

1.6: Subtracting Real Numbers

Ex:

$$5 - 2 = 3 \quad 5 + (-2) = 3$$

$$2 - 5 = -3 \quad 2 + (-5) =$$

$$5 - (-2) = 7 \quad 5 + (2)$$

$$-5 - 2 = -7 \quad -5 + (-2)$$

$$-5 - (-2) = -3 \quad -5 + (2)$$

$$-2 - (-5) = 3 \quad -2 + 5$$

If you don't want to do subtraction

Subtracting Two Real Numbers

If a and b are real numbers, then $a - b = a + (-b)$.

Note : $-(-2) = 2$

Ex: (p 46)

70. Much of New Orleans is below sea level. If George descends 12 feet from an elevation of 5 feet above sea level, what is his new elevation?

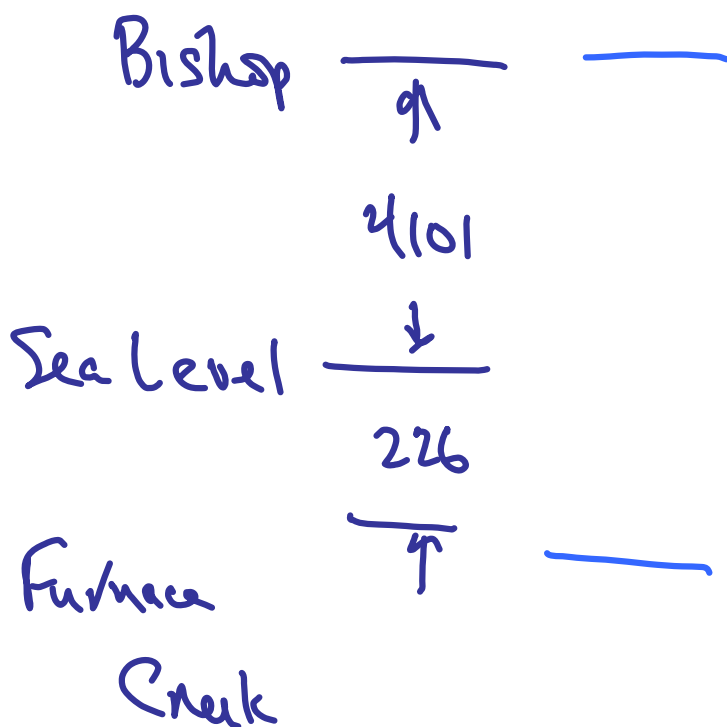

$$5 + (-12) = -7$$

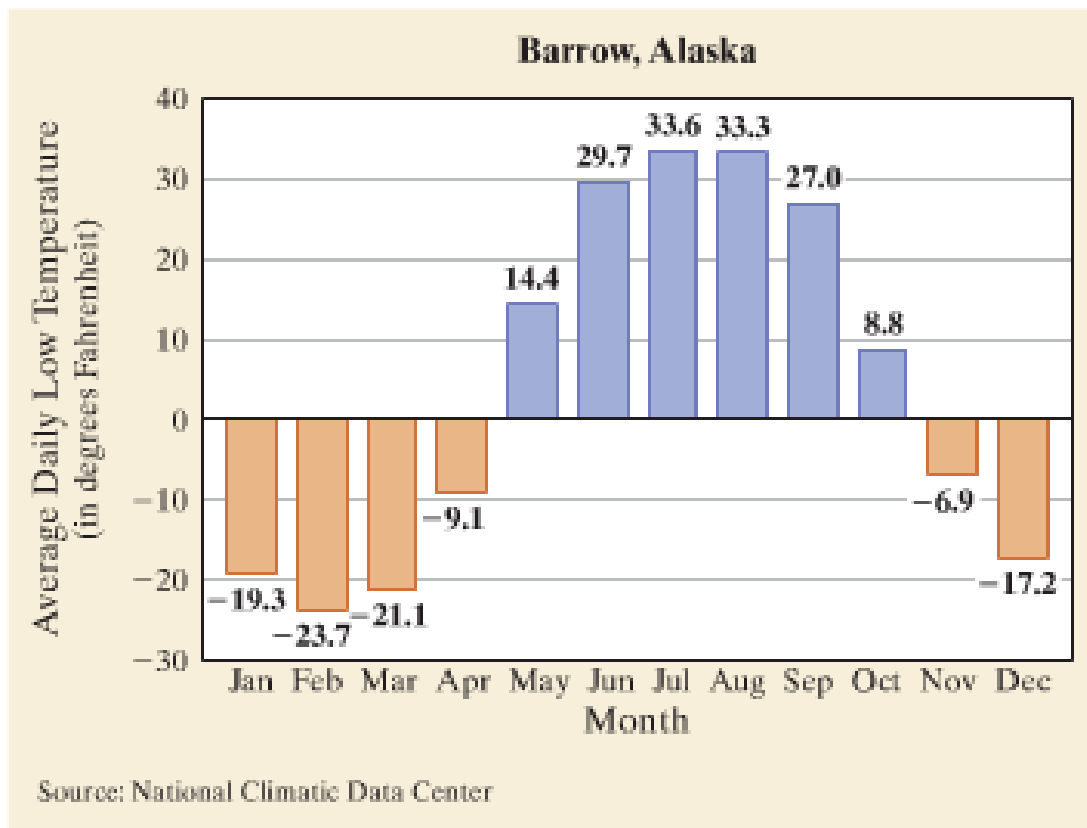
72. In some card games, it is possible to have a negative score. Lavonne Schultz currently has a score of 15 points. She then loses 24 points. What is her new score?

