

UNIT 4

2016-17
EQUATIONS
CCM6+/7+

Name: _____

Math Teacher: _____

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Common Core Math 7 PLUS Unit 3 Vocabulary

Definitions of Critical Vocabulary and Underlying Concepts	
rational numbers	A number expressible in the form a/b or $-a/b$ for some fraction a/b . The rational numbers include the integers.
integers	A number expressible in the form a or $-a$ for some whole number a .
constant	A number that does not change.
expression	A mathematical phrase that contains operations, numbers, and/or variables.
equation	A mathematical sentence that shows that two expressions are equivalent.
additive inverses	Two numbers whose sum is 0 are additive inverses of one another.
additive identity property of zero	The property that states the sum of zero and any number is that number.
addition property of opposites	The property that states that the sum of a number and its opposite equals zero.
subtraction property of equality	The property that states that if you subtract the same number from both sides of an equation, the new equation will have the same solution.
distributive property	The property that states if you multiply a sum by a number, you will get the same result if you multiply each addend by that number and then add the products.
radicand	the number underneath the square root symbol
repeating decimal	a decimal in which one or more digits repeat infinitely
perfect square	the square of an integer number
square root	one of the two equal factors of a number
radicand	the number or expression underneath the radical sign
principal square root	the positive square root of a number
cube root	one of three equal factors of a number

SOLVING EQUATIONS...UnDo It!
You can ALWAYS Check your answer!
 ONE STEP...

$\frac{x}{4} = 8$	$\frac{x}{-3} = 1$
$-8x = -3.2$	$x + \frac{3}{8} = 5$
$x - 6.4 = -8.7$	$-2x = 4\frac{1}{2}$

TWO-STEP... Follow OoO Backwards!!! Undo +/- then Undo \cdot/\div .

$2x - 12 = -16$	$\frac{x}{3} + 6 = -12$
$-\frac{x}{6} - 12 = -3$	$-12x + 16 = -20$

Kuta Software - Infinite Algebra 1

Two-Step Equations

Solve each equation.

1) $6 = \frac{a}{4} + 2$

2) $-6 + \frac{x}{4} = -5$

3) $9x - 7 = -7$

4) $0 = 4 + \frac{n}{5}$

5) $-4 = \frac{r}{20} - 5$

6) $-1 = \frac{5+x}{6}$

7) $\frac{v+9}{3} = 8$

8) $2(n+5) = -2$

9) $-9x + 1 = -80$

10) $-6 = \frac{n}{2} - 10$

11) $-2 = 2 + \frac{v}{4}$

12) $144 = -12(x+5)$

15) $\frac{p}{4} + 8 = 7$

16) $9 + \frac{n}{4} = 15$

17) $6 + \frac{x}{2} = 4$

18) $\frac{b+11}{3} = -2$

19) $\frac{a-10}{3} = -4$

20) $-12r + 4 = 100$

21) $\frac{m}{16} - 9 = -8$

22) $-7 + 4r = -15$

23) $\frac{m-13}{2} = -8$

24) $-5x + 13 = -17$

25) $\frac{k+10}{-2} = 5$

26) $\frac{p+8}{-2} = 10$

27) $-14r - 19 = 303$

28) $\frac{x}{-4} - 5 = -8$

Guided Practice - Equations with Fractions and Decimals

1. $m - (-0.7) = -1.2$

2. $-\frac{1}{3}p = \frac{1}{4}$

3. $x - \frac{5}{6} = \frac{1}{10}$

4. $4 = \frac{4}{9} + y$

5. $-\frac{11}{12}w = -1$

6. $-1.3m = 3.12$

7. $-8k = .8$

8. $\frac{-5}{6} + g = 4\frac{2}{3}$

9. $\frac{1}{5}k - 3 = -3\frac{1}{3}$

10. $\frac{h}{2} - \left(-6\frac{1}{2}\right) = 14\frac{1}{4}$

One- & Two-Step Equations with Rational Numbers

Goal: Isolate the Variable

How to achieve the goal: Inverse Operations and Opposites

REMEMBER: CHECK YOUR WORK!!

