

Name \_\_\_\_\_

Math 8

Date \_\_\_\_\_ Period \_\_\_\_\_

Mrs. Zigrossi

## Equations and Expressions Study Guide

Based on the New York State Standards and our district curriculum, you should know and be able to do each of the following by the end of this unit.

As a result of this unit, you should know or be able to...

### The process to evaluate expressions using order of operations

$$\begin{aligned}
 1) \quad & 5 + 2(6 - 8 \div 2)^3 \\
 & 5 + 2(6 + 4)^3 \\
 & 5 + 2(10)^3 \\
 & 5 + 2(1000) \\
 & 5 + 2000 \\
 & \boxed{2005}
 \end{aligned}$$

$$\begin{aligned}
 2) \quad & 4 [ 14 \div -2 - (3 \cdot -4)^2 \div 9 ] \\
 & 4 [ 14 \div 2 - (-12)^2 \div 9 ] \\
 & 4 [ 14 \div 2 - 144 \div 9 ] \\
 & 4 [ 14 \div 2 - 16 ] \\
 & 4 [ -7 - 16 ] \\
 & 4 [ -23 ] \\
 & \boxed{-92}
 \end{aligned}$$

### The process to substitute rational numbers in expressions and evaluate

Let  $m = -2$ ,  $n = 10$ ,  $q = -3$ ,  $r = 4$

$$\begin{aligned}
 3) \quad & mnq \div rn \\
 & \frac{-2(10)(-3) \div 4(10)}{-20(-3) \div 4(10)} \\
 & \frac{60 \div 4(10)}{15(10)} = \boxed{15}
 \end{aligned}$$

$$\begin{aligned}
 4) \quad & -q^2 + (mq)^2 + m^2 \\
 & -(-3)^2 + (-2 \cdot -3)^2 + (-2)^2 \\
 & -(-3)^2 + (6)^2 + (-2)^2 \\
 & -9 + 36 + 4 \\
 & \frac{27 + 4}{27 + 4} = \boxed{31}
 \end{aligned}$$

$$\begin{aligned}
 5) \quad & \frac{mq^2 - m}{n + m} = \frac{(-2)(-3)^2 - -2}{10 + -2} \\
 & = \frac{(-2)(9) - -2}{10 + -2} \\
 & = \frac{-18 + 2}{10 - 2} = \frac{-16}{8} = \boxed{-2}
 \end{aligned}$$

$$\begin{aligned}
 6) \quad & 4m^3n - 3q - q \\
 & 4(-2)^3(10) - 3(-3) - -3 \\
 & 4(-8)(10) - 3(-3) + 3 \\
 & -320 + 9 + 3 \\
 & -311 + 3 = \boxed{-308}
 \end{aligned}$$

## The difference between expressions and equations

7) What is the difference between equations and expressions?

↑  
have equal signs  
and are solved

↑  
no equal sign  
and are simplified

## The process to solve equations with parentheses and variables on both sides

8)  $3(x + 5) = 2x - 29$

$$\begin{array}{r} 3x + 15 = 2x - 29 \\ -2x \quad -2x \\ \hline \end{array}$$

$$\begin{array}{r} x + 15 = -29 \\ -15 \quad -15 \\ \hline \end{array}$$

$$\boxed{x = -44}$$

9)  $\frac{3}{4}(24 - 8x) = 2(5x + 1)$

$$\begin{array}{r} 18 - 6x = 10x + 2 \\ +6x \quad +6x \\ \hline \end{array}$$

$$\begin{array}{r} 18 = 16x + 2 \\ -2 \quad -2 \\ \hline \end{array}$$

$$\begin{array}{r} 16 = 16x \\ 16 \quad 16 \\ \hline \end{array}$$

$$\boxed{1 = x}$$

## Solve equations with integral coefficients

10)  $4(1-x) + 3x = -2(x+1)$

$$4 - 4x + 3x = -2x - 2$$

$$\begin{array}{r} 4 - x = -2x - 2 \\ +2x \quad +2x \\ \hline \end{array}$$

$$\begin{array}{r} 4 + x = -2 \\ -4 \quad -4 \\ \hline \end{array}$$

$$\boxed{x = -6}$$

11)  $3x - (-2x + 5) = 13 - 2(x + 2)$

$$3x + 2x - 5 = 13 - 2x - 4$$

$$\begin{array}{r} 5x - 5 = 9 - 2x \\ +2x \quad +2x \\ \hline \end{array}$$

$$\begin{array}{r} 7x - 5 = 9 \\ +5 \quad +5 \\ \hline \end{array}$$

$$\begin{array}{r} 7x = 14 \\ 7 \quad 7 \\ \hline \end{array}$$

$$\boxed{x = 2}$$

Solve equations with special solutions (no solution or infinite solutions)