$$15 - 24 = 15 + (-24) = -9$$

78. The airport in Bishop, California, is at an elevation of 4101 feet above sea level. The nearby Furnace Creek Airport in Death Valley, California, is at an elevation of 226 feet below sea level. How much higher in elevation is the Bishop Airport than the Furnace Creek Airport? (*Source: National Climatic Data Center*)

$$\begin{aligned} 4101 - (-226) &= 4101 + 226 \\ &= 4327 \text{ ft.} \end{aligned}$$





90. Which month had the greatest increase in temperature?

91. Which month had the greatest decrease in temperature?

Apr - May

$$14.4 - (-9.1)$$

$$14.4 + 9.1$$

$$23.5^{\circ}$$

May - Jun

$$29.7 - 14.4 = 15.3^{\circ}$$

Sep - Oct

$$27.0 - 8.8 = 19.2$$

Oct - Nov

$$8.8 - (-6.9) = 8.8 + 6.9 =$$

1.7: Multiplying and Dividing Real Numbers

Ex:

$$2(3) = 6$$

$$2(-3) = -6$$

$$(-3) + (-3)$$

$$-2(3) = -6$$

$$(-2) + (-2) + (-2)$$

$$-2(-3) = 6$$

$$-2(-3)(-4) = -24$$

Two cases we'll get to
Same sign & Different sign

Zero as a Factor

If b is a real number, then $b \cdot 0 = 0$. Also, $0 \cdot b = 0$.

► Helpful Hint

You may have noticed from the example that if we multiply:

- an *even* number of negative numbers, the product is *positive*.
- an *odd* number of negative numbers, the product is *negative*.

Helpful Hint

Be careful when identifying the base of an exponential expression.

$(-3)^2$	-3^2
Base is -3	Base is 3
$(-3)^2 = (-3)(-3) = 9$	$-3^2 = -(3 \cdot 3) = -9$

EX: $4^2 = 16$

$$-4^2 = -16$$

$$\begin{aligned} &(-4)^2 \\ &(-4)(-4) \\ &16 \end{aligned}$$

$$-2^3$$

$$-8$$

$$(-2)^3 = (-2)(-2)(-2)$$

$$= -8$$

Additive Inverse

The additive inverse of 6 is -6 .

Reciprocals or Multiplicative Inverses

Two numbers whose product is 1 are called reciprocals or multiplicative inverses of each other.