1. $n + (-3) = -7$	1. <u>AGAIN</u> $n + (-3) = -7$	2. $k - 13.8 = -16.4$
3. $\frac{1}{2} + x = -\frac{2}{3}$	4. $n - \left(-2\frac{3}{4}\right) = 1\frac{4}{5}$	5. $-73.5 = 3w$
6. $-\frac{2}{3}m = -18$	7. $4m - 9 = -17$	
8. $\frac{1}{6}x - 17.1 = -18$	9. $3.45x - (-7.43) = -20.86$	

MULTI-STEP...Distributive Property...then +/- undone...then •/÷

$$4(x + 2) = 20$$

$$20 = (2 + x)5$$

$$5(1 + x) + 3 = 18$$

$$2(2x + 3) = 18$$

$$-4(x - 8) = 4$$

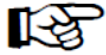
$$\frac{2}{3}(6x + 9) = -6$$



Solving Multi-Step Equations

Distributive With Parentheses - Negative Coefficients

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Solve the equations.

(1) $34 = -3x - 2(2x + 4)$

(2) $76 = -2x + 6(3x - 14)$

(3) $2x - 5(5x - 17) = -53$

(4) $7x - 3(-2x + 8) = 119$

(5) $140 = -4x + 2(-3x + 15)$

(6) $-54 = 6x - 4(7x - 14)$

(7) $-5x + 3(5x - 13) = 81$

(8) $5x + 6(2x - 3) = 186$

Guided Practice - Solving Equations with the Distributive Property

Solve each of the following equations showing all work.

Class Example: $12 + 3(2x - 5) = 21$	Class Example: $\frac{1}{3}(6x + 12) = 5$
1. $-5(x + 8) = -55$	2. $13 = -\frac{1}{5}(10a + 5)$
3. $-3.6 = 6(y - 2.8)$	4. $-8(y - 6) = -16$
5. $\frac{1}{7}(14r - 56) = -14$	6. $3.3(m + -6.4) = -4.62$
7. $63 = 9(2 - a)$	8. $6\left(2 - \frac{x}{6}\right) = 1$

VersaTiles: MULTI-STEP EQUATIONS

Solve each problem, making sure to show your work for each problem, step-by-step.

1. $9b + 5 - 9 = -49$	2. $8z - 9 + 12z = 71$	3. $-4.3c + 12 + 15.1c = 33.6$
4. $\frac{2}{5}(10p - 15) = 14$	5. $2(5x + 3) = 16$	6. $2(5c - 5.1) = -20.2$
7. $4(2q - 7) = -4$	8. $\frac{1}{2}(6n - 18) + 3 = 24$	9. $3.4(2x + 5) = -23.8$
10. $-2(4x + 2) = 20$	11. $-\frac{1}{4}(8w + 3) = 3\frac{1}{4}$	12. $34.1 = -3.1(4y + 5)$

ANSWER SQUARES

A.	B.	C.	D.	E.	F.	G.	H.	I.	J.	K.	L.
5	-5	-2	2	-1	4	3	-3	-6	1	-4	10

EQUATIONS WITH VARIABLES ON BOTH SIDES

$$8x - 2 = -9 + 7x$$

$$5p - 14 = 8p + 4$$

$$a + 5 = -5a + 5$$

$$p - 1 = 5p + 3p - 8$$

$$3(x + 3) = 15 + 2x$$

$$2(x + 4) = 2 + 5x$$

$$2(4x - 3) - 8 = 4 + 2x$$

$$-5(1 - 5x) + 5(-8x - 2) = -4x - 8x$$

Solving Linear Equations: Variable on Both Sides

Solve each equation.

