

Name: _____

UNIT 3 LEARNING GUIDE – EQUATIONS

INSTRUCTIONS:

Using a pencil, complete the following questions as you work through the related lessons. Show ALL of your work as is explained in the lessons. Do your best and always ask questions if there is anything that you don't understand.

3.1 EQUATIONS

- An equation always contains an _____ sign.
- Circle all of the equations in the examples below.

$15 - y = 3$

$1300 - 450$

$x \geq 75$

$4\ 970\ 201$

$0 < 67 + 2$

$18 \div m = 9 - n$

$22 + 7 + 3 = 31$

$d - t = s$

$10 = t + \frac{1}{3} - 25$

$6 \div 3 + 8 \times 2$

$6 + 5 = 9 - 2 + 4$

$xy > ab$

- Determine the value of one square in each example.



- Find the missing value. *Reminder: Both sides must be equal.*



3.2 VARIABLES

1. Write an equation to match the sentence. You do not need to solve the equation.
Reminder: Use a variable to represent the unknown number. A variable can be any letter.

Ex. Five times a number plus 15 is 40

$$5y + 15 = 40$$

a. The sum of six and a number is

b. A number minus four is 11.

c. Nine times number minus four is 41.

d. Fifty divided by a number less 22 is 3.

e. Sixty plus 12 times a number is 96.

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2. Fill in the table. Use the terminology

	Word Sentence	Equation
Ex.	<i>Five plus a number divided by 3 is 20.</i>	$5 + \frac{n}{3} = 20$
a.		$10 + x = 30$
b.		$s - 9 = 12$
c.		$2d + 7 = 15$
d.		$20 - \frac{6}{x} = 17$

3. Write an equation to represent each mathematical problem. You do not have to solve the problem. *Reminder: One of the terms of your equation will be a variable. You can use any letter to represent that unknown value.*

a. Lee had \$400 in his bank account. After withdrawing some money, he had \$342.

b. There were 27 people on a bus. At the next stop, a certain number got on the bus and then there were 35 people on the bus.

c. A grandmother divided some apples into 5 groups. Each group contained 8 apples.

- d. Adelaide purchased several packs of chewing gum. Each pack cost 2 dollars and she paid a total of 14 dollars.

3.3 SUBSTITUTION

1. Follow the steps in order to evaluate each expression.

Ex.

	$x + 4$ if $x =$
	5
Step 1	$(\quad) + 4$
Step 2	$(5) + 4$
Step 3	9

b.

	$3y + 2$ if $y =$
	7
Step 1	_____
Step 2	_____
Step 3	_____

a.

	$x - 2$ if $x =$
	9
Step 1	_____
Step 2	_____
Step 3	_____

c.

