1-3 Add and Subtract Real Numbers

Objective To model addition of signed numbers on a number line • To apply rules for adding and subtracting signed numbers

An oil well has been dug to a depth of 1.7 miles. Additional drilling makes the well 1.2 miles deeper. What signed number expresses the final depth of the well?

To find the signed number, add: $-1.7 + (-1.2)$

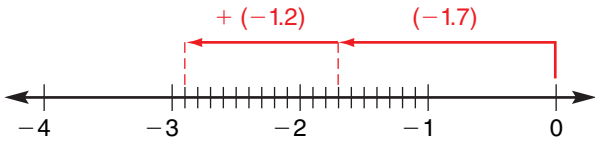
First estimate by rounding to the nearest integer: $-1.7 + (-1.2) \approx -3$

Think
$-2 + (-1) = -3$

Then add the actual numbers.

▶ You can add signed numbers by using a number line.

- Start at 0.
- Move *left* for negative numbers. Move *right* for positive numbers.



▶ Add signed numbers the same way you add integers.

Add with Like Signs

Add: $-1.7 + (-1.2)$

Align the decimal points.

$$\begin{array}{r} -1.7 \\ +\ -1.2 \\ \hline \end{array} \quad \begin{array}{r} |-1.7| \\ +\ |-1.2| \\ \hline \end{array} \quad \begin{array}{r} 1.7 \\ +\ 1.2 \\ \hline 2.9 \end{array}$$

So $-1.7 + (-1.2) = -2.9$ ← Both addends are negative. The sum is negative.

Key Concept

Adding Signed Numbers

To add signed numbers with like signs:

- Add their absolute values.
- Use the sign of the addends for the sum.

To add signed numbers with unlike signs:

- Subtract the lesser absolute value from the greater absolute value.
  $|\text{greater}| - |\text{lesser}|$
- Use the sign of the addend with the greater absolute value for the sum.

The final depth of the well is 2.9 miles (-2.9).

Think
-2.9 is close to the estimate of -3. The answer is reasonable.

Add with Unlike Signs

Add: $1\frac{7}{8} + \left(-3\frac{2}{3}\right)$

First estimate by rounding: $1\frac{7}{8} + \left(-3\frac{2}{3}\right) \approx -2$

Think
$2 + (-4) = -2$

Then add the actual numbers.

$1\frac{7}{8} + \left(-3\frac{2}{3}\right) \rightarrow \left|-3\frac{2}{3}\right| - \left|1\frac{7}{8}\right| = 3\frac{2}{3} - 1\frac{7}{8}$ ← $\left|-3\frac{2}{3}\right| > \left|1\frac{7}{8}\right|$ Subtract $1\frac{7}{8}$ from $3\frac{2}{3}$.

$= 3\frac{16}{24} - 1\frac{21}{24}$ ← Rename the fractions using the LCD, 24.

$= 2\frac{40}{24} - 1\frac{21}{24} = 1\frac{19}{24}$ ← Regroup $3\frac{16}{24}$ as $2\frac{40}{24}$.

So $1\frac{7}{8} + \left(-3\frac{2}{3}\right) = -1\frac{19}{24}$ ← The addend with the greater absolute value is negative. The sum is negative.

Think
$-1\frac{19}{24}$ is close to the estimate of -2. The answer is reasonable.

Subtract signed numbers the same way you subtract integers. Use the Subtraction Principle.

Key Concept

Subtraction Principle

To subtract any signed number, add its opposite.

Subtract with Like Signs

Subtract: $-20.2 - (-7.33)$

First estimate by rounding: $-20.2 - (-7.33) \approx 13$

Think
$-20 - (-7) = -13$

Then subtract the actual numbers.

Align the decimal points.

$$\begin{array}{r} -20.2 \\ -\ \ -7.33 \\ \hline \end{array}$$

Add the opposite of the subtrahend.

$$\begin{array}{r} -20.2 \\ +\ \ \ 7.33 \\ \hline \end{array}$$

Apply the rule for adding with unlike signs.

$$\begin{array}{r} |-20.2| \\ -\ \ |7.33| \\ \hline \end{array} \rightarrow \begin{array}{r} 20.20 \\ -\ \ 7.33 \\ \hline 12.87 \end{array}$$

$-20.2 - (-7.33) = -12.87$ ← The addend with the greater absolute value is negative. The sum is negative.

So $-20.2 - (-7.33) = -12.87$.

Think
-12.87 is close to the estimate of -13. The answer is reasonable.

Subtract with Unlike Signs

Find the difference: $2\frac{5}{6} - \left(-4\frac{1}{3}\right)$

First estimate by rounding: $2\frac{5}{6} - \left(-4\frac{1}{3}\right) \approx 7$

Think
$3 - (-4) = 7$

Then subtract the actual numbers.

$2\frac{5}{6} - \left(-4\frac{1}{3}\right) = 2\frac{5}{6} + 4\frac{1}{3}$ ← Add the opposite of the subtrahend.

$\left|2\frac{5}{6}\right| + \left|-4\frac{1}{3}\right| = 2\frac{5}{6} + 4\frac{2}{6} =$ ← Add the numbers in absolute value. Rename the fractions using the LCD, 6.

$= 6\frac{5+2}{6} = 6\frac{7}{6}$ ← Add the integers. Then add the fractions.

$= 6 + 1\frac{1}{6} = 7\frac{1}{6}$ ← Rename the sum.

$2\frac{5}{6} + 4\frac{1}{3} = 7\frac{1}{6}$ ← Both addends are positive. The sum is positive.

So $2\frac{5}{6} - \left(-4\frac{1}{3}\right) = 7\frac{1}{6}$.

Think
$7\frac{1}{6}$ is close to the estimate of 7. The answer is reasonable.

Try These

Add or subtract. Watch for the signs.

1. $8.4 + (-12.63)$

2. $-4.93 + \frac{1}{4}$

3. $-6.34 - (-10.4)$

4. $7.54 - 8.4 - 4$

5. $-2\frac{1}{9} + \left(-7\frac{1}{3}\right)$

6. $\frac{1}{2} - \left(-5\frac{1}{2}\right)$

7. $-2\frac{3}{5} - \left(-1\frac{1}{10}\right) - \frac{2}{5}$

8. $-6.2 - (-1.1) + 6.41$

9. Discuss and Write How would you model $2\frac{3}{4} + 1\frac{1}{2} - \left(-2\frac{1}{4}\right)$ on a number line?

Go to PRACTICE BOOK Lesson 1-3 for exercise sets.