

**Unit 1A Study Guide: Absolute Value, Addition and Subtraction with Rational Numbers**

Absolute Value	
<p>Integers less than zero are <b>negative integers</b>. Integers greater than zero are <b>positive integers</b>.</p> <div style="text-align: center; margin: 10px 0;"> </div> <p>The <b>absolute value</b> of an integer is the distance the number is from zero on a number line. Two vertical bars are used to represent absolute value. The symbol for absolute value of 3 is <math> 3 </math>.</p>	<p><b>Evaluate each expression.</b></p> <p>1. <math> 12  = 12</math>      2. <math>- -150  = -150</math></p> <p>3. <math> -8  + 2 = 10</math>      4. <math> 6  +  5  = 11</math></p> <p>5. <math> -19  - 17 = 2</math>      6. <math> 84  -  -62  = 22</math></p>

Integer Operations – Add Integers			
<p>To <b>add integers with the same sign, add their absolute values</b>. The sum is:</p> <ul style="list-style-type: none"> <li>• positive if both integers are positive.</li> <li>• negative if both integers are negative.</li> </ul> <p>To <b>add integers with different signs, subtract their absolute values</b>. The sum is:</p> <ul style="list-style-type: none"> <li>• positive if the positive integer's absolute value is greater.</li> <li>• negative if the negative integer's absolute value is greater.</li> </ul>	<p><b>Example 1</b> Find <math>4 + (-6)</math>.</p> <p>Use a number line.</p> <ul style="list-style-type: none"> <li>• Start at 0.</li> <li>• Move 4 units right.</li> <li>• Then move 6 units left.</li> </ul> <div style="text-align: center; margin-top: 10px;"> <p><math>4 + (-6) = -2</math></p> </div>	<p><b>Example 2</b> Find <math>-2 + (-3)</math>.</p> <p>Use a number line.</p> <ul style="list-style-type: none"> <li>• Start at 0.</li> <li>• Move 2 units left.</li> <li>• Move another 3 units left.</li> </ul> <div style="text-align: center; margin-top: 10px;"> <p><math>-2 + (-3) = -5</math></p> </div>	
7) $-10 + 9 = -1$	8) $-2 + 8 = 6$	9) $-5 + (-9) = -14$	10) $-6 + 7 = 1$
11) <b>Write an addition expression to describe the situation. Then find the sum.</b> You owe Mr. Diaz \$20 and then borrow \$13 more. $-20 + (-13) = -33$		12) <b>Write an addition expression to describe the situation. Then find the sum.</b> A team gains 20 yards. Then they lose 7 yards. $20 + (-7) = 13$	

### Integer Operations – Subtract Integers

**Subtraction** of integers is just **adding the opposite**.  
**Change** your problem to an **addition** problem and then follow **addition rules**.

Subtraction  
 Means  
 Add  
 The  
 Opposite

**Example 1**  
**Find  $6 - 9$ .**

$$6 - 9 = 6 + (-9) \\ = -3$$

To subtract 9, add -9.  
 Simplify.

**Example 2**  
**Find  $-10 - (-12)$ .**

$$-10 - (-12) = -10 + 12 \\ = 2$$

To subtract -12, add 12.  
 Simplify.

13)  $4 - (-8) = 12$

14)  $4 - 7 = -3$

15)  $0 - 7 = -7$

16)  $0 - (-4) = 4$

17) **Write a subtraction expression to describe the situation. Then find the difference.**  
 Your checking account is overdrawn by \$50. You write a check for \$20. What is the balance in your account?

$$-50 - 20 = -30$$

18) **Write a subtraction expression to describe the situation. Then find the difference.**  
 The average temperature in Calgary, Canada, is  $22^{\circ}\text{C}$  in July and  $-11^{\circ}\text{C}$  in January.

$$22 - (-11) = 33^{\circ}$$

### Operations with Fractions – Add and Subtract Fractions

**To add or subtract mixed numbers:**

- Add or subtract the fractions. Rename using the **LCD** if necessary.
- Then, **add or subtract** the whole numbers.
- **Simplify** if necessary.

