days.

2. a. Emma's Walk

<table>
<thead>
<tr>
<th>Time (min)</th>
<th>20</th>
<th>30</th>
<th>50</th>
<th>70</th>
<th>75</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance (mi)</td>
<td>$\frac{3}{4}$</td>
<td>$\frac{3}{4}$</td>
<td>$\frac{11}{4}$</td>
<td>2</td>
<td>$2\frac{1}{2}$</td>
</tr>
</tbody>
</table>

b. Emma's Walk

3. a. Answers will vary: It makes sense to connect the dots because Emma and her mother are moving through time continuously, either walking or standing still.
   d. Students' preferences and reasons will vary. The graph gives a quick overview of the walk at a glance, but it is harder to know what the individual data points are and the actual amount of change between them. The table gives the total miles Emma and her mother walked after a certain time in a very convenient and more exact form, but it is difficult to get a quick overview of the whole walk.
b. Answers will vary. It is important to give students some examples of complete and thoughtful responses early in this unit so they have a sense of what is expected of them. Possible answer: Sarah learned no words between the first month and the eleventh. She learned her first word during the 12th month and learned only a few (about 1 per month) until the 16th month. At the end of 16 months, Sarah knows 7 words and continues to learn new words at more than 1 per month from then on. Between 16 months and 19 months, Sarah learns an increasing number of new words each month (3, 5, 6) and then the number of new words she learns each months decreases in the 20th and 21st month (she learns 4 and then 2 new words). The number of new words Sarah learns increases rapidly in the 22nd month (17 new words). This might represent a developmental milestone. She then learns less in the 23rd (8) and slightly more in the 24th month (11).

c. She learned the most in the 22nd month (17 new words). She learned the least, not counting between 1 and 11 months, between the 12th and 13th month when she did not learn any new words. She still only knew 1 word in the 13th month.

4. a. The variables are “idea” and “number of yes votes.”
   b. “Idea” is the independent variable and “yes votes” is the dependent variable; the number of “yes votes” is determined by which “idea” is being voted on.
   c. The graph should look like this:

   ![Graph of favorable votes]

   d. Since 9 student council members voted on each idea and each member must vote yes or no (i.e., no abstentions), the number of “no” votes for each idea would be 9 – (number of yes votes). A coordinate graph of the data would look like this:

   ![Graph of unfavorable votes]
Variables and Patterns Practice Answers

5. a. Harbor Water Depth

b. From 14 hours after midnight to 15 hours after midnight, the depth increases by the greatest amount, 1.4 meters.

c. Between 9 and 10 hours after midnight and between 22 and 23 hours after midnight, the depth decreases by the greatest amount, 1.2 meters.

d. It makes sense to connect the points because the depth is changing continuously.

e. Possible answer: It is easier to use the table because you can read the exact values.

6. Answers will vary.

7. Answers will vary.

8. a. 52.5 mph  
b. 55 mph  
c. 50 mph  
d. Sample graph:

Shah Family Road Trip

8. e. Hour six; hours one, three, and eight 
f. 8 hours and 45 minutes

9. a. 

b. 11 and 12  
c. 4 and 5

Investigation 2 Additional Practice

1. a. (Figure 1)  
b. (Figure 2)

<table>
<thead>
<tr>
<th>Figure 1</th>
<th>East Coast Transport</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance</td>
<td>100</td>
</tr>
<tr>
<td>Cost</td>
<td>1,250</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Figure 2</th>
<th>Superior Buses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance</td>
<td>100</td>
</tr>
<tr>
<td>Cost</td>
<td>500</td>
</tr>
</tbody>
</table>
c. The combined plots will look like this:

![Graph of combined plots]

- East Coast Transport  ■ Superior Buses

d. It probably makes sense to connect the dots with line segments because it is natural to assume that prices for mile totals between 100 miles units will be charged at the same rates per mile as at the 100-mile markers.

e. The better deal for less than 400 miles is Superior Buses. Both have the same charge for 400 miles. For distances greater than 400 miles, East Coast Transport is cheaper.

2. a. Year and land area in square kilometers

b. About 16 square kilometers


d. Possible answer: The information shows a constant change in the area used for landfill from one year to the next. It isn't necessarily accurate because we do not know the details of how the landfill "grew" from one year to the next.

