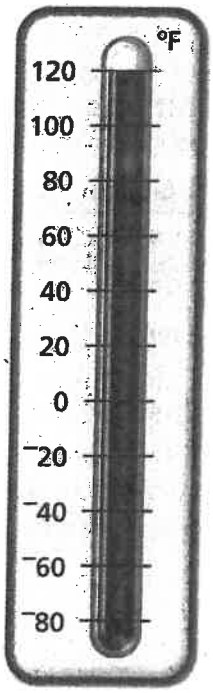
1.2 From Sauna to Snowbank

The record high and low temperatures in the United States are 134°F in Death Valley, California and ⁻80°F in Prospect Creek, Alaska. Imagine going from 134°F to ⁻80°F in an instant!

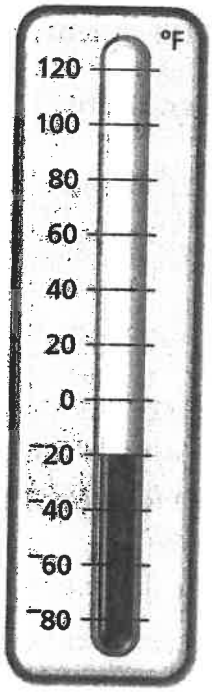
In Finland, people think that such temperature shocks are fun and good for your health. This activity is called sauna-bathing.

In the winter, Finnish people sit for a certain amount of time in sauna houses. The houses are heated as high as 120°F. Then the people run outside, where the temperature might be as low as ⁻20°F.

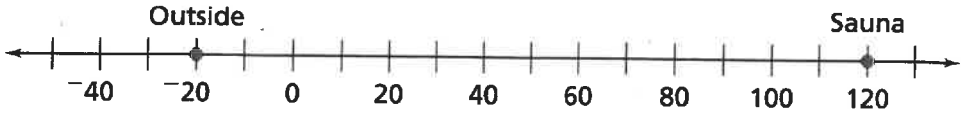
Inside the Sauna



Outside in Snow



The two thermometers shown are similar to number lines. One horizontal number line can show the same information as the two thermometers.



On the number line, a move to the left is a move in a negative direction. The numbers decrease in value. A move to the right is a move in a positive direction. The numbers increase in value. On the thermometers, a move down means the number values decrease and the temperatures get colder. A move up means the number values increase and the temperatures get hotter.

Problem 1.2 Comparing and Ordering Positive and Negative Numbers

Sketch number lines to show your reasoning.

A. Order these temperatures from least to greatest.

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

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

1. $6°F$ or $^{-}6°F$?

2. $^{-}7°F$ or $3°F$?

3. $2°F$ or $^{-}5°F$?

4. $^{-}10°F$ or $7°F$?