	$8 + \frac{r}{6}$ if $r =$
	24
Step 1	_____
Step 2	_____
Step 3	_____

2. Evaluate each expression. Reminder: Use the same steps as you did in #1.

a. $12t$ if $t = 5$

c. $100 - x$ if $x = 38$

b. $\frac{45}{e} + 2$ if $e = 9$

d. $11n - 30$ if $n = 5$

3. Fill in the charts below.

a. Evaluate $\frac{24}{m}$

If $m = 2$, the quotient is	12
If $m = 8$, the quotient is	_____

b. Evaluate $8y$

If $y = 2$, the product is	_____
If $y = 10$, the product is	_____

If $m = 4$, the quotient is	
If $m = 1$, the quotient is	

If $y = 8$, the product is	
If $y = 25$, the product is	

4. Wu gets paid \$250 over the winter for clearing his neighbour's driveway of snow. He gets paid an extra \$5 each time that he feeds the cat when his neighbour is away.
- Write an expression for this situation. *Reminder: An **expression** does not contain an equal sign.*
 - Solve the expression to find out how much money Wu will earn over the winter if feeds the cat 13 times.
5. Four friends divide a large stack of graphic novels equally among themselves. Kathryn adds her portion to her current collection of 21 graphic novels.
- Write an expression for this situation.
 - Solve the expression to find out how many graphic novels Kathryn has if there are 76 books in the stack.
6. Choose the correct equation that relates to the word problem, then solve.
- Logan has 4 cm of hair cut off at the hair salon. If b is the length of hair before getting it cut and a is the length of hair after getting it cut, which equation would you use to show the length of Logan's hair after getting it cut?
 - $4 - a = b$
 - $b + 4 = a$
 - $b - 4 = a$
 - Solve for a if Logan's hair was 11 cm long before getting it cut.
7. Evaluate.
- Ex. $2x - y$ if $x = 16$, $y = 9$

$$2() - ()$$

$$2(16) - (9)$$

$$23$$

a. $5w + s$ if $w = 7$, $s = 4$

b. $bh - 4$ if $b = 15, h = 3$

c. $\frac{n+5}{m}$ if $n = 37, m = 6$

8. Evaluate each expression.

a. $4 + t$ if $t = -8$

d. $-9n$ if $n = -4$

b. $30 \div s$ if $s = -3$

e. $f - 28$ if $f = -11$

c. $50 - x$ if $x = -24$

f. $z \div (-8)$ if $z = -64$

9. Fill in the charts below. Reminder: You can remove the \times symbol between a number and a variable and it still means multiplication.

a.

Evaluate $\frac{d+5}{2}$	
If $d = -1$	2
If $d = -9$	
If $d = 17$	
If $d = -21$	

b.

Evaluate $-3n + 10$	
If $n = -8$	
If $n = 4$	
If $n = -11$	
If $n = 11$	

c.

Evaluate $f - 6g$	
If $f = 10$ and $g = 1$	
If $f = 33$ and $g = -2$	
If $f = -5$ and $g = 5$	
If $f = -42$ and $g = -7$	

d.

Evaluate $\frac{18}{m} + p$	
If $m = 3$ and $p = 1$	
If $m = -2$ and $p = 9$	
If $m = 6$ and $p = -1$	
If $m = -9$ and $p = -5$	

10. The following equation can be used to approximate the temperature in degrees Celsius

from degrees Fahrenheit: $C = \frac{F-30}{2}$

- g. Determine the approximate temperature in degrees Celsius when the temperature is $26^{\circ}F$.
- h. Determine the approximate temperature in degrees Celsius when the temperature is $-4^{\circ}F$.
- i. Determine the approximate temperature in degrees Celsius when the temperature is $-32^{\circ}F$.
11. The percentage of battery power left after using your new smart phone can be determined using the equation $P = -0.1h + 1$. The percentage is shown in decimal form (ex. $0.4 = 40\%$).
- j. Use this equation to determine how much battery power you would have left after 3 hours of use.

- k. Use this equation to determine how much battery power you would have left after 7.5 hours of use.

3.4 EQUATION SOLVING

1. A student worked at solving the following equations. Determine whether they reached the correct answer or not by checking their work. *Reminder: To check the solution to an equation, plug the solution back into the problem and evaluate.*

Ex. $d - 16 = 51$

Student answer: $d = 68$

$() - 16 = 51$

$(68) - 16 = 51$

$52 \neq 51$

The answer is incorrect.

c. $m + 15 = -21$

Student answer: $m = -36$

a. $x - 23 = 38$

Student answer: $x = 61$

d. $-5t = 45$

Student answer: $t = 9$

b. $q + 20 = 93$

Student answer: $q = 63$

e. $-4v = 56$

Student answer: $v = -14$

2. Solve each equation by isolating the variable. Follow the steps. *Reminder: Even though you may be able to solve these equations in your head, practice writing down the steps as they will be needed when the level of difficulty increases.*