1) $6r + 7 = 13 + 7r$

2) $13 - 4x = 1 - x$

3) $-7x - 3x + 2 = -8x - 8$

4) $-8 - x = x - 4x$

5) $-14 + 6b + 7 - 2b = 1 + 5b$

6) $n + 2 = -14 - n$

7) $n - 3n = 14 - 4n$

8) $7a - 3 = 3 + 6a$

9) $5 + 2x = 2x + 6$

10) $-10 + x + 4 - 5 = 7x - 5$

11) $-8n + 4(1 + 5n) = -6n - 14$

12) $-6n - 20 = -2n + 4(1 - 3n)$

13) $4n - 40 = 7(-2n + 2)$

14) $7(5a - 4) - 1 = 14 - 8a$

15) $-31 - 4x = -5 - 5(1 + 5x)$

16) $38 + 7k = 8(k + 4)$

17) $8x + 4(4x - 3) = 4(6x + 4) - 4$

18) $3(1 - 3x) = 2(-4x + 7)$

19) $4(-8x + 5) = -32x - 26$

20) $-3(x - 1) + 8(x - 3) = 6x + 7 - 5x$

Hands-On Equations: Verbal Problems

Example	Variable and Equation Set-Up	Solution and Check
1.) Kayla made the same number of cakes in March and April. In May, she made 4 cakes. If she made a total of 16 cakes in these three months, how many cakes did she make in each of the other two months?	Let = _____ Let = _____	
2.) John and Jack each count the money in their wallets. Jack has three times as much as John. Altogether, they have \$20. How much money does each boy have?	Let = _____ Let = _____	
3.) 5 times a number, increased by 3, is equal to 18. Find the number.	Let = _____	
4.) Three consecutive even integers have a sum of 18. Find the integers.	Let = _____ Let = _____ Let = _____	
5.) John's age is 4 more than 3 times Michael's age. If the sum of their ages is 20, how old are John and Michael?	Let = _____ Let = _____	
6.) Jimmy joined a gym that charges a monthly fee of \$21, plus an entry fee each time he goes for a workout. If he worked-out eight times this month and was charged a total of \$45, how much is the entry fee?	Let = _____	

Hands-On Equations: Verbal Problems

Classwork	Variable and Equation Set-Up	Solution and Check
1.) Three consecutive odd integers have a sum of 75. Find the integers.	Let = _____ Let = _____ Let = _____	
2.) Megan is 8 years older than Lauren. Jackie is two times Megan's age. If the sum of the three girls' ages is 32, how old is each girl?	Let = _____ Let = _____ Let = _____	
3.) Ryan joined a holiday coffee club that charged him a one-time fee of \$15 for a coffee mug, plus \$2 every time he filled his mug throughout the holiday season. If he spent a total of \$43 over the season, how many mugs of coffee did he buy?	Let = _____	
4.) Kayla and Tanya went shopping at the mall. If Tanya spent \$104, eight times more than Kayla, how much did Kayla spend?	Let = _____	
5.) Sam and Todd went trick-or-treating. When they arrived home and counted their candy, Todd had three times more pieces of candy than Sam. If together they have 544 pieces, how many does each boy have?	Let = _____ Let = _____	
6.) Challenge: Garrett is five less than 3 times Jerry's age. If Garrett is 25, how old is Jerry?	Let = _____	

Writing Equations from Word Problems

For each word problem, clearly define your variables and set-up an equation. Solve.

<p>1. 5 times the sum of a number and negative 12 is equal to -40. What is the number?</p> <p>Variable: _____</p> <p>Equation: _____</p> <p>Solution: _____</p>	<p>2. You return a book that is 5 days overdue. Including a previously unpaid overdue balance of \$1.30, your new balance is \$2.05. What is the fine for a book that is one day overdue?</p> <p>Variable: _____</p> <p>Equation: _____</p> <p>Final Solution: _____</p>
<p>3. During the basketball season, Jason scored 43 points. He scored 5 fewer points than three times the number Kevin did. How many points did Kevin score?</p> <p>Variable: _____</p> <p>Equation: _____</p> <p>Solution: _____</p>	<p>4. Johnny has three more than twice the number of stickers that Jane has. If all together, they have 51 stickers, how many does each person have?</p> <p>Variables: _____ _____</p> <p>Equation: _____</p> <p>Solution: _____</p>
<p>5. The sum of three consecutive numbers is equal to 192. What are the numbers?</p> <p>Variables: _____ _____ _____</p> <p>Equation: _____</p> <p>Final Solutions: _____</p>	<p>6. Peter has \$25 more than Jacob. Their friend Mike has \$14 less than Jacob. The total amount of money they have is \$272. How much does each boy have?</p> <p>Variables: _____ _____ _____</p> <p>Equation: _____</p> <p>Final Solutions: Jacob: _____ Peter: _____ Mike: _____</p>

Practice: Writing Equations from Word Problems

For each word problem, clearly define your variable and set-up an equation/inequality. Solve.