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

1. $0°F$ and $10°F$

2. $^{-}5°F$ and $15°F$

3. $5°F$ and $^{-}15°F$

4. $0°F$ and $^{-}20°F$

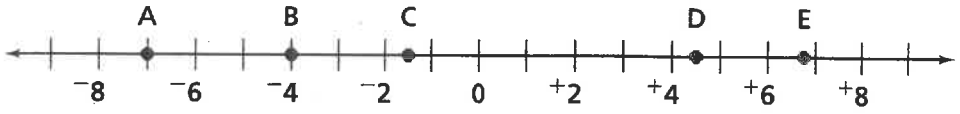
5. $^{-}8°F$ and $8°F$

6. $^{-}6°F$ and $6°F$

7. During one week, the high temperature was $60°F$. The halfway temperature was $15°F$. What was the low temperature?

D. Name six temperatures between $^{-}2°F$ and $^{+}1°F$. Order them from least to greatest.

E. 1. Estimate values for points A–E.



2. How does the number line help you find the smaller value of two numbers?

F. What are the opposites of these numbers?

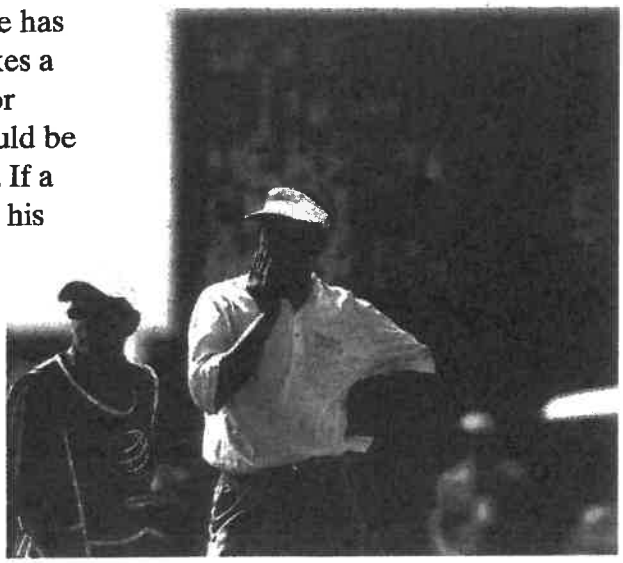
1. 3 **2.** 7.5 **3.** $^{-}2\frac{2}{3}$

4. What is the sum of a number and its opposite?

ACE Homework starts on page 16.

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, like Vijay Singh, should be able to complete a par 4 hole in four strokes. If a golfer completes the hole in six strokes, then his or her score for that hole is "two over par" ($^+2$). If a golfer completes the hole in two strokes, his or her score is "two under par" ($^-2$). A player's score for a round of golf is the total of the number of strokes above or under par.



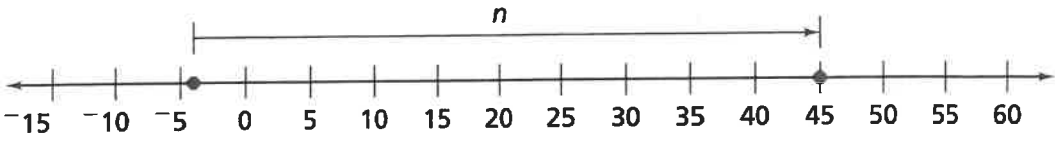
Go Online PHSchool.com **For:** Information about golf **Web Code:** ane-9031

1.3 What's the Change?

The National Weather Service keeps records of temperature changes.

> The world record for fastest rise in outside air temperature occurred in Spearfish, South Dakota, on January 22, 1943. The temperature rose from $^-4$°F to 45°F in two minutes.

What was the change in temperature over that two minutes? How could you show this change, n, on the number line?

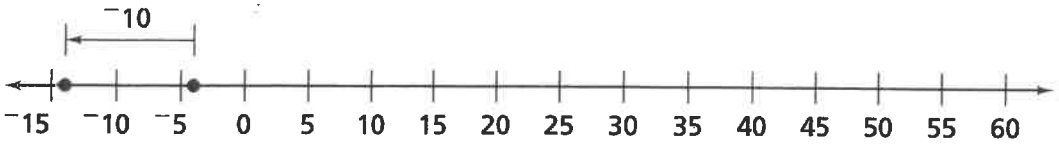


From $^-4$°F to 0°F is a change of $^+4$°F, and from 0°F to 45°F is a change of $^+45$°F. So the total change is $^+49$°F. The following number sentences show this.

$$^-4 + n = {}^+45$$
$$^-4 + {}^+49 = {}^+45$$

The sign of the change in temperature shows the direction of the change. In this case, $^+49$ means the temperature increased 49°F.

If the temperature had instead dropped 10° from $^-4$°F, you would write the change as $^-10$°F.



$$^-4 + {}^-10 = n$$
$$^-4 + {}^-10 = {}^-14$$

Problem 1.3 Using a Number Line Model

Sketch number lines and write number sentences for each question.

A. A person goes from a sauna at 120°F to an outside temperature of $^-20$°F. What is the change in temperature?

B. The temperature reading on a thermometer is 25°F. In the problems below, a positive number means the temperature is rising. A negative number means the temperature is falling. What is the new reading for each temperature change below?