	Ex. $8e = 56$	a. $f - 13 = 51$	b. $\frac{x}{10} = 4$
<u>Step 1:</u> Determine the operation needed to isolate the variable. (The opposite operation).	\div		
<u>Step 2:</u> Use this operation on both sides of the equation.	$\frac{8e}{8} = \frac{56}{8}$		
<u>Step 3:</u> Evaluate	$e = 7$		
<u>Step 4:</u> Check your answer by putting it back into the question.	$8(7) = 56$ $56 = 56$		

3. Solve each equation. Follow the same steps as you did in #2.

$$\begin{array}{r} \text{Ex. } u + 15 = 47 \\ -15 \quad -15 \\ \hline u = 32 \end{array}$$

□

$$(32) + 15 = 47$$

Correct

a. $\frac{c}{12} = 8$

d. $3g = -45$

e. $t + 62 = 50$

b. $6a = 18$

f. $\frac{w}{-2} = 34$

c. $p - 23 = 34$

g. $j - 41 = 26$

3.5 TWO-STEP SOLVING

1. Identify each equation as *1 step* or *2 steps*. You do not need to solve the equation.
Reminder: You are counting how many operations you need to perform on each equation in order to isolate the variable.

Ex. $15n + 1 = 46$

Two steps

a. $32 - y = 9$

b. $\frac{x}{5} + 16 = 21$

c. $75 = 12w + 3$

d. $f + 16 = 21$

e. $19 = 24 - \frac{u}{8}$

2. Match each number sentence with its corresponding expression.

a. 3 times a number increased by 6

b. A number divided by 6 plus 3

c. A number divided by 3 increased by 6

d. 3 minus six times a number

e. 3 subtracted by a number divided by 6

f. 6 times a number less 3

i. $3 - \frac{n}{6}$

ii. $3n + 6$

iii. $3 - 6n$

iv. $6n - 3$

v. $\frac{n}{3} + 6$

vi. $\frac{n}{6} + 3$

3. In general, when solving 2-step equations, it is easiest to deal with any _____ and _____ first. Then, you can deal with any _____ and _____.

4. Isolate the variable to solve each 2-step equation.

Ex. $3a + 2 = 11$

$$\begin{array}{r} -2 \quad -2 \\ \hline 3a \quad 9 \\ \hline 3 \quad 3 \\ \hline a = 3 \end{array}$$

Check: $3(2) + 2 = 11$
 $11 = 11$

a. $6y + 3 = 27$

Check:

b. $10r - 13 = 57$

Check:

c. $\frac{s}{5} + 4 = 8$

Check:

d. $\frac{n}{2} - 4 = -9$

Check:

e. $4t - 61 = 39$

Check:

f. $\frac{(x+12)}{8} = -2$

Check:

g. $11p + 42 = 119$

Check:

3.6 SOLVING WITH FRACTIONS

1. Use the distribution method to expand these expressions.

Ex. $4(3x - 1)$

$12x - 4$

c. $3\left(r + \frac{1}{3}\right)$

a. $6(3a + 2)$

d. $8\left(2m - \frac{3}{8}\right)$

b. $2(7 - 5y)$

e. $5\left(\frac{x}{5} + 4\right)$

2. Remove the fractions from these equations. You do not have to solve the equations.

Reminder: Multiply **all** terms on **each** side by the denominator of the fraction.

Ex. $4x - \frac{4}{5} = 8$

$5\left(4x - \frac{4}{5}\right) = 5(8)$

$20x - 4 = 40$

c. $\frac{11}{3} - \frac{4c}{3} = 2$

a. $3y + \frac{1}{4} = 4$

d. $2n - 1 = \frac{1}{2}$

b. $\frac{x}{6} + 7 = 10$

e. $\frac{r}{2} + 8 = \frac{1}{2}$

3. Solve the equations below. Reminder: First remove the fractions from the equation as you did in #1, then solve as usual. Always check your answer.

a. $w + \frac{7}{8} = 5$

d. $\frac{4r}{3} - 1 = \frac{8}{3}$

b. $5h - \frac{2}{3} = 6$

e. $5y = \frac{13}{4}$

c. $\frac{v}{9} + 2 = 7$

f. $\frac{3f}{2} + \frac{1}{2} = \frac{7}{2}$

4. Match each equation with the Lowest Common Multiple that could be used to remove the fractions from the equation. Reminder: You are looking for the LCM of the denominators in the equation.