3. a. Roller Rink Fees

- $24.50
- $21.00
- $17.50
- $14.00
- $10.50
- $7.00
- $3.50

b. Possible answer: It would make sense to connect the points on the graph if there are partial fees for minutes between half hours.

c. The cost increases by $3.50 for each additional half hour of skating. On the graph, this is shown by a straight-line pattern going up as we read from left to right. The values on the "Cost" axis increase by $3.50 for each increase of 30 on the "Minutes" axis.
4. a. **Roller Blade Rental**

<table>
<thead>
<tr>
<th>Number of Skaters</th>
<th>Rental Charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$0</td>
</tr>
<tr>
<td>5</td>
<td>$12.50</td>
</tr>
<tr>
<td>10</td>
<td>$25.00</td>
</tr>
<tr>
<td>15</td>
<td>$37.50</td>
</tr>
<tr>
<td>20</td>
<td>$50.00</td>
</tr>
<tr>
<td>25</td>
<td>$62.50</td>
</tr>
<tr>
<td>30</td>
<td>$75.00</td>
</tr>
<tr>
<td>35</td>
<td>$87.50</td>
</tr>
<tr>
<td>40</td>
<td>$100.00</td>
</tr>
<tr>
<td>45</td>
<td>$112.50</td>
</tr>
<tr>
<td>50</td>
<td>$125.00</td>
</tr>
</tbody>
</table>

![Roller Blade Rental Graph](image)

b. Possible answer: Both tables show a constant increase in the $y$-values as the $x$-values increase by a fixed amount. The points on both graphs follow a straight-line pattern.

5. a. **Concession Stand Sales**

<table>
<thead>
<tr>
<th>Month</th>
<th>Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sept.</td>
<td>$100</td>
</tr>
<tr>
<td>Oct.</td>
<td>$75</td>
</tr>
<tr>
<td>Nov.</td>
<td>$150</td>
</tr>
<tr>
<td>Dec.</td>
<td>$200</td>
</tr>
<tr>
<td>Jan.</td>
<td>$150</td>
</tr>
<tr>
<td>Feb.</td>
<td>$200</td>
</tr>
<tr>
<td>Mar.</td>
<td>$100</td>
</tr>
<tr>
<td>Apr.</td>
<td>$125</td>
</tr>
<tr>
<td>May</td>
<td>$100</td>
</tr>
</tbody>
</table>

![Concession Stand Sales Graph](image)

b. **Concession Stand Profit**

<table>
<thead>
<tr>
<th>Month</th>
<th>Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sept.</td>
<td>$50</td>
</tr>
<tr>
<td>Oct.</td>
<td>$37.50</td>
</tr>
<tr>
<td>Nov.</td>
<td>$75</td>
</tr>
<tr>
<td>Dec.</td>
<td>$100</td>
</tr>
<tr>
<td>Jan.</td>
<td>$75</td>
</tr>
<tr>
<td>Feb.</td>
<td>$100</td>
</tr>
<tr>
<td>Mar.</td>
<td>$50</td>
</tr>
<tr>
<td>Apr.</td>
<td>$62.50</td>
</tr>
<tr>
<td>May</td>
<td>$50</td>
</tr>
</tbody>
</table>

c. The graph of the profit is similar to the sales graph except that each $y$-coordinate in the profit graph is exactly half the value of the $y$-coordinate in the total sales graph.

6. a. The graph shows the cyclist's speed constantly increasing.

b. The graph shows the cyclist's speed constantly decreasing.

c. The graph shows the cyclist's speed increasing and then leveling off.