1. $^+10$°F **2.** $^-2$°F **3.** $^-30$°F

C. The temperature reading on a thermometer is $^-15$°F. What is the new reading for each temperature change?

1. $^+3$°F **2.** $^-10$°F **3.** $^+40$°F

D. What is the change in temperature when the thermometer reading moves from the first temperature to the second temperature? Write an equation for each part.

1. 20°F to $^-10$°F **2.** $^-20$°F to $^-10$°F

3. $^-20$°F to 10°F **4.** $^-10$°F to $^-20$°F

5. 20°F to 10°F **6.** 10°F to 20°F

E. The temperature was $^-5$°F when Sally went to school on Monday. The temperature rose 20°F during the day, but fell 25°F during the night. A heat wave the next day increased the temperature 40°F. But an arctic wind overnight decreased the temperature 70°F! What was the temperature after the 70° decrease?

ACE Homework starts on page 16.

Applications

1. Use your algorithms to find each sum without using a calculator.

a. $^{+}12 + {}^{+}4$ **b.** $^{+}12 + {}^{-}4$ **c.** $^{-}12 + {}^{+}4$

d. $^{-}7 + {}^{-}8$ **e.** $^{+}4.5 + {}^{-}3.8$ **f.** $^{-}4.5 + {}^{+}3.8$

g. $^{-}250 + {}^{-}750$ **h.** $^{-}6{,}200 + {}^{+}1{,}200$ **i.** $^{+}0.75 + {}^{-}0.25$

j. $+\frac{2}{3} + -\frac{1}{6}$ **k.** $-\frac{5}{12} + +\frac{2}{3}$ **l.** $-\frac{8}{5} + -\frac{3}{5}$

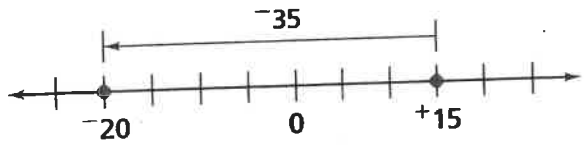
2. Find each sum.

a. $^{+}3.8 + {}^{+}2.7$ **b.** $^{-}3.8 + {}^{-}2.7$

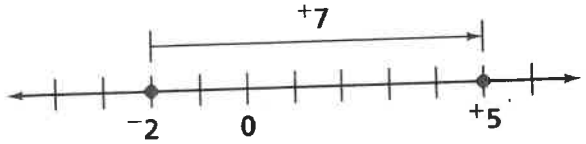
c. $^{-}3.8 + {}^{+}2.7$ **d.** $^{+}3.8 + {}^{-}2.7$

3. Write an addition number sentence that matches each diagram.

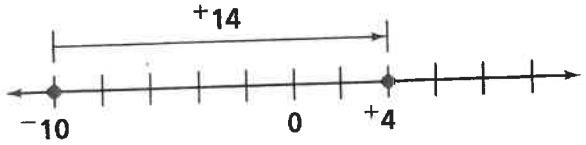
a.



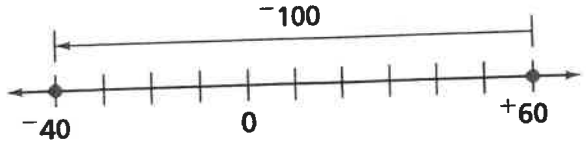
b.



c.

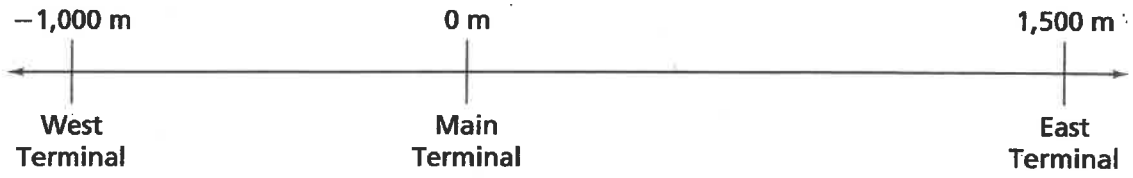


d.



Applications

1. At some international airports, trains carry passengers between the separate terminal buildings. Suppose that one such train system moves along a track like the one below.

