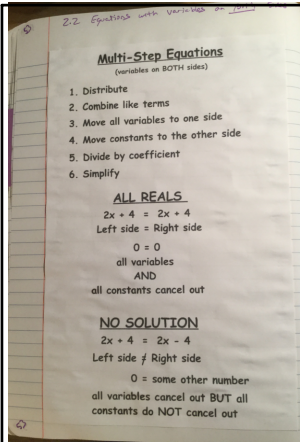
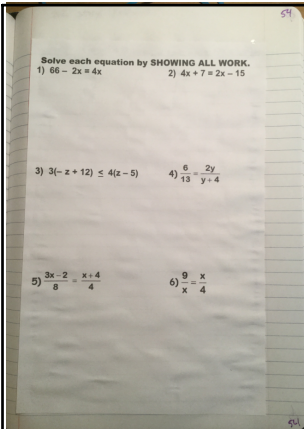


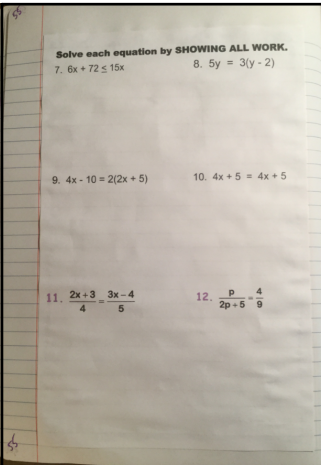


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2.2 Equations with Variables on Both Sides



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Lesson Objectives

Standards

Lesson Notes

2.2 Equations with Variables on Both Sides

Press the tabs to view details.

Start Lesson

Lesson Objectives	Standards	Lesson Notes
A.CED.3 I will demonstrate how an equation with variables on both sides, both with and without distributing can have "no solution" or an "all reals" solution A.REI.1 I will solve a proportion by using cross multiplication A.REI.1 I will explain each step in solving an equation with variables on both sides A.REI.3 I will solve an equation with variables on both sides with and without distribution A.REI.3 I will explain each step in solving an equation with variables on both sides		

Press the tabs to view details.

Start Lesson

Lesson Objectives	Standards	Lesson Notes
	A.CED.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. A.REI.1 Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method. A.REI.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.	

Press the tabs to view details.

Start Lesson

Multi-Step Equations

(variables on BOTH sides)

1. Distribute
2. Combine like terms
3. Move all variables to one side
4. Move constants to the other side
5. Divide by coefficient
6. Simplify

ALL REALS

$$2x + 4 = 2x + 4$$

Left side = Right side

$$0 = 0$$

all variables

AND

all constants cancel out

NO SOLUTION

$$\cancel{2x} + 4 = \cancel{2x} - 4$$

Left side $\neq$ Right side

0 = some other number
all variables cancel out BUT all
constants do NOT cancel out

Solve each equation by **SHOWING ALL WORK.**

1) $66 - 2x = 4x$

$+2x \quad +2x$

$$\frac{66}{6} = \frac{6x}{6}$$

$$X = 11$$

2) $4x + 7 = 2x - 15$

$-2x \quad -2x$

$$2x + 7 = -15$$

$$\frac{2x}{2} = \frac{-22}{2}$$

$$X = -11$$

Solve each equation by **SHOWING ALL WORK.**

1) $66 - 2x = 4x$

$+2x \quad +2x$

$$\frac{66}{6} = \frac{6x}{6}$$

$$X = 11$$

2) $4x + 7 = 2x - 15$

$-2x \quad -2x$

$$2x + 7 = -15$$

$$-7 \quad -7$$

$$\frac{2x}{2} = \frac{-22}{2}$$

$$X = -11$$

Solve each equation by **SHOWING ALL WORK.**

3) $3(-z + 12) \leq 4(z - 5)$

$$-3z + 36 \leq 4z - 20$$

$$+36 \leq 7z - 20$$

$$\frac{56}{7} \leq \frac{7z}{7}$$

$$8 \leq z$$

$$z \geq 8$$

4) $\frac{6}{13} = \frac{2y}{y+4}$

$\times \text{ times}$

$$26y = 6(y+4)$$

$$26y = 6y + 24$$

$$\frac{20y}{20} = \frac{24}{20}$$

$$y = 1.2$$

3) $3(-z + 12) \leq 4(z - 5)$

$$\begin{aligned} -3z + 36 &\leq 4z - 20 \\ +3z &\quad +3z \\ 36 &\leq 7z - 20 \\ +20 &\quad +20 \\ 56 &\leq 7z \\ \frac{56}{7} &\leq \frac{7z}{7} \\ 8 &\leq z \quad \boxed{z \geq 8} \end{aligned}$$

