Math 7 Solving Equations with Variables on Both Sides Date:

Objective: Students will

- solve equations with variables on both sides
- use equations with variables on both sides

Math 7+ Solving Equations with Variables on Both Sides te:

*To solve an equation with a variable on both sides

- Follow the steps for each side of the equation if needed
  - Step 1 – Use the distributive property if necessary
  - Step 2 – Combine like terms
  - Step 3 – Use addition or subtraction to collect the variable on one side of the equation.
  - Step 4 – Undo multiplication and division

EXAMPLE 1: Solve $4c + 3 = 15 - 2c$

EXAMPLE 2: Solve $4x + 4 = 2x + 36$

EXAMPLE 3: Solve $-15 + 6b = -8b + 13$

EXAMPLE 4: Solve $4(x + 4) - 3x = 5(2x + 4) - x$

EXAMPLE 5: Steve types at a rate of 15 words/minute and Jenny types at a rate of 20 words/minute. Steve and Jenny are both typing the same document, and Steve starts 5 minutes before Jenny. How long will it take Jenny to catch up with Steve?

U1 - Week 3 Plus

Name _____ Class _____ Date _____

Practice 7-5 Solving Equations with Variables on Both Sides

Practice

Solve each equation.

1. $3k + 16 = 5k$ _____
2. $5e = 3e + 36$ _____
3. $n + 4n - 22 = 7n$ _____
4. $2(x - 7) = 3x$ _____
5. $8h - 10h = 3h + 25$ _____
6. $7n + 6n - 5 = 4n + 4$ _____
7. $11(p - 3) = 5(p + 3)$ _____
8. $9(m + 2) = -6(m + 7)$ _____
9. $y + 2(y - 5) = 2y + 2$ _____
10. $-9x + 7 = 3x + 19$ _____
11. $k + 9 = 6(k - 11)$ _____
12. $-6(4 - t) = 12t$ _____
13. $2(x + 7) = 5(x - 7)$ _____
14. $5m + 9 = 3(m - 5) + 7$ _____
15. $5x + 7 = 6x$ _____
16. $k + 12 = 3k$ _____
17. $8m = 5m + 12$ _____
18. $3p - 9 = 4p$ _____

Write an equation for each situation. Solve.

19. The difference when 7 less than a number is subtracted from twice the number is 12. What is the number?

_____

_____

20. Four less than three times a number is three more than two times the number. What is the number?

_____

_____

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1A

Notes - Con[illegible]ing Repeating Decimals Name: _____ E#_____

How do you convert a repeating decimal to a fraction?

When ALL numbers repeat

Step 1: Let x = the decimal

Step 2: How many numbers repeat? Multiply both sides of the equation by that number.

Step 3: Subtract your original equation from your new equation. (Line up the decimals).

Step 4: Solve for x and check your solution.

Convert $0.\overline{2}$ to a fraction.

$x = 0.222222$

$10x = 2.22222$

If 1 number repeats, use 10

$$\begin{array}{r} 10x = 2.22222 \\ -\ x = 0.22222 \\ \hline 9x = 2 \end{array}$$

$$\frac{\cancel{9}x}{\cancel{9}} = \frac{2}{9} \qquad x = \frac{2}{9}$$

a) $0.\overline{4}$

b) $0.\overline{36}$

c) $0.\overline{15}$

d) $3.\overline{6}$

e) $0.\overline{27}$

f) $0.\overline{123}$

How do you convert a repeating decimal to a fr[illegible]n?

When NOT all numbers repeat

Step 1: Let x = the decimal

Step 2: How many numbers repeat? Multiply both sides of the equation by that number.

Step 3: Subtract your original equation from your new equation. (Line up the decimals).

Step 4: Solve for x and check your solution.

If you have a decimal in your fraction, multiply the numerator and denominator by a multiple of 10 until you have a whole number in the numerator.

Convert $0.8\overline{16}$ to a fraction.

$x = 0.8161616$

$100x = 81.61616$

If 2 numbers repeats, use 100

$$\begin{array}{r} 100x = 81.61616 \\ -\ x = 0.81616 \\ \hline 99x = 80.8 \end{array}$$

$$\frac{\cancel{99}x}{\cancel{99}} = \frac{80.8}{99} \qquad x = \frac{808}{990}$$

a) $0.\overline{16}$

b) $0.\overline{521}$

c) $0.\overline{08}$

d) $2.\overline{07}$

e) $0.\overline{627}$

f) $0.\overline{318}$

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Homework – Convert Repeating Decimals Name: _____ E#_____

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a) $0.\overline{8}$

b) $0.\overline{48}$

c) $0.\overline{25}$

d) $3.\overline{12}$

e) $0.\overline{14}$

f) $0.\overline{321}$

How do you convert a repeating decimal to a fraction?

When NOT all numbers repeat

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$$\frac{\cancel{99}x}{\cancel{99}} = \frac{80.8}{99} \qquad x = \frac{808}{990}$$

a) $0.\overline{63}$

b) $0.\overline{871}$

c) $0.\overline{06}$

d) $2.\overline{04}$

e) $0.\overline{924}$

f) $0.\overline{562}$

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Name _____

Cubes and Cube Roots

A **perfect cube** has three identical integer factors.

