

## STUDY GUIDE: OPERATIONS ON RATIONAL NUMBERS AND SOLVING EQUATIONS

**Instructions:** Please review this study guide for more information on the skills and techniques that are going to be required in order to successfully complete our unit assessment on Wednesday November 16. There are questions that should be answered and submitted on Tuesday November 15 before we take our test.

### RULES FOR ADDITION AND SUBTRACTION

**Remember your Rules!!**

#### Adding Numbers with the Same Sign

Add the absolute values and use the common sign

#### Adding Numbers with Different Signs

Subtract the absolute values and use the sign of the number with the larger absolute value

**Subtracting** a number is the same as **ADDING THE ADDITIVE INVERSE**.

*Examples:*

$$-6 - 8 = -6 + (-8) = -14$$

$$4 - (-6) = 4 + 6 = 10$$

Add the additive inverse of 8, which is -8!

### RULES FOR MULTIPLICATION AND DIVISION

When you multiply or divide integers with the **SAME SIGN**, the result is **POSITIVE**

*Examples:*

$$12 \times 5 = 60$$

$$-63 \div (-7) = 9$$

When you multiply or divide integers with **DIFFERENT SIGNS**, the result is **NEGATIVE**

*Examples:*

$$\frac{45}{-9} = -5$$

Think about rules involving negatives AND parentheses:

*Example:*  $-3(-4 \times -2) \rightarrow$  multiply the numbers inside the parentheses first...

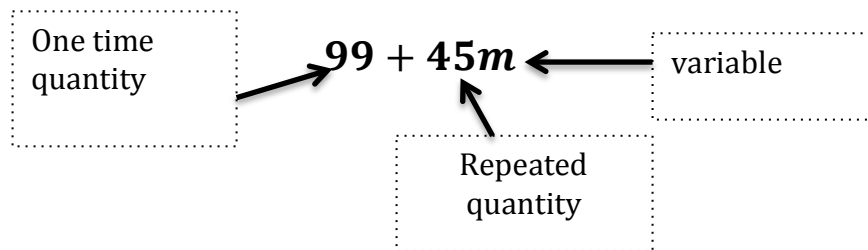
$$-3 \times 8 = -24.$$

## WRITING AND EVALUATING EXPRESSIONS

**Be careful when translating from a word problem to a math expression.**

- Identify the variable as the unknown quantity.
- Identify the quantity that is repeated and the quantity that's not repeated.

*Example:* An individual membership at the El Camino YMCA is \$45 each month, but you need to pay a registration fee of \$99.00. Write an expression that represents how much you will pay for any number of months.

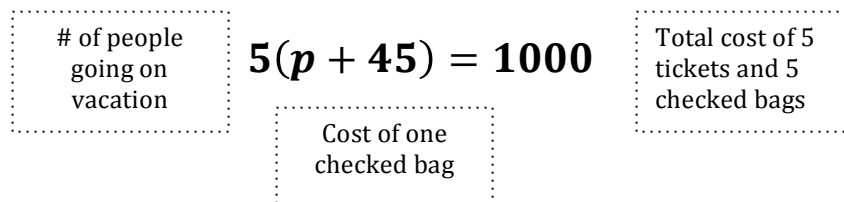



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### Recognize other structures for equations!!

- Do you need parentheses to create your expression?
- What are the important quantities?

*Example:* A family of 5 is going on vacation. They each need their own plane ticket. Everyone also needs to check a bag for \$45 each bag. Their total cost is \$1000.00 for transportation costs to their destination. How much does a plane ticket cost?




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### Look for Equivalent Expressions

- Distribute the terms outside parentheses to the term inside parentheses.
- Find a common factor in the terms you're given.