7. a. cost and year or year and cost

b. 2007 and 2008

c. 2004 and 2005

8. height of a feather as it falls from a flying bird, total distance remaining to travel over time.
Variables and Patterns Practice Answers

Skill: Tables and Graphs
1. 100 MB Computer Disks

<table>
<thead>
<tr>
<th>Price ($)</th>
<th>Number of Disks</th>
</tr>
</thead>
<tbody>
<tr>
<td>$200</td>
<td>10</td>
</tr>
<tr>
<td>$160</td>
<td>9</td>
</tr>
<tr>
<td>$120</td>
<td>8</td>
</tr>
<tr>
<td>$80</td>
<td>7</td>
</tr>
<tr>
<td>$40</td>
<td>6</td>
</tr>
<tr>
<td>$20</td>
<td>5</td>
</tr>
<tr>
<td>$10</td>
<td>4</td>
</tr>
<tr>
<td>$5</td>
<td>3</td>
</tr>
<tr>
<td>$2</td>
<td>2</td>
</tr>
</tbody>
</table>

b. $80

2. a. Average Monthly Temperatures

<table>
<thead>
<tr>
<th>July Temperature (°F)</th>
<th>January Temperature (°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>90</td>
<td>0</td>
</tr>
<tr>
<td>80</td>
<td>10</td>
</tr>
<tr>
<td>70</td>
<td>20</td>
</tr>
<tr>
<td>60</td>
<td>30</td>
</tr>
<tr>
<td>50</td>
<td>40</td>
</tr>
<tr>
<td>40</td>
<td>50</td>
</tr>
<tr>
<td>30</td>
<td>60</td>
</tr>
<tr>
<td>20</td>
<td>70</td>
</tr>
<tr>
<td>10</td>
<td>80</td>
</tr>
<tr>
<td>0</td>
<td>90</td>
</tr>
</tbody>
</table>

b. About 66°F

Skill: Analyzing Graphs
1. II
2. V
3. IV
4. I
5. III
6. VI
7-8. Sample graphs are shown.

Investigation 3 Additional Practice
1. a. \( p \) is perimeter, \( l \) is length, \( w \) is width:
\[ p = 2l + 2w \]
b. \( A \) is area, \( b \) is base, \( h \) is height:
\[ A = \frac{1}{2} bh \ (\frac{1}{2} \times b \times h) \]
c. \( s \) is number of s'mores, \( m \) is number of marshmallows:
\[ s = \frac{m}{3} \]
d. \( q \) is the number of quarters, \( D \) is the amount of money in dollars:
\[ q = 4D \ (4 \times D) \]
e. \( u \) is cups of unpopped popcorn,
\( p \) is cups of popped popcorn:
\[ p = 12u \ (12 \times u) \]

2. a. Traveling at 44 Miles per Hour

<table>
<thead>
<tr>
<th>Time (hr)</th>
<th>Distance (mi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.5</td>
<td>22</td>
</tr>
<tr>
<td>1.0</td>
<td>44</td>
</tr>
<tr>
<td>1.5</td>
<td>66</td>
</tr>
<tr>
<td>2.0</td>
<td>88</td>
</tr>
<tr>
<td>2.5</td>
<td>110</td>
</tr>
<tr>
<td>3.0</td>
<td>132</td>
</tr>
<tr>
<td>3.5</td>
<td>154</td>
</tr>
<tr>
<td>4.0</td>
<td>176</td>
</tr>
</tbody>
</table>

b. Traveling at 44 Miles per Hour

\[ d = 110 \]
\[ t = 1.5 \]
e. It makes sense to connect points because the distance increases at a constant rate.

3. a. \( S \) is number of students, \( T \) is number of teachers:
\[ S = 21 \times T \ (21T) \]

b. \( S = 21 \times 50 = 1050 \) students
c. \( 60 \) teachers.

4. a. \( A \) is the area, \( s \) is the side length:
\[ A = s \times s \text{ or } A = s^2 \]
\[ A = 36 \text{ cm}^2 \]
\[ 1.44 \text{ m}^2 = s \times s, \text{ and so } s = 1.2 \text{ cm} \]

5. Note: Some students may have trouble switching sides in an equation. Have them rewrite the rule with Input on the left side of the equals sign.
For an input of 6, the output is 18; An input of 4 has an output of 12; Input 1, Output 3
Variables and Patterns Practice Answers

6. | $x$ | $2.5x$ |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>8</td>
<td>20</td>
</tr>
<tr>
<td>12</td>
<td>30</td>
</tr>
<tr>
<td>16</td>
<td>40</td>
</tr>
<tr>
<td>20</td>
<td>50</td>
</tr>
</tbody>
</table>

7. Two batches of muffins use 5 cups of flour, $2y = 5x$; the number of feet in a distance expressed in yards is three times the number of yards, $y = 3x$; One cup of juice concentrate is needed to make 5 quarts of punch, $x = 5y$; The cost of going to the county fair is a $5-entrance fee and $2 per ride, $y = 5 + 2x$.