<p>1. Your friend bought 3 bags of wild bird seed and an \$18 bird feeder. Each bag of birdseed costs the same amount. If your friend spent \$45, find the cost of one bag of birdseed.</p> <p>Variable: _____</p> <p>Equation: _____</p> <p>Final Answers: _____</p>	<p>2. Wanda earns an hourly wage plus commission at her retail job. Last week, she worked 32 hours and earned a \$65.85 bonus. If her total paycheck, including the bonus, was \$352.25 how much does Wanda make each hour?</p> <p>Variable: _____</p> <p>Equation: _____</p> <p>Final Answers: _____</p>
<p>3. The price of a DVD player today is \$56.60. This is eight dollars less than $\frac{2}{3}$ the price of the same DVD player in 2005. What was the cost of the DVD player in 2005?</p> <p>Variable: _____</p> <p>Equation: _____</p> <p>Final Answer: _____</p>	<p>4. As a sales person, Harvey earns \$60 per day plus $\frac{1}{4}$ of his customer sales. If Harvey must earn a total of at least \$147.50 in order to buy a new gaming system, how much must his customer sales be?</p> <p>Variable: _____</p> <p>Equation: _____</p> <p>Final Answer: _____</p>
<p>5. Which equation below could be used to solve the following problem? Karlle has a collection of quarters, dimes, and nickels that equal \$2.70. If she has 7 quarters and 7 nickels, how many dimes does she have?</p> <p>A. $.10d + 7(.25) + 7(.5) = 2.70$ B. $.10d + 7(.25 + .05) = 2.70$ C. $10d + 7(25 + 5) = 2.70$ D. $.10d + 7(.25) + .05 = 2.70$</p>	<p>6. Which equation below could be used to solve the following problem? The length of a rectangle is $3\frac{2}{5}$ inches longer than the rectangle's width. If the perimeter of a rectangle is $9\frac{3}{10}$ inches, what is the width of the rectangle?</p> <p>A. $(3\frac{2}{5} + w) = 9\frac{3}{10}$ B. $2(3\frac{2}{5} + w) = 9\frac{3}{10}$ C. $(3\frac{2}{5} + w) + w = 9\frac{3}{10}$ D. $2(3\frac{2}{5} + w) + 2w = 9\frac{3}{10}$</p>

Write an equation to the situation given. Then solve.

1. When Joe is 12 years older, he will be 36. How old is he now?

Equation: _____

Solve: _____

2. If Tom had twice as much money as he has now, he would have \$36. How much does he have now?

Equation: _____

Solve: _____

3. When 36 brownies are shared among all club members, each gets 12. How many club members are there?

Equation: _____

Solve: _____

4. Two years ago, Sue was 36 years old. How old is she now?

Equation: _____

Solve: _____

5. After Tom reads 36 pages of his magazine, he still has 12 pages to read. How many pages are in the magazine?

Equation: _____

Solve: _____

6. Joe is 2 years older than his brother. The sum of their ages is 12. How old is Joe's brother?

Equation: _____

Solve: _____

7. When a package of candy is shared among 12 friends, each gets 36 pieces. How many pieces of candy were in the package?

Equation: _____

Solve: _____

8. Pete's dog weighs 12 pounds more than Joe's dog. The dogs weigh 36 pounds together. How much does Joe's dog weigh?

Equation: _____

Solve: _____

9. When an athletic team is divided into two groups, each group has 36 people in it. How many people are in the team?

Equation: _____

Solve: _____

10. Steven bought 36 ride tickets. The total cost of the tickets is \$9. How much does each ticket cost?

Equation: _____

Solve: _____

11. Five statues are in a box that weighs one pound. The total weight is 36 pounds. How much does each statue weigh?

Equation: _____

Solve: _____

12. Five envelopes each contain the same amount of money. After \$14 is removed \$36 is left. How much was in each envelope?

Equation: _____

Solve: _____

13. Bob wants to deal a deck of 12 cards equally among the players. Each one gets six cards, how many players are there?

Equation: _____

Solve: _____

14. Randy has \$36. The amount he has is \$2 more than half the amount his sister has. How much does his sister have?

Equation: _____

Solve: _____

15. Moe bought a box of cookies. He had a dozen more at home. When he divides them among six people, each gets 7. How many cookies are in a box?

Equation: _____

Solve: _____

16. Sally has \$36. After she buys 12 tapes, she has \$18 left. How much does each tape cost?

Equation: _____

Solve: _____

17. A family of 5 gets a \$4 discount on their dinner bill. The total cost is \$36. What would be the cost for each person with no discount?

Equation: _____

Solve: _____

18. Nick has some baseball cards, and his brother has $\frac{1}{3}$ as many as Nick. Together, they have 36. How many cards does Nick have?

