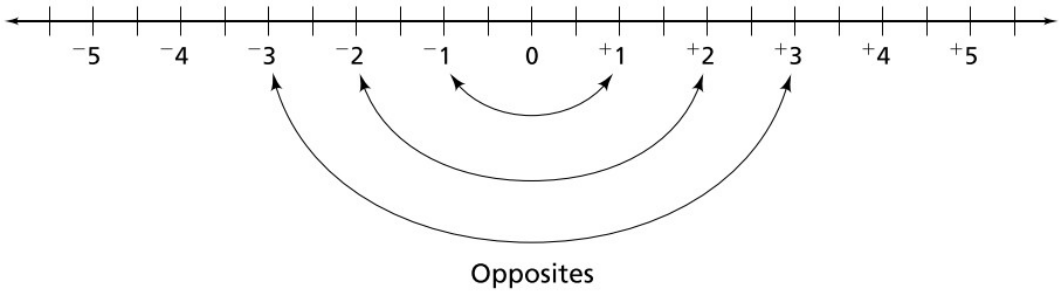
1.2 Extending the Number Line

Rational numbers are numbers that can be expressed as one integer a divided by another integer b, where b is not zero. You can write a rational number in the form $\frac{a}{b}$ or in decimal form.

For a rational number, $\frac{a}{b}$, why does b have to be nonzero?

- Are integers rational numbers? Explain.
- Is zero a rational number? Explain.

Each **negative number** can be paired with a **positive number.** These two numbers are called **opposites** because they are the same distance from zero on the number line, but in different directions.



- Where would the following pairs of numbers be located on the number line?

  7 and $^{-}7$; $\frac{21}{2}$ and $\frac{^{-}21}{2}$; $^{-}3\frac{1}{2}$ and $3\frac{1}{2}$; $\frac{^{-}1}{2}$ and $\frac{1}{2}$

- How would you graph the set of all numbers less than 4 on a number line? The numbers between 1 and $^{-}15\frac{1}{2}$?

Problem 1.2

A **1.** Estimate values for points *A*–*E*.

2. For each value you estimated in part (1), state the number's opposite.

3. A thermometer can be thought of as part of a vertical number line on which values above zero are positive. Sketch a thermometer (vertical number line), and place the following temperatures on it. Explain how you decided where each temperature should be placed.

$0°F$ $^{+}115°F$ $^{-}15°F$ $^{-}32.5°F$ $^{+}40°F$ $^{+}113.2°F$ $^{-}32.7°F$

4. How do the number lines from parts (1) and (3) help you find which of two numbers is greater?

B For each pair of temperatures, identify which temperature is further from $^{-}2°F$. Explain how you decided.

1. $^{+}6°F$ or $^{-}6°F$?

2. $^{-}7°F$ or $^{+}3°F$?

3. $^{+}2°F$ or $^{-}7°F$?

4. $^{-}10°F$ or $^{+}7°F$?

C Identify the temperature that is halfway between each pair of temperatures. Explain your reasoning.

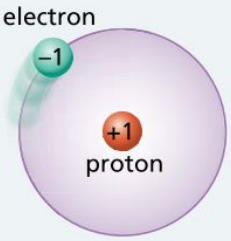
1. $0°F$ and $^{+}10°F$

2. $^{-}5°F$ and $^{+}15°F$

3. $^{+}5°F$ and $^{-}15°F$

4. $^{-}8°F$ and $^{+}8°F$

Problem 1.2 continued



D Integers are also used in chemistry. For example, a hydrogen atom has one proton, which has a charge of $^{+}1$, and one electron, which has a charge of $^{-}1$. The total charge of a hydrogen atom is $^{+}1 + {}^{-}1$, or 0. Describe three more real-life situations in which opposite quantities combine to make 0.

E Recall that the graph of an inequality is a sketch on a number line on which possible answers are shaded. For each part, graph the possible solutions for x on a number line.

1. x is positive.
2. x is less than or equal to $^{-}5$.
3. $x < {}^{-}7$
4. $x \geq 5$
5. $6 < x$
6. $^{-}1 \leq x$

F Find the values of x that satisfy the inequality. Then graph the solutions.

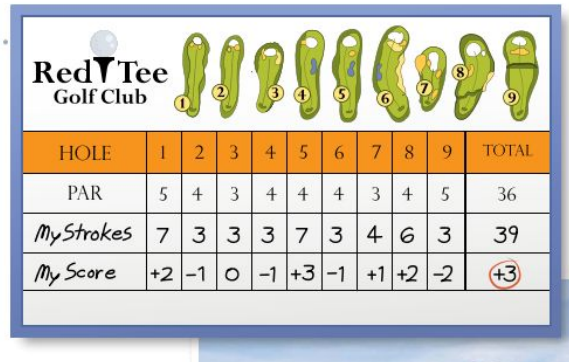
1. $x + 5 > 0$
2. $x - 1 \leq 0$
3. $3x < 9$

G Describe how you drew your graphs for Questions E and F.

ACE Homework starts on page 20.

Did You Know?

In golf, scores can be negative. Each golf hole has a value called *par*. Par is the number of strokes a golfer usually needs to complete the hole. For example, a good golfer should be able to complete a par-4 hole in four strokes or less. If a golfer completes the hole in six strokes, then the score for that hole is "two over par" ($^{+}2$). A player's score for a round of golf is the total number of strokes above or below par. A winning score at a golf tournament is often negative. The lower the score, the better!



HOLE	1	2	3	4	5	6	7	8	9	TOTAL
PAR	5	4	3	4	4	4	3	4	5	36
My Strokes	7	3	3	3	7	3	4	6	3	39
My Score	+2	−1	0	−1	+3	−1	+1	+2	−2	+3