Skill: Variables, Tables, and Graphs

1. 20; 25
2. 80; 100
3. 9; 10
4. 10; 11
5. 11; 12

Investigation 4 Additional Practice

1. a. 16; 19; 22; 25; 31; 61
   b. Possible answer: $C = 3n + 1$; Each number of circles is one more than three times the shape number.
   c. 121; Possible answer: Multiply 40 by 3, and then add 1.
   d. 9; Possible answer: 28 is between 22 and 31, which are shape numbers 8 and 10 respectively.

2. a. No; This equation works for only the first shape, but she may have assumed it works for all shapes.
    b. Possible answer: $C = n + n + n + 1$
    c. Answers will vary. Students might show use of Distributive Property, combining like terms, and/or Commutative Property for addition.

3. a. 16; 18; 20; 22; 26; 46
    b. Possible answer: $F = 2n + 6$
    c. Possible answer: No. There would be no space between the wall and the tiles to have a garden since the width of a tile is 1 foot.

4. Linda’s equation and Alex’s equation
   a. 25
   b. $3n$
   c. $5n + 25$
   d. $2n$

5. $a. C = 25 + 3n + (5n + 25) + 2n$
   b. $C = 50 + 10n$; Evidence will vary.

6. a. $C = 25 + 3n + (5n + 25) + 2n$
   b. $C = 50 + 10n$; Evidence will vary.

7. $a. C = 25 + 3n + (5n + 25) + 2n$
   b. $C = 50 + 10n$; Evidence will vary.

8. $a. P = a + b + c$
   b. $b + c = 12$
   c. $6 + 12 = 18$ inches. Sample answer: No, because there wouldn’t be enough wire.
   d. Sample answer: $a + 12 \leq 18$

9. $a. 200 + 40n = 400; n = 5$ hours

10. $b. C = 5 + 1b$ or $C = 5 + b$
    School: $C = 2b$

10. $a. 200 + 40n = 400; n = 5$ hours
11. a. $5 + b = 17; b = 12$ books
   b. Possible answer: first subtract the $5$
      entry fee, and then the rest is the
      number of books since each book is $1$
   c. Students should show substitution to
      verify $5 + 12 = 17$.
12. a. $2b = 12; b = 6$ books
   b. Possible answer: divide $12$ by $2$ price
      per book.
   c. Students should show substitution to
      verify $2(6) = 12$.
13. a. $5 + b = 10; b = 5$ books
   b. $2b = 10; b = 5$ books
   c. Possible answer: Parker could go to
      either, because he can afford to buy
      5 books at each fair.
14. a. $4x \leq 60$
   b. Answers will vary, but should be
      positive numbers less than or equal
      to 15.
   c. $x \leq 15$; any positive side length less
      than or equal to 15 feet
15. a. $27 + x \leq 100$
   b. Answers will vary, but should be
      nonnegative integers less than or equal
      to 73.
   c. $x \leq 73$; any nonnegative integer less
      than or equal to 73
16. a. $12.50 + x \leq 16.00$
   b. 0, 1, 2, or 3 toppings
   c. $x < 3.5$; 0, 1, 2, or 3 toppings are the
      only options
17. a. $m < 40$;
   b. $w < 11$;
   c. $x > 1.25$;
   d. $5 < n$;
18. 
   19. a. $30n$
   b. $35n + 12$
   c. $30n + 10n + 7n$
      Not a Solution: $y = 3.5, y = 10.6,$
      $y = -2.4, y = 2.9$
   
   **Skill: Finding Solutions**
   1. $x = 15$
   2. $c = 2.7$
   3. $m = 60$
   4. $k = 17$
   5. $p = 6.3$
   6. $k = 525$
   7. $a = 8$
   8. $x = 6$
   9. $p = 24.5$
   10. $y = 88$
   11. $g = 5$
   12. $n = 390$
   13. (a)
   14. (a) and (b)
   15. (c)
   16. (b) and (c)