	Equation	LCM
a.	$\frac{c}{5} + 9 = \frac{7}{2}$	8
b.	$3x + \frac{2}{3} = \frac{4}{9}$	10
c.	$\frac{2z}{4} = \frac{15}{6}$	18
d.	$\frac{6f}{4} - \frac{3}{2} = \frac{5}{8}$	12
e.	$\frac{23}{6} + \frac{e}{3} = \frac{11}{8}$	24
f.	$\frac{5d}{2} - \frac{1}{9} = \frac{4}{3}$	9

5. Follow the steps to solve each equation.

	Ex. $\frac{2x}{4} = \frac{15}{6}$	a. $\frac{3x}{2} = \frac{6}{5}$	b. $2x - \frac{2}{3} = \frac{4}{9}$
<u>Step 1</u> : Find the LCM of the denominators.	LCM of 4 & 6 = 12		
<u>Step 2</u> : Use the LCM to remove the fractions from each side of the equation.	$3 \cancel{12} \left(\frac{2x}{\cancel{4}} \right) = 2 \cancel{12} \left(\frac{15}{\cancel{6}} \right)$ $6x = 30$		
<u>Step 3</u> : Solve.	$\frac{6x}{6} = \frac{30}{6}$ $x = 5$		

6. Elisa is learning to solve equations that include fractions. Here is some of her work.

a. Identify Elisa's error in her solution below.

$$\frac{x}{2} - 3 = \frac{3}{4} \square \square$$

$$4 \left(\frac{x}{2} \right) - 3 = 4 \left(\frac{3}{4} \right)$$

$$2x - 3 = 3$$

$$2x = 6$$

$$x = 3$$

b. Fix Elisa's error and solve the equation correctly.

$$\frac{x}{2} - 3 = \frac{3}{4} \square \square$$

7. Solve the equations below using the method of your choice.

a. $\frac{r}{5} - 4 = \frac{7}{2}$

c. $\frac{5}{2} - x = \frac{11}{8}$

b. $\frac{f}{4} = \frac{2}{3}$

d. $\frac{5x}{2} - \frac{3}{9} = \frac{5}{6}$

3.7 SOLVING WITH BRACKETS

1. Use the distribution method to expand these expressions.

Ex. $6(3x - 7)$

$18x - 42$

a. $3(a + 5)$

b. $9(5y - 2)$

c. $-5(4r + 8)$

d. $-8(-2z - 1)$

e. $2(-6 + 10d)$

2. Solve the following equations. *Reminder: Often, using distribution to remove the brackets from the equation is the most efficient method.*