For example: $8 = 2 \cdot 2 \cdot 2 = 2^3$ **and** $-8 = -2 \cdot -2 \cdot -2 = -2^3$ or $(-2)^3$

Therefore, 2 is the **cube root** of 8 and -2 is the **cube root** of -8,
or rather $\sqrt[3]{8} = 2$ *and* $\sqrt[3]{-8} = -2$

Identify the cube root of the following perfect cubes:

1. The cube root of 27 is ____ because ($)^3 =$ ____
2. The cube root of -27 is ____ because ($)^3 =$ ____
3. The cube root of 216 is ____ because ($)^3 =$ ____
4. The cube root of -216 is ____ because ($)^3 =$ ____
5. The cube root of 1 is ____ because ($)^3 =$ ____
6. The cube root of -1 is ____ because ($)^3 =$ ____
7. The cube root of -125 is ____ because ($)^3 =$ ____
8. The cube root of 125 is ____ because ($)^3 =$ ____
9. The cube root of -64 is ____ because ($)^3 =$ ____
10. The cube root of -64 is ____ because ($)^3 =$ ____

Simplify each expression

1. $\sqrt[3]{27} + 15$

2. $20 - \sqrt[3]{125}$

3. $\sqrt[3]{\frac{1}{64}}$

4. $\frac{\sqrt[3]{-216}}{3}$

Name _____

Solve the following problems involving cube roots:

1. What is the side length of a cube that has a volume of 27 cubic centimeters? Show why your answer is correct.

   Why would it be unrealistic to ask this same question for a cube with a volume of -27 cubic centimeters?

2. You have a gift box that is a perfect cube. Its volume is 8 cubic inches. How much wrapping paper do you need to cover the box? Give an explanation for your answer.

   Would this gift box likely be able to hold Hershey's kisses or a large birthday cake? Justify your answer.

Notes – Equations with Powers & Roots Name: _____ E# _____

REVIEW: Exponents	1) -5^2	2) 6^3	3) $(-1)^4$	4) $(-3)^3$

Equations with Squares/Cubes

STEPS:

1. Isolate the variable.
2. Take the square/cube root of each side of the equation to eliminate the exponent.

   x^2 → take the _____ of each side.

   x^3 → take the _____ of each side.
3. Solve for the given variable.

When equations have a variable that is raised to the 2nd power, we can expect to have _____ solution(s).

If c is a positive number and $x^2 = c$, then $x = \pm\sqrt{c}$

EXAMPLE 1:	EXAMPLE 2:	EXAMPLE 3:
$w^2 = 16$	$7x^2 = 21$	$4g^2 - 8 = 12$
1) $64 = x^3$	2) $4 = z^2$	3) $\frac{m^2}{4} = 36$
4) $33 = y^2 + 17$	5) $\frac{25}{36} = y^2$	6) $\frac{r^3}{2.5} = 50$
7) $2n^2 = 144$	8) $3m^3 + 7 = 88$	9) $4f^2 - 5 = -4$

3A

REVIEW: Square Roots & Cube Roots	1) $\sqrt{121}$	2) $\sqrt{-36}$	3) $\sqrt[3]{27}$	4) $-\sqrt[3]{64}$

Equations with Radicals

STEPS:

1. Isolate the variable.
2. Raise each side of the equation to a power to eliminate the radical

   $\sqrt{x}$ → **take the _____ of each side.**

   $\sqrt[3]{x}$ →**take the _____ of each side.**

3. Solve for the given variable.

EXAMPLE 1: $9 = \sqrt{t}$

EXAMPLE 2: $\sqrt[3]{c} - 1 = 3$

EXAMPLE 3: $\sqrt{2x+8} - 4 = 6$

1) $\sqrt{x} - 3 = 2$	2) $\sqrt[3]{j} + 4 = 11$	3) $\sqrt{10x} + 1 = 5$
4) $0 = \sqrt{k} - 13$	5) $\sqrt[3]{x+4} = 5$	6) $4\sqrt{x-1} + 3 = 11$
7) $7 = 5\sqrt{h} + 2$	8) $\sqrt{5y+1} + 8 = 12$	9) $\sqrt[3]{4g} + 5 = 7$

Homework – Solving Equations with Powers & Roots

Name: _____ E# _____

1) $a^2 = 100$	2) $b^3 = 216$	3) $25 = c^2$	4) $d^2 = \frac{49}{16}$
5) $e^3 = -\frac{27}{64}$	6) $\sqrt{f} = 12$	7) $\sqrt[3]{g} = 3$	8) $7 = \sqrt{h}$

9) $j^2 + 25 = 50$	10) $k^2 - 81 = 0$	11) $9m^2 - 8 = -4$
12) $3\sqrt{2n} = 12$	13) $\frac{\sqrt{p+5}}{3} = 2$	14) $\sqrt[3]{5q+2} = 3$
15) $r^3 - 2 = 64$	16) $s^2 + 19 = 100$	17) $t^3 + 5 = 13$
18) $5\sqrt{u} + 1 = 6$	19) $\sqrt{3w-5} = 5$	20) $\sqrt{2x} - 6 = 4$

4A

Name _____

Estimating Square Roots without a Calculator

Estimate each of the following square roots to the nearest hundredth. Show your work.