**Example 1**

Find  $6\frac{1}{10} + 2\frac{3}{10}$ . Write in simplest form.

$$\begin{array}{r} 6\frac{1}{10} \\ + 2\frac{3}{10} \\ \hline 8\frac{4}{10} \text{ or } 8\frac{2}{5} \end{array}$$

Add the whole numbers and the fractions separately.

Simplify.

**Example 2**

Find  $8\frac{2}{3} - 6\frac{1}{2}$ .

$$\begin{array}{r} 8\frac{2}{3} \rightarrow 8\frac{4}{6} \\ - 6\frac{1}{2} \rightarrow 6\frac{3}{6} \\ \hline 2\frac{1}{6} \end{array}$$

Rename the fractions using the LCD.

Subtract.

$$-3\frac{4}{6} + 2\frac{3}{6} =$$

19) $-1\frac{3}{5} + 4\frac{1}{5}$ $-\frac{8}{5} + \frac{21}{5} = \frac{13}{5} = 2\frac{3}{5}$	20) $-3\frac{2}{3} + (-2\frac{1}{2})$ $-5\frac{7}{6} = -6\frac{1}{6}$	21) $-2\frac{5}{6} - 1\frac{1}{6}$ $-2\frac{5}{6} + -1\frac{1}{6} = -4$	22) $5\frac{3}{4} - (-3\frac{1}{2})$ $5\frac{3}{4} + 3\frac{2}{4} = 8\frac{5}{4} = 9\frac{1}{4}$
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23) Mr. and Mrs. Simpson went to two movies. The first movie lasted  $2\frac{1}{3}$  hours and the second one lasted  $1\frac{4}{5}$  hours. How much longer was the first than the second movie?

$$2\frac{1}{3} - 1\frac{4}{5} \rightarrow \frac{35}{15} + (-\frac{27}{15}) = \frac{8}{15}$$

$$2\frac{5}{15} - 1\frac{12}{15}$$

24) Rodrick and Valentina drove to the coast. Rodrick drove  $38\frac{9}{10}$  miles. Then Valentina drove the last  $51\frac{3}{5}$  miles. How far did they drive to the coast?

$$38\frac{9}{10} + 51\frac{3}{5}$$

$$38\frac{9}{10} + 51\frac{6}{10} = 89\frac{15}{10} = 90\frac{1}{2}$$

### Operations with Decimals - Add and Subtract Decimals

If you know how to add and subtract whole numbers, then you can add and subtract decimals! Just be sure to **line up the terms** so that all the decimal points are in a vertical line.

$$\begin{array}{r} 45.12 \\ + 3.71 \\ \hline 48.83 \end{array}$$

$$\begin{array}{r} 48.18 \\ - 3.01 \\ \hline 45.17 \end{array}$$

25) $-25.13 + 10.6$ $\begin{array}{r} 25.13 \\ - 10.60 \\ \hline 14.53 \end{array}$ $= -14.53$	26) $-4.2 + (-1.9)$ $\begin{array}{r} 4.2 \\ 1.9 \\ \hline 6.1 \end{array}$ $= -6.1$	27) $-21.2 - (-14.6)$ $-21.2 + 14.6$ $\begin{array}{r} 21.2 \\ - 14.6 \\ \hline 6.6 \end{array}$ $= -6.6$	28) $7.9 - (-9.42)$ $7.9 + 9.42$ $\begin{array}{r} 7.90 \\ + 9.42 \\ \hline 17.32 \end{array}$ $= 17.32$
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### Adding and Subtracting Rational Numbers

