Solution for section 2.4, B10:
(a) This is a function, since each voter goes to only one polling place.
(b) Not a function. Some cities have more than one zip code.
(c) This is a function since each plant can belong to only one genus.
(d) Not a function. Some pet owners have more than one pet.

Solution for section 2.4, B11ad:
(a) The formula for this function is \( f(x) = x + 3 \) for \( x \in \{1, 5, 8\} \), the set of ordered pairs is \{(1, 4), (5, 8), (8, 11)\}, and the table is

<table>
<thead>
<tr>
<th>( x )</th>
<th>( f(x) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>8</td>
<td>11</td>
</tr>
</tbody>
</table>

(b) The formula for this function is \( f(x) = \frac{1}{x} \) for \( x \in \{1/2, 1, 3, 4\} \), the set of ordered pairs is \{(1/2, 2), (3, 1/3), (4, 1/4), (1, 1)\}, and the arrow diagram is

\[
\begin{align*}
1/2 & \rightarrow 2 \\
3 & \rightarrow 1/3 \\
4 & \rightarrow 1/4 \\
1 & \rightarrow 1
\end{align*}
\]

Solution for section 2.4, B16: This is an arithmetic sequence with initial term \( a = 2 \) and common difference \( d = 7 \). Therefore, the 731th term is \( a + (731 - 1)d = 2 + 730 \cdot 7 = 5112 \)

Solution for section 2.4, B24: Since this is arithmetic sequence we know \( a + (114 - 1)d = 341 \) and \( a + (175 - 1)d = 524 \). Subtracting these two equations, we have

\[
\begin{align*}
a + (174)d &= 524 \\
a + (113)d &= 341 \\
0 + 61d &= 183,
\end{align*}
\]
which implies that \( d = 3 \). Now, we can plug this into any of the two equations above to solve for \( a \). Indeed,

\[
a + 174 \cdot 3 = 524,
\]
gives \( a = 2 \). Therefore, the 4th term of this sequence is

\[
a + (4 - 1)d = 2 + 3 \cdot 3 = 11.
\]

Solution for section 3.1, B3:
(a) Notice that since \( 3 \in S \), then \( 3 + 3 = 6, 6 + 3 = 9, 9 + 3 = 12, 12 + 3 = 15, 15 + 3 = 18 \), and \( 18 + 3 = 21 \) all must be in \( S \).
(b) By part (a) \( S \) must contain all multiples of 3 and since 24 is a multiple of 3, it must be in \( S \).

Solution for section 3.1, B4bc:
(b) \( 7 + 5 = 5 + 7 \) since addition is commutative.
(c) \( (4 + 3) + 6 = 4 + (3 + 6) \) since addition is associative.

Solution for section 3.1, B5a:
The statement reads \( 39 + 68 = 40 + 67 = 107 \).

Solution for section 3.1, B9bc:
(b) \( 279 - 156 = x \) if and only if \( 279 = x + 156 \).
(c) \( 279 - x = 156 \) if and only if \( 279 = 156 + x = x + 156 \).
Solution for section 3.1, B14: Any set containing 5 must also contain 5+5 = 10, 10+5 = 15, 15+5 = 20, 20+5 = 25, and so on. There any set that contains 5, must also contain all multiples of 5 to be closed under addition.

Solution for section 3.2, B3:
(a) A 2 × 4 rectangle suggests 2 · 4
(b) Four pairs of circles suggests 4 · 2
(c) An array of stars with 7 rows and 3 columns suggests 7 × 3

Solution for section 3.2, B5:
The set of whole numbers with 3 removed looks like {0, 1, 2, 4, 5, 6, 7, . . .}
(a) i. This set is not closed under addition since 1 + 2 = 3 and 3 is not in the set. ii. However, this set is closed under multiplication. One way to think about this is starting from the fact that the set of whole numbers is closed under multiplication, that is, if you multiply to two whole numbers, the product is a whole number. If you remove 3 from the whole numbers, you only need to check if any factors of 3 remain. In this case the number 1 is the only factor of 3 in the set, but you need to multiply 1 by 3 to get 3, which isn’t in the set. Therefore, if you multiply any two numbers in this set, you will get a always get some number in this set.
(b) For the same reasons as in part (a), the set of whole numbers with 7 removed is not closed under addition, but closed under multiplication.

Solution for section 3.2, B6:
(a) 5x + 2x = (5 + 2)x = 7x
(b) 3a + 6a + 4a = (3 + 6 + 4)a = 13a
(c) 3(a + 1) + 5(a + 1) = (3 + 5)(a + 1) = 8(a + 1)
(d) x(x + 2) + 3(x + 2) = (x + 3)(x + 2)

Solution for section 3.2, B12ab:
(a) 7 ÷ 3 = 2R1
(b) 3 ÷ 7 = 0R3. Some books say 3 ÷ 7 is defined because it does not precisely fit into the division algorithm as given in the textbook.

Solution for section 3.2, B15:
(a) Division is not close over the whole numbers. One, of many, example is 2 ÷ 3, which is not a whole number.
(b) Division is not commutative. For example,
1 ÷ 2 = 1/2 ≠ 2 ÷ 1 = 2.
(c) Division is not Associative. For example,
12 ÷ (6 ÷ 2) = 12 ÷ 3 = 4

but
(12 ÷ 6) ÷ 2 = 2 ÷ 2 = 1.
(d) Division does not have an identity. The best candidate would be 1, which is the multiplicative identity. However, for any whole number greater than 1, we have
1 ÷ a = 1/a < 1 < a = a ÷ 1.

Solution for section 3.2, B25:
Deleting every second number from the last sequence, starting with 3 we get
1, 7, 19, 37, 61, 91, . . .
The sequence of cumulative sums is
1, 8, 27, 64, 125, 216, . . .
The resulting sequence is the sequence of perfect cubes, that is,
1³, 2³, 3³, 4³, 5³, 6³, . . .