1. $\sqrt{12}$

2. $\sqrt{20}$

3. $\sqrt{42}$

4. $\sqrt{33}$

5. Write instructions on how to estimate the square root of a number that is not a perfect square.

_____

_____

_____

_____

6. Sudip estimates that $\sqrt{62}$ is about six. Do you agree or disagree? Explain.

_____

_____

7. Is $\sqrt{105}$ more or less than 10? Explain.

_____

_____

8. Is 8.5 a good first guess for $\sqrt{72}$? Why or why not?

_____

_____

Name _____

Estimating Square Roots

1. Explain what a perfect square is.

_____

_____

_____

2. Complete the table below by listing the first 15 perfect squares and their square roots.

Perfect Squares	
1	$\sqrt{1}=$
4	$\sqrt{4}=$
	$\sqrt{9}=$
	$\sqrt{16}=$
	$\sqrt{25}=$
	$\sqrt{36}=$
	$\sqrt{49}=$
	$\sqrt{64}=$
	$\sqrt{81}=$
	$\sqrt{100}=$
	$\sqrt{121}=$
	$\sqrt{144}=$
	$\sqrt{169}=$
	$\sqrt{196}=$
	$\sqrt{225}=$

3. You can approximate the value of non-perfect squares using what you know about perfect squares.

Between which two perfect squares would you find the number 65? _____and _____

What are their square roots? _____ and _____

Knowing that, between which two integers would you find $\sqrt{65}$? _____and _____

Approximate $\sqrt{65}$ to the nearest tenth then check yourself with a calculator.

Name _____

4. Without using your calculator, approximate the value of each of the following square roots by identifying the perfect squares the radicand falls between.

$\sqrt{12}$ is between $\sqrt{}$ and $\sqrt{}$ .Therefore, it is between the integers _____ and _____.

$\sqrt{38}$ is between $\sqrt{}$ and $\sqrt{}$ .Therefore, it is between the integers _____ and _____.

$\sqrt{75}$ is between $\sqrt{}$ and $\sqrt{}$ .Therefore, it is between the integers _____ and _____.

$\sqrt{130}$ is between $\sqrt{}$ and $\sqrt{}$ .Therefore, it is between the integers ____ and _____.

$-\sqrt{29}$ is between $\sqrt{}$ and $\sqrt{}$ .Therefore, it is between the integers ____ and _____.

$-\sqrt{57}$ is between $\sqrt{}$ and $\sqrt{}$ .Therefore, it is between the integers ____ and _____.

5. Write instructions on how to estimate the square root of a number that is not a perfect square.

_____

_____

_____

_____

6. Tricia estimates that $\sqrt{85}$ is about eight. Do you agree or disagree? Explain.

_____

_____

7. Is $\sqrt{37}$ more or less than 6? Explain.

_____

_____

8. Is 9.5 a good first guess for $\sqrt{75}$? Why or why not?

_____

_____

5A

Name: _____

Comparing and Ordering Real Numbers

Write the numbers in ascending order.

1) $0,\ -\sqrt{2},\ \sqrt{5},\ \frac{13}{4}$

2) $3, \sqrt{10}, \frac{3}{4}, -1.5$

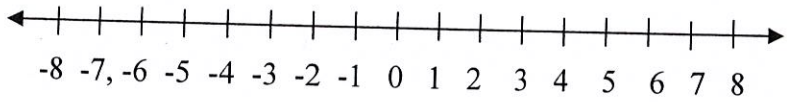
3) $2,\ -\frac{3}{7},\ 0.75,\ -\frac{3}{2}$

4) Which list shows the numbers in increasing order?

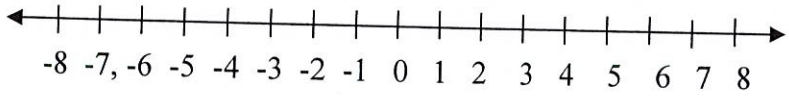
A) -0.5, 1.5, -2, -0.75, $\sqrt{7}$ B) -0.5, -2, -0.75, 1.5, $\sqrt{7}$

C) -2, -0.75, -0.5, 1.5, $\sqrt{7}$ D) $\sqrt{7}, 1.5, -0.5, -0.75, -2$

5) Graph the numbers -0.2, $\frac{7}{10}, -1,\ \sqrt{2},$ and -4 on a number line.



6) Graph the numbers $-\frac{3}{4}$, 5, $\frac{9}{2}$, -2, and -1 on a number line.



7) Graph the numbers $-3,\ \frac{5}{2},\ 2,\ -\frac{9}{4},$ and 4 on a number line.