

UNIT 4

2016-17
EQUATIONS
CCM6+/7+

Name: _____

Math Teacher: _____

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Projected Test Date: _____

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

Name: _____ Date: _____



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: _____

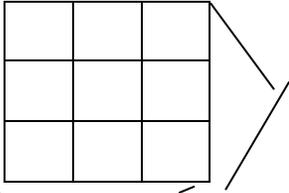
Equations with Squares and Square Roots

| | |
|-------------------|----------------------|
| 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

$$3^2 = 9 \quad \text{“square”}$$

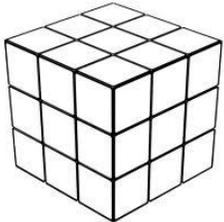
$$\sqrt{9} = 3 \quad \text{“square root”}$$

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? |