4) $\frac{6}{13} = \frac{2y}{y+4}$

$$\begin{aligned} 6(y+4) &= 26y \\ 6y + 24 &= 26y \\ -6y &\quad -6y \\ 24 &= 20y \\ \frac{24}{20} &= \frac{20y}{20} \\ y &= 1.2 \end{aligned}$$

Solve each equation by SHOWING ALL WORK.

5) $\frac{3x-2}{8} = \frac{x+4}{4}$

$$\begin{aligned} 8(x+4) &= 4(3x-2) \\ 8x + 32 &= 12x - 8 \\ -8x &\quad -8x \\ 32 &= 4x - 8 \\ +8 &\quad +8 \\ 40 &= 4x \\ \frac{40}{4} &= \frac{4x}{4} \\ x &= 10 \end{aligned}$$

6) $\frac{9}{x} = \frac{x}{4}$

$$\begin{aligned} x^2 &= 36 \\ x &= 6 \text{ and } x = -6 \\ x &= \pm 6 \end{aligned}$$

5) $\frac{3x-2}{8} = \frac{x+4}{4}$

$$\begin{aligned} 4(3x-2) &= 8(x+4) \\ 12x - 8 &= 8x + 32 \\ -8x &\quad -8x \\ 4x - 8 &= 32 \\ +8 &\quad +8 \\ 4x &= 40 \\ \frac{4x}{4} &= \frac{40}{4} \\ x &= 10 \end{aligned}$$

6) $\frac{9}{x} = \frac{x}{4}$

$$\begin{aligned} x^2 &= 36 \\ x &= \pm 6 \\ \text{or} \\ x &= 6 \text{ and } x = -6 \end{aligned}$$

Solve each equation by SHOWING ALL WORK.

7. $6x + 72 \leq 15x$

$$\begin{aligned} -6x &\quad -6x \\ 72 &\leq 9x \\ \frac{72}{9} &\leq \frac{9x}{9} \\ 8 &\leq x \\ x &\geq 8 \end{aligned}$$

8. $5y = 3(y - 2)$

$$\begin{aligned} 5y &= 3y - 6 \\ -3y &\quad -3y \\ 2y &= -6 \\ \frac{2y}{2} &= \frac{-6}{2} \\ y &= -3 \end{aligned}$$

Solve each equation by SHOWING ALL WORK.

7. $6x + 72 \leq 15x$
 $-6x$ $-6x$
 $\frac{72}{9} \leq \frac{9x}{9}$
 $8 \leq x$
 $x \geq 8$

8. $5y = 3(y - 2)$
 $5y = 3y - 6$
 $-3y$ $-3y$
 $2y = -6$
 $\frac{2y}{2} = \frac{-6}{2}$
 $y = -3$

Solve each equation by SHOWING ALL WORK.

9. $4x - 10 = 2(2x + 5)$
 $4x - 10 = 4x + 10$
 $-4x$ $-4x$
 $-10 = 10$
 NO Solution

10. $4x + 5 = 4x + 5$
 All Reals

9. $4x - 10 = 2(2x + 5)$
 $4x - 10 = 4x + 10$
 $-4x$ $-4x$
 $-10 = 10$
 NO Solution

10. $4x + 5 = 4x + 5$
 $-4x$ $-4x$
 $5 = 5$
 All Reals

Solve each equation by SHOWING ALL WORK.