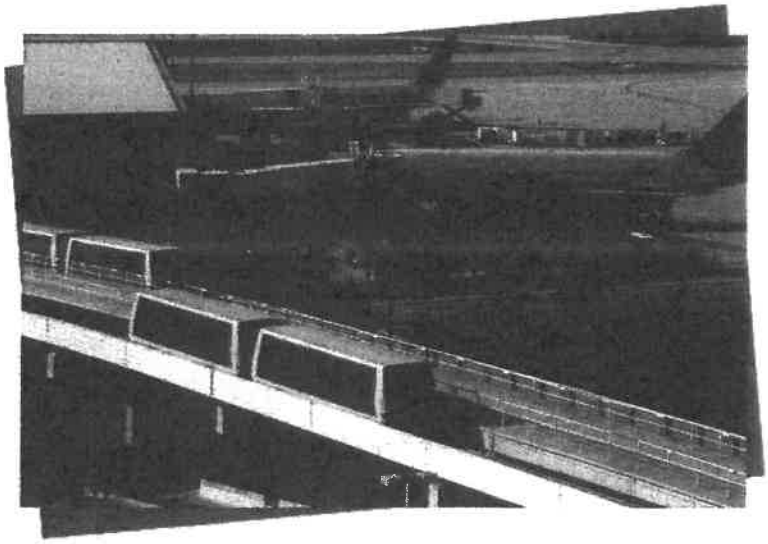


a. A train leaves the main terminal going east at 10 meters per second. Where will it be in 10 seconds? When will it reach the east terminal?

b. A train passes the main terminal going east at 10 meters per second. Where was that train 15 seconds ago? When was it at the west terminal?

c. A train leaves the main terminal going west at 10 meters per second. Where will it be in 20 seconds? When will it reach the west terminal?

d. A train passes the main terminal going west at 10 meters per second. When was it at the east terminal? Where was it 20 seconds ago?



8. Find a value for n to make each sentence true.

a. $24 \div 2 = n$ **b.** $-24 \div (-2) = n$

c. $24 \div n = -12$ **d.** $n \div 2 = -12$

e. $5 \div 2.5 = n$ **f.** $-12 \div n = 3$

g. $n \div (-3) = -4$ **h.** $-16 \div \frac{1}{4} = n$

Write four related multiplication and division facts for each set of integers.

Sample 27, 9, 3

$9 \times 3 = 27$
$3 \times 9 = 27$
$27 \div 9 = 3$
$27 \div 3 = 9$

9. 7, −3, −21 **10.** −4, −5, 20 **11.** 1.5, −3, −4.5

Without doing any calculations, determine whether each expression is greater than, less than, or equal to 0.

12. $-1{,}105.62 \div 24.3$ **13.** $0 \times (-67)$

14. $-27.5 \times (-63)$ **15.** $0 \div 89$

16. $-54.9 \div (-3)$ **17.** $-2{,}943 \times 1.06$

18. Use the algorithms you developed to find each value. Show your work.

a. $12 \cdot 9$ **b.** $5 \times (-25)$ **c.** $-220 \div (-50)$

d. $48 \div (-6)$ **e.** $-63 \div 9$ **f.** $\frac{2}{-3} \times \left(-\frac{4}{5}\right)$

g. $\frac{-99}{33}$ **h.** $-2.7 \div (-0.3)$ **i.** -36×5

j. $52.5 \div (-7)$ **k.** $-2\frac{1}{2} \times \left(-\frac{2}{3}\right)$ **l.** $9 \div 5$

m. $-9 \times (-50)$ **n.** $-\frac{96}{24}$ **o.** $6 \times 1\frac{1}{2}$

p. $-\frac{5}{8} \times \frac{8}{5}$ **q.** $4 \times \left(-1\frac{1}{4}\right)$ **r.** $-2.5 \times 2\frac{1}{5}$

Go Online
PHSchool.com
For: Multiple-Choice Skills Practice
Web Code: ana-4354

Multiple Choice **Find each value.**

19. $-24 \div 4$

A. −96 **B.** −6 **C.** 6 **D.** 96

20. $-10 \times (-5)$

F. −50 **G.** −2 **H.** 2 **J.** 50