The multiplicative inverse
(reciprocal) of

6	is	$\frac{1}{6}$	$\frac{3}{7}$	$\frac{7}{3}$
8		$\frac{1}{8}$	-4	$-\frac{1}{4}$
$\frac{2}{3}$		$\frac{3}{2}$	$-\frac{6}{7}$	$-\frac{7}{6}$
$\frac{1}{4}$		4	0	none

Quotient of Two Real Numbers

If a and b are real numbers and b is not 0, then

$$a \div b = \frac{a}{b} = a \cdot \frac{1}{b}$$

Multiplying and Dividing Real Numbers

1. The product or quotient of two numbers with the *same* sign is a positive number.
2. The product or quotient of two numbers with *different* signs is a negative number.

$$2(-3) = -6$$

$$\frac{6}{-2} = -3$$

$$\frac{1}{4} \left(\frac{2}{3} \right) = \frac{2}{12} = \frac{1}{6}$$

(Note: A blue arrow points from the first equation to the second.)

$$\frac{1}{4} \left(\frac{2}{3} \right) = \frac{\frac{1}{4}}{2} \left(\frac{2}{3} \right) = \frac{1}{6}$$

(Note: A green arrow points from the first equation to the second.)

$$\frac{3}{4} \left(-\frac{4}{5} \right) = -\frac{3}{5}$$

(Note: Orange markings show cancellation of 4 and 4, and a vertical line under the 4 in the denominator.)

Zero as a Divisor or Dividend

1. The quotient of any nonzero real number and 0 is undefined. In symbols, if $a \neq 0$, $\frac{a}{0}$ is **undefined**.
2. The quotient of 0 and any real number except 0 is 0. In symbols, if $a \neq 0$, $\frac{0}{a} = 0$.

$$\frac{6}{0} = \text{undefined} \quad \frac{0}{6} = 0$$

Ex:

$$\left(1\frac{1}{2}\right)\left(3\frac{1}{4}\right)$$

$$\left(\frac{3}{2}\right)\left(\frac{13}{4}\right)$$

$$\frac{39}{8} \quad \text{or} \quad 4\frac{7}{8}$$

Note

$$1\frac{1}{2} = \frac{2 \cdot 1}{2 \cdot 1} + \frac{1}{2}$$
$$\frac{2}{2} + \frac{1}{2}$$
$$3\frac{1}{2}$$

$$\left(3\frac{1}{2}\right)(4) = \left(\frac{7}{2}\right)\left(\frac{4}{1}\right) = 14$$

Test - Next Thursday

Ex: (p 56)

If $x = -5$ and $y = -3$, evaluate each expression.

104. $4x + 5y$

110. $\frac{2y - 12}{x - 4}$

114. At the end of the third quarter of 2006, General Motors reported a net loss of \$115 million. If this continued, what would General Motor's income be after four more quarters?
(Source: General Motors)

116. Is -4 a solution of $2x = x - 1$?

120. Is -4 a solution of $2x + 4 = x + 8$?

Write each of the following as an expression and evaluate.

132. The sum of 1 and the product of -8 and -5

134. 7 subtracted from the quotient of 0 and 5

1.8: Properties of Real Numbers

Commutative Properties

Addition: $a + b = b + a$

Multiplication: $a \cdot b = b \cdot a$

Associative Properties

Addition: $(a + b) + c = a + (b + c)$

Multiplication: $(a \cdot b) \cdot c = a \cdot (b \cdot c)$

Distributive Property of Multiplication Over Addition

$$a(b + c) = ab + ac$$

Identities for Addition and Multiplication

0 is the identity element for addition.

$$a + 0 = a \quad \text{and} \quad 0 + a = a$$

1 is the identity element for multiplication.

$$a \cdot 1 = a \quad \text{and} \quad 1 \cdot a = a$$

Additive or Multiplicative Inverses

The numbers a and $-a$ are additive inverses or opposites of each other because their sum is 0; that is,

$$a + (-a) = 0$$

The numbers b and $\frac{1}{b}$ (for $b \neq 0$) are reciprocals or multiplicative inverses of each other because their product is 1; that is,

$$b \cdot \frac{1}{b} = 1$$

Ex: (p 63)

Simplify

36. $5(7 + 8y)$

38. $3(8x - 1)$

40. $2(x + 5)$

42. $-3(z - y)$

44. $-5(2r + 11)$

52. $-(q - 2 + 6r)$

56. $-\frac{1}{5}(10a - 25b)$

60. $-11(5x + 3) + 10$