Example: how else can we write the following expression:

$$\begin{aligned}
 & \mathbf{6x - 90} \\
 & 6(x - 15) \\
 & 3(2x - 30) \\
 & 2(3x - 45) \\
 & 4x + 2x - 90
 \end{aligned}$$

## SOLVING EQUATIONS USING IF-THEN MOVES

<p style="text-align: center;"><b><u>Addition Property of Equality</u></b></p> <p style="text-align: center;">If <math>a = b</math>, then <math>a + c = b + c</math></p> <p><i>Examples:</i></p> <p style="text-align: center;">If <math>x - 2 = 7</math>, then <math>x - 2 + 2 = 7 + 2</math></p>	<p style="text-align: center;"><b><u>Subtraction Property of Equality</u></b></p> <p style="text-align: center;">If <math>a = b</math>, then <math>a - c = b - c</math></p> <p><i>Examples:</i></p> <p style="text-align: center;">If <math>x + 3 = 18</math>, then <math>x + 3 - 3 = 18 - 3</math></p>
<p><b><u>Use the Addition and Subtraction Properties to MAKE 0!</u></b> <b><u>When SOLVING EQUATIONS!</u></b></p>	

<p style="text-align: center;"><b><u>Multiplication Property of Equality</u></b></p> <p style="text-align: center;">If <math>a = b</math>, then <math>a \times c = b \times c</math></p> <p><i>Examples:</i></p> <p style="text-align: center;">If <math>\frac{2x}{3} = 6</math>,</p> <p style="text-align: center;">then <math>\frac{3}{2} \left( \frac{2x}{3} \right) = \frac{3}{2} (6)</math></p>	<p style="text-align: center;"><b><u>Division Property of Equality</u></b></p> <p style="text-align: center;">If <math>a = b</math> (and <math>c \neq 0</math>), then <math>\frac{a}{c} = \frac{b}{c}</math></p> <p><i>Examples:</i></p> <p style="text-align: center;">If <math>3x = 12</math>, then <math>\frac{3x}{3} = \frac{12}{3}</math></p>
<p><b><u>Use the multiplication and division properties to MAKE 1!</u></b> <b><u>When SOLVING EQUATIONS!</u></b></p>	

## TAPE DIAGRAMS AND GENERAL TIPS FOR TEST TAKING

<ul style="list-style-type: none"> <li>➤ Use tape diagrams where appropriate!</li> <li>➤ Always ask yourself: Is this a reasonable answer?</li> <li>➤ Think to yourself: Does this make sense?</li> <li>➤ If at all possible, make a visual representation of your problem DRAW A PICTURE!!             <ul style="list-style-type: none"> <li>○ A tape diagram</li> <li>○ Picture</li> <li>○ Chart</li> <li>○ Number line, etc.</li> </ul> </li> </ul>
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**Complete ALL problems and turn in on November 15, 2016.**

Rewrite each of the expressions **at least 2** additional ways. An example is provided for you. **NOTE: Answers will vary, below are just a few of the possible answers.**

<p><u>Example:</u></p> $8x + 12y$ <p>Additional Ways:</p> $4(2x + 3y)$ $2(4x + 6y)$ $6x + 2x + 12y$ $8(x + y) + 4y$	$5a + 35$ $5(a + 7)$ $2a + 3a + 35$
$14a + 21b + 28$ $7(2a + 3b + 4)$ $14(a + 2) + 21b$	$4(x + 15)$ $4x + 60$ $2(2x + 30)$
$6p + 6s$ $6(p + s)$ $3(2p + 2s)$ $2(3p + 3s)$	$2y + 3y + 20$ $5y + 20$ $5(y + 4)$

**Write a math expression that represent the situation described.**

<p><u>Example:</u> The length of a piece of a graph paper is 2.5 times its width. Write an expression that represents the perimeter of the paper.</p> $w = \text{width}$ $2.5w = \text{length}$ $\text{Perimeter} = 2l + 2w$ <p>So, Perimeter of paper equals:</p> $2(2.5w) + 2w = 5w + 2w$	<p>A football field is 2 times as long as it wide. Write an expression to express the perimeter of the football field.</p> <p>Perimeter is distance around.</p> $w = \text{width}$ $2w = \text{length}$ $\text{Perimeter} = 2(\text{length}) + 2(\text{width})$ $2(2w) + 2w = 6w$
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At WingStop, the cost of their soda fountain is \$100. The paper cups cost \$0.15 each and the soda syrup itself cost \$0.10. They charge \$2.00 for each cup of soda they sell. Write an expression that would determine WingStop's profit on soda.

The profit would be the difference between what Wingstop pays and what they charge...so if

$$c = \text{cups of soda sold,} \\ \text{then the profit is as follows:} \\ 2.00c - 0.15c - 0.10c - 100$$

this means that Wingstop won't make a profit until after they make up for the cost of the soda fountain itself.