<p>1) <math>-5.6 + (-9.72)</math></p> $\begin{array}{r} 5.60 \\ + 9.72 \\ \hline 15.32 \end{array}$ <p><math>= -15.32</math></p>	<p>2) <math>-7.79 + 9.55</math></p> $\begin{array}{r} 89.14 \\ - 7.79 \\ \hline 1.76 \end{array}$ <p><math>= 1.76</math></p>
<p>3) <math>18 - (-22.45)</math></p> $18 + 22.45 = 40.45$	<p>4) <math>-\frac{2}{3} - \frac{1}{8}</math></p> $-\frac{16}{24} + \left(-\frac{3}{24}\right) = \frac{-19}{24}$
<p>5) <math>-2\frac{3}{4} - (-1\frac{4}{5})</math></p> $-\frac{2 \times 15}{20} + \frac{16}{20}$ $-\frac{55}{20} + \frac{46}{20} = \frac{-9}{20}$	<p>6) <math>3\frac{1}{3} + (-\frac{5}{6})</math></p> $3\frac{2}{6} + \left(-\frac{5}{6}\right)$ $\frac{20}{6} + \left(\frac{-5}{6}\right) = \frac{15}{6} = 2\frac{1}{2}$
<p>7) <math>-209 + 987</math></p> $\begin{array}{r} 987 \\ - 209 \\ \hline 778 \end{array}$ <p><math>= 778</math></p>	<p>8) <math>-566 + (-455)</math></p> $\begin{array}{r} 566 \\ + 455 \\ \hline 1021 \end{array}$ <p><math>= -1,021</math></p>
<p>9) Apply properties to solve <math>\left(-\frac{1}{8} + \frac{2}{5}\right) + 3\frac{3}{5}</math></p> $-\frac{5}{40} + \frac{16}{40} = \frac{11}{40}$ $\frac{11}{40} + 3\frac{24}{40} = 3\frac{35}{40} = 3\frac{7}{8}$	<p>10) Apply properties to solve <math>-\frac{2}{3} + 5 - 3\frac{1}{3}</math></p> $-\frac{2}{3} + \frac{15}{3} = \frac{13}{3} - \frac{10}{3} = \frac{3}{3} = 1$

### Problem Solving Problem Solving

1) For a negative number,  $x$ , is the absolute value of  $x$  a positive number or a negative number? Explain.

$$|-x| = x$$

Absolute value is the distance from zero which makes it positive.

2) Identify whether each statement below is true or false:

- If a number is a positive integer, then the number is a whole number. yes
- If a number is negative, then its absolute value is negative. no
- If a number is positive, then its opposite is positive. no

3) Without actually adding, how can you tell if the sum of two numbers will be zero? Give an example.

Any two opposite numbers will have a sum of zero.

4) The surface temperature of Neptune is about  $-218^{\circ}\text{C}$ . There is evidence of ice water on Neptune. The melting temperature of water is  $0^{\circ}\text{C}$ . By how much must the surface temperature of Neptune change to melt any ice to water? Justify your reasoning.

Increase  $218^{\circ}\text{C}$  to reach the melting point of  $0^{\circ}\text{C}$ .

5) In four plays a football team gains 3 yards, loses 7 yards, loses 2 yards, and gains 15 yards. How many yards did the team gain or lose after four plays?

$$3 - 7 - 2 + 15$$

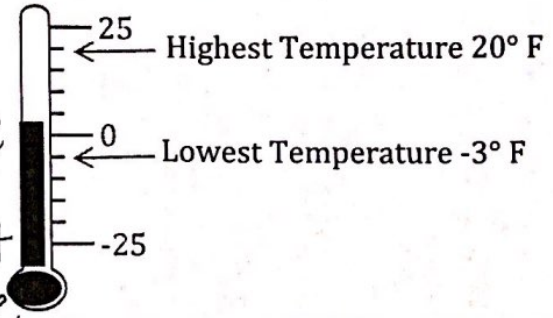
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$$-4 - 2$$

$$-6 + 15 = 9 \text{ yard gain}$$

6) The thermometer shows the high and low temperatures in Katherine's town one day last month. Write a numbers sentence that shows the difference between the highest and lowest temperatures on that day? Solve.

$$20 - (-3) = 23^\circ \text{ difference in highest and lowest temperature}$$



7) A shark swimming 600 feet below the surface of the water spots a fish and rises 200 feet. After eating the fish he dives down an additional 300 feet. Where is the shark now in relation to the surface of the water? Justify.

$$-600 + 200 + (-300)$$

$$-400 + (-300) = -700 \text{ ft}$$

5) Alex received his graded math test with the question  $(-6 - 8)$  marked wrong. Identify Alex's mistake and correct it.

Original Problem	Alex's Work
$-6 - 8 =$	$-6 - 8 = -6 + 8 = 2$

He did not keep, flip, change to make the 8 negative. He should have done  $-6 + (-8)$  which is  $-14$ .