12)  $5m - 2 + 3(m - 11) = 5 + 8m$

13)  $2x - 7 + 8x + 12 = -5(x - 1) + 15x$

$2x - 7 + 8x + 12 = -5x + 5 + 15x$

$10x + 5 = 10x + 5$

$5m - 2 + 3m - 33 = 5 + 8m$

$8m - 35 = 8m + 5$   
 $\frac{-8m \quad -8m}{-35 \neq 5}$

**No Solution**

**Infinite Solutions**

Solve equations with fractional or decimal coefficients

14)  $\left(\frac{2}{7}x\right) - (6) = (10)$

15)  $\left(\frac{1}{2}x\right) + \left(\frac{2}{5}\right) - \left(\frac{1}{4}x\right) = [-3(x+1)]$

16)  $(1.5) = [-0.3(x-1)] - (0.9)$

$2x - 42 = 70$   
 $\frac{+42 \quad +42}{2x = 112}$   
 $\frac{2x}{2} = \frac{112}{2}$

**X = 56**

$10x + 8 - 5x = -60(x+1)$   
 $10x + 8 - 5x = -60x - 60$   
 $5x + 8 = -60x - 60$   
 $\frac{+60x \quad +60x}{65x + 8 = -60}$   
 $\frac{-8 \quad -8}{65x = -68}$   
 $\frac{65x}{65} = \frac{-68}{65}$

**X = -1  $\frac{3}{65}$**

$15 = -3(x-1) - 9$   
 $15 = -3x + 3 - 9$   
 $15 = -3x - 6$   
 $\frac{+6 \quad +6}{21 = -3x}$   
 $\frac{-3 \quad -3}{-7 = x}$

**-7 = x**

17)  $(0.3x) + (1.4) = (4.2) - (0.1x) + (0.4x) - (2.8)$

18)  $\left(\frac{1}{6}x\right) - \left(\frac{1}{15}\right) + \left(\frac{1}{10}(x-11)\right) = \left(\frac{1}{6}\right)$

$3x + 14 = 42 - 1x + 4x - 28$   
 $3x + 14 = 3x + 14$

**Infinite Solutions**

$5x - 2 + 3(x-11) = 5$   
 $5x - 2 + 3x - 33 = 5$

$8x - 35 = 5$   
 $\frac{+35 \quad +35}{8x = 40}$   
 $\frac{8x}{8} = \frac{40}{8}$   
**X = 5**

## Translating into expressions or equations

- 19) twice a number increased by six  $2n+6$   
20) a number less than three  $3-n$   
21) five times the sum of twice a number and seven  $5(2n+7)$   
22) the quotient of ten and number is thirteen  $\frac{10}{n} = 13$   
23) four more than a number is the same as twice a number less eight  $n+4 = 2n-8$   
24) nine times the sum of a number and two is equivalent to half a number  $9(n+2) = \frac{1}{2}n$   
25) when a number is diminished by three, the result is the same as twice the number increased by six  $n-3 = 2n+6$   
26) the product of five and the sum of a number and two is equivalent to the quotient of six times the number and three  $5(n+2) = \frac{6n}{3}$

## The process to solve proportional equations

27)  $\frac{8}{7x-1} \times \frac{4}{3x-2}$

$$\begin{aligned} 8(3x-2) &= 4(7x-1) \\ 24x-16 &= 28x-4 \\ -24x & \quad -24x \\ \hline -16 &= 4x-4 \\ +4 & \quad +4 \\ \hline -12 &= 4x \\ \frac{-12}{4} &= \frac{4x}{4} \\ \boxed{x = -3} \end{aligned}$$

28)  $\frac{w+4}{3} \times \frac{w-2}{5}$

$$\begin{aligned} 5(w+4) &= 3(w-2) \\ 5w+20 &= 3w-6 \\ -3w & \quad -3w \\ \hline 2w+20 &= -6 \\ -20 & \quad -20 \\ \hline 2w &= -26 \\ \frac{2w}{2} &= \frac{-26}{2} \\ \boxed{w = -13} \end{aligned}$$

## Rewriting formulas so they are solved for different variables

29) Solve for r:  $3Q = \frac{3}{1} \left( \frac{1}{3}rt + 1 \right)$

$$\begin{aligned} 3Q &= rt + 3 \\ -3 & \quad -3 \\ \hline 3Q-3 &= rt \\ \frac{3Q-3}{t} &= \frac{rt}{t} \end{aligned}$$

$$\boxed{r = \frac{3Q-3}{t}}$$

30) Solve for m:  $P = 4(m+n)$

$$\begin{aligned} P &= 4m + 4n \\ -4n & \quad -4n \\ \hline P-4n &= 4m \\ \frac{P-4n}{4} &= \frac{4m}{4} \end{aligned}$$

$$\boxed{m = \frac{P-4n}{4}}$$

or

$$\begin{aligned} \frac{P}{4} &= \frac{4(m+n)}{4} \\ \frac{P}{4} &= m+n \\ -n & \quad -n \\ \hline \frac{P}{4} - n &= m \end{aligned}$$
$$\boxed{\frac{P}{4} - n = m}$$