11. $\frac{2x+3}{4} = \frac{3x-4}{5}$
 $4(2x+3) = 5(3x-4)$
 $8x + 12 = 15x - 20$
 $-10x$ $-10x$
 $-8x + 12 = -20$
 $-8x = -32$
 $\frac{-8x}{-8} = \frac{-32}{-8}$
 $x = 4$

12. $\frac{p-4}{2p+5} = \frac{9}{9}$
 $p - 4 = 9$
 $p = 13$

11. $\frac{2x+3}{4} = \frac{3x-4}{5}$

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

$$10x + 15 = 12x - 16$$

$$-10x \quad -10x$$

$$15 = 2x - 16$$

$$+16 \quad +16$$

$$31 = 2x$$

$$\frac{31}{2} = \frac{2x}{2}$$

$$x = 15.5$$

12. $\frac{p}{2p+5} = \frac{4}{9}$

$$9p = 4(2p+5)$$

$$9p = 8p + 20$$

$$-8p \quad -8p$$

$$p = 20$$

On Your Whiteboards

a) $3y + 6 > 2y - 4$ b) $3(7 + 2w) \geq \frac{1}{2}(-2 - 10w)$

c) $\frac{n}{18} = \frac{n-3}{16}$

On the
Worksheet

Homework

1. $10x = 143 - x$

2. $4x + 2x - 3 = 21$

3. $3x + 5 - 5x < 14$

4. $6x + 6 > -x + 55$

5. $5x + 20 = 3x$

6. $n + 8 = -4n + 53$

7. $12 - 7n = 2n + 30$

8. $-9(d + 2) = 4(15 + d)$

9. $13 = -2(x - 8)$

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

11. $4x - 5 < 2x + 17$

12. $-6u + 11 \geq 7u - 28$

$$13. -9 + 8w > 3w - 24$$

$$14. 2x + 6 = 2x + 3$$

$$15. 5x - 8 = 5x + 8$$

$$16. 4x + 1 = 4x + 1$$

$$17. 6(4 - 2h) = 4(5 - 3h)$$

$$18. 3(2x - 2) = 6(x - 1)$$

$$19. 6(3x + 9) = 9(2x + 1)$$

Round answers to the nearest tenth if necessary.

20. $\frac{x+3}{4} = \frac{x-1}{3}$

21. $\frac{x}{8} = \frac{2}{x}$

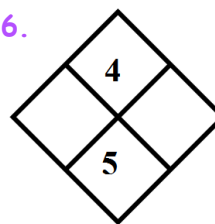
22. $\frac{x+3}{4} = \frac{2x-5}{6}$

23. $\frac{x-4}{2} = \frac{x+1}{9}$

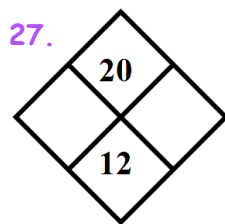
24. $\frac{15}{8x-3} = \frac{1}{2+2x}$

25. $\frac{x}{4} = \frac{2x+3}{15}$

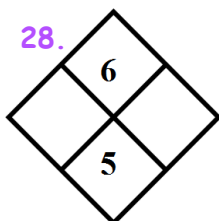
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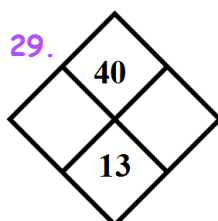
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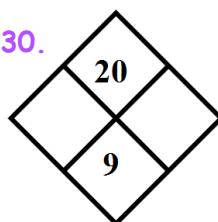
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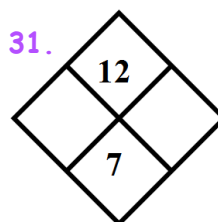
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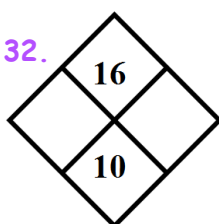
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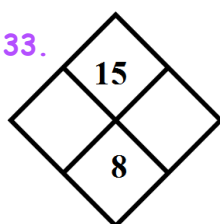
31.



32.



33.



Answers:

1) $x = 13$ 3) $x > -4.5$ 5) $x = -10$ 7) $n = -2$ 9) $x = 1.5$ 11) $x < 11$
 13) $w > -3$ 15) no solution 17) no solution 19) no solution 21) $x = 4$ and $x = -4$
 23) $x = 5.4$ 25) $x = 1.7$ 27) 10 and 2 29) 8 and 5 31) 4 and 3 33) 5 and 3