Annie's Bakery sells cupcakes for \$3 each. Before she can sell any cupcakes, she buys equipment (a one time cost) worth \$50. She also spends \$1 per cupcake on ingredients. Write an expression that will determine how much money Annie will make from selling cupcakes.

Similar to the Wingstop, Annie needs to sell cupcakes to pay for her equipment before she can turn a profit. Her expression is as follows:

$$c = \text{cupcakes sold}$$

$$3c - 1c - 50$$

Solve each of the following problems using if-then moves.

$$\frac{2}{5}x - 1 = 13$$

$$\frac{2}{5}x - 1 + 1 = 13 + 1$$

$$\frac{2}{5}x = 14$$

$$\frac{5}{2} \left( \frac{2}{5}x \right) = \frac{5}{2} (14)$$

$$x = 35$$

$$-2x + 13 = -3$$

$$-2x + 13 - 13 = -3 - 13$$

$$-2x = -16$$

$$\frac{-2x}{-2} = \frac{-16}{-2}$$

$$x = 8$$

$3(x - 6) = 15$ $3x - 18 = 15$ $3x - 18 + 18 = 15 + 18$ $3x = 33$ $\frac{3x}{3} = \frac{33}{3}$ $x = 11$	$\frac{3}{4}(3x + 1) = 12$ $\frac{4}{3} \left[ \frac{3}{4}(3x + 1) \right] = \frac{4}{3}(12)$ $3x + 1 = 16$ $3x + 1 - 1 = 16 - 1$ $3x = 15$ $\frac{3x}{3} = \frac{15}{3}$ $x = 5$
<p>For a week (7 days) over winter break, Rod swam the same distance twice a day in the morning and in the afternoon. Each morning, he swam 2,500 yards, and for the entire week, he swam 45,500 yards. How many yards did he swim each afternoon?</p> <p>Let <math>s</math> be the distance Rod swims in the afternoon.</p> $7(2500 + s) = 45,500$ $17,500 + 7s = 45,500$ $17,500 + 7s - 17,500 = 45,500 - 17,500$ $7s = 28,000$ $\frac{7s}{7} = \frac{28,000}{7}$ $s = 4,000$ <p>Rod swam 4,000 yards each afternoon.</p>	<p>Riley already had \$80 in his bank account. For his birthday, he received cash from each of his 7 uncles/aunts. After he deposited all of these gifts, and wrote his thank you notes, he had \$332 in his account. How much did each of his uncles/aunts give him?</p> <p>Let <math>g</math> be the amount of each gift from his aunt and uncle.</p> $7g + 80 = 332$ $7g + 80 - 80 = 332 - 80$ $7g = 252$ $\frac{7g}{7} = \frac{252}{7}$ $g = 36$ <p>Each of Riley's aunts and uncles gave him \$36 for his birthday.</p>

Baby use lots of diaper. When he was a newborn, Max needed 28 diapers his first week and then after that, he only needed 22 diapers. How many weeks did it take his family to get through their first jumbo pack of 226 diapers?

Let  $d$  be the number of weeks Max used 22 diapers.

$$28 + 22s = 226$$

$$28 + 22s - 28 = 226 - 28$$

$$22s = 198$$

$$\frac{22s}{22} = \frac{198}{22}$$

$$s = 9$$

Max will be covered for 10 weeks with those diapers (because he used 28 in the first week)

Madison bought a plant on Monday and measured it—it was 2 feet tall. Each Monday after that, she measured the plant, it had grown exactly 3 inches. How many weeks will it take until the plant is  $4\frac{1}{2}$  feet tall?

Let  $w$  be the number of weeks it took for Madison's plant to grow.

\*\* Here we need to do some unit conversion—we need to know that 3 inches is  $\frac{1}{4}$  foot. This affects our equation.

$$2 + \frac{1}{4}w = 4\frac{1}{2}$$

$$2 + \frac{1}{4}w - 2 = 4\frac{1}{2} - 2$$

$$\frac{1}{4}w = 2\frac{1}{2}$$

$$\frac{1}{4}w = \frac{5}{2}$$

$$\frac{4}{1}\left(\frac{1}{4}w\right) = \frac{4}{1}\left(\frac{5}{2}\right)$$

$$w = 10$$

Madison's plant took 10 weeks to grow to be 4.5 feet.