Equation: _____

Solve: _____

19. There are 36 members at a club meeting. After some leave there are 27 left. How many members left?

Equation: _____

Solve: _____

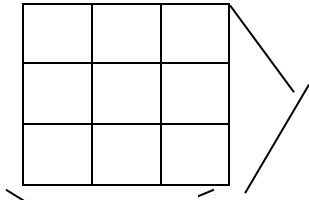
Equations with Squares and Square Roots

1. $\sqrt{x} = 5$	6. $8 = \sqrt{x}$
2. $\sqrt{x} = 7$	7. $11 = \sqrt{x}$
3. $x^2 = 64$	8. $9 = x^2$
4. $x^2 = 16$	9. $\sqrt{x} = 6$
5. $x^2 = 4$	10. $\sqrt{x+1} = 1$

When do you have to be careful about your answer—as in, when are there TWO ANSWERS?

Inverse Operations: Operations that undo one another

Squares and square roots are inverse operations.



Base or
Root = 3

$$3^2 = 9 \quad \text{“square”}$$

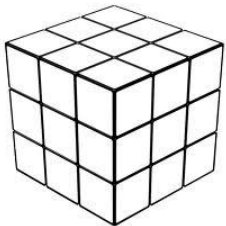
$$\sqrt{9} = 3 \quad \text{“square root”}$$

Base or
Root = 3

Solve each of the following equations. Make sure to give the complete answer.

1. $\sqrt{x} = 10$	2. $\sqrt{x} = 4$	3. $\sqrt{x} = 3$
4. $\sqrt{x} = 7$	5. $x^2 = 36$	6. $x^2 = 144$

Cubes and cube roots are inverse operations.



$$3^3 = 27 \quad \text{“cube”}$$

$$\sqrt[3]{27} = 3 \quad \text{“cube root”}$$

EQUATIONS WITH CUBES AND CUBE ROOTS...Solve each of the following.

1. $\sqrt[3]{8} = x$	2. $\sqrt[3]{64} + x = \sqrt[3]{343}$	3. $3 = \sqrt[3]{x}$
4. $\sqrt[3]{x} - 1 = 4$	5. $x^3 - 9 = 216$	6. $4 - x^3 = 5$

STUDY GUIDE: CCM7+ Unit 3 Solving Equations with Real Numbers

Solve the following equations showing all steps.

1. $2(n - 7) + 3 = 9$

2. $0 = 5(k + 9)$

3. $23 + x = -19$

4. $6a - 4 = -2$

5. $\frac{1}{3}(6x - 15) = x + 7$

6. $\frac{2}{3}x - 18.5 = -12.5$

7. $1.1(x + 5) = -4.4$

8. $\frac{5}{12}x + \frac{1}{4}x - \frac{2}{3} = 8$

Solve each situation by 1) defining a variable, 2) setting up an equation, and 3) solving.

<p>9. Eleven less than five times a number is 19. Find the number.</p> <p>Variable: _____</p> <p>Equation: _____</p> <p>Solution: _____</p>	<p>10. A telephone company charges \$5 a month plus \$0.15 a minute for long distance. If your total phone bill was \$16.25, how many minutes did you talk?</p> <p>Variable: _____</p> <p>Equation: _____</p> <p>Solution: _____</p>
<p>11. During a basketball season, Veronica scored 39 points. She scored 5 fewer than twice the number Rochelle scored. How many points did Rochelle score?</p> <p>Variable: _____</p> <p>Equation: _____</p> <p>Solution: _____</p>	<p>12. The sum of three consecutive integers is -69. Find the three integers.</p> <p>Variables: _____ _____ _____</p> <p>Equation: _____</p> <p>Solution: _____</p>
<p>13. Mike has 27 DVD's. This is five less than four times the number that Jed has. How many does Jed have?</p> <p>Variable: _____</p> <p>Equation: _____</p> <p>Solution: _____</p>	<p>14. A store is selling a new couch for \$907 on a 24-month payment plan. If a down payment of \$145 is given, how much will a customer have to pay each month? Round your answer to the nearest penny.</p> <p>Variable: _____</p> <p>Equation: _____</p> <p>Solution: _____</p>

Solve these equations involving roots, squares, cube roots, and cubes.

15. $\sqrt{x+2} = 7$	16. $a^2 - 6 = 30$
17. $16 - x^3 = -11$	18. $-5 = \sqrt[3]{n}$
19. The volume of a cube is 64 in^3 . What is the length of one side of the cube?	20. The formula for the area of a circle is $A = \pi r^2$. If the area of a circle is 144π , what is the measure of the radius?