Ex. $2(3y - 4) = 7$

$6y - 8 = 7$

$6y = 15$

$y = \frac{15}{6}$

$y = \frac{5}{2}$

c. $5(x - 4) = 3x$

a. $7(f + 11) = 0$

d. $75 = -10(a - 4)$

b. $3(2k - 5) = 21$

e. $4(3x - 4) = 4x + 6$

3. Solve the following equations. Reminder: Make sure that you keep your work well organized.

a. $2(4x - 3) = -5(x - 6)$

c. $-4(3y - 1) = 3(2y + 2)$

b. $4(5c - 3) = 7(2c + 3)$

d. $3(4 + w) = 5(10 + w)$

4. Simplify the expressions by combining like terms.

Ex. $3e + 9 - e + 11$

$2e + 20$

c. $-10f - 15 + 2f - 6$

a. $5x + 20 + 2x - 1$

d. $25 + 4z - 5z + 25 + 1$

b. $y - 8 + 1 + 7y$

e. $11m - 4 + m + 3 - 3m$

5. Solve the following equations.

Ex. $2(4v + 1) - 3(2v - 5) = 60$

$8v + 2 - 6v + 15 = 60$

$2v + 17 = 60$

$2v = 43$

$v = \frac{43}{2}$

$v = 21\frac{1}{2}$

a. $3(x + 9) + 5(2x - 4) = 46$

b. $10(2y - 4) - 2(3y - 31) = -6$

c. $4(4n + 9) - (6n + 7) = 54$

6. Combine all of your skills to solve the following equations.

a. $8t + 5 = -4(3t + 7)$

c. $\frac{5x+1}{2} = \frac{3x+7}{3}$

b. $6 + 2(7x - 5) = 2(-8x - 1)$

d. $\frac{h-11}{2} = 7 - (h - 40)$

3.8 SOLVING APPLIED

1. Solve each word problem by following the 4 steps outlined in the Word Problems videos.

- a. James is 5 years older than Marin. If you add their ages together, they total 31. Determine the ages of both James and Marin.

Step 1 – Read the question carefully and summarize:

Step 2 – Note the variables:

Step 3 – Translate and Solve:

Step 4 – Ensure you've answered the question:

- b. The sum of two consecutive integers is 109. Determine the integers.

Step 1:

Step 2:

Step 3:

Step 4:

- c. Three pieces of piping are needed on a construction site. The second piece needs to be 2m longer than the first, and the third piece needs to be 7m longer than the first. The combined length of the piping is 72m. Determine the lengths of the 3 pieces of pipe.

Step 1:

Step 2:

Step 3:

Step 4:

2. Solve each word problem by following the 4 steps outlined in the Word Problems videos.

- a. In a football game, the home team scored 3 times as many points as the visiting team. They won the game with a total of 21 points. How many points did the visiting team score?

Step 1:

Step 2:

Step 3:

Step 4:

- b. The width of a straight racetrack is one tenth of the measurement of its length. The perimeter of the track is 132 metres. What are the dimensions of the length and width of the track?

Step 1:

Step 2:

Step 3:

Step 4:

3. Solve each word problem by following the 4 steps outlined in the Word Problems videos.

- a. Rebecca bought 15 cupcakes for her birthday party. Each cupcake was \$3 plus tax. The total bill was \$47.25. How much tax did she pay on each cupcake?

Step 1:

Step 2:

Step 3:

Step 4:

- b. A family of four went to see a live concert in Vancouver. Each family member bought a commemorative concert T-shirt, which cost $\frac{1}{5}$ of the price of a ticket. The total bill for 4 tickets and 4 T-shirts was \$384. How much did each ticket and each T-shirt cost?

Step 1:

Step 2:

Step 3:

Step 4:

4. Write out a real-world problem that could be represented by each of the following equations.
- a. $2(y + 10) = 32$

b. $\frac{x}{3} + x = 20$

UNIT 3 – ANSWER KEY

SECTION 3.1

$$15 - y = 3$$

$$1300 - 450$$

$$x \geq 75$$

$$4\ 970\ 201$$

$$0 < 67 + 2$$

$$18 \div m = 9 - n$$

$$22 + 7 + 3 = 31$$

$$d - t = s$$

$$10 = t + \frac{1}{3} - 25$$

$$6 \div 3 + 8 \times 2$$

$$6 + 5 = 9 - 2 + 4$$

$$xy > ab$$

1. equal

2.

3. a. 2 circles b. 6 c. 3 d. 5

4. a. 35 b. 9

SECTION 3.2

1. a. $6 + x = 16$ b. $x - 4 = 11$ c. $9x - 4 = 41$ d. $\frac{50}{x} - 22 = 3$ e. $60 + 12x = 96$

2. a. Ten plus a number is 30. b. A number less 9 is 12. c. Two times a number plus seven is 15. d. Twenty less six divided by a number is 17.

3. a. $400 - x = 342$ b. $27 + x = 35$ c. $\frac{x}{5} = 8$ d. $2x = 14$

SECTION 3.3

1. a. $() - 2$, $(9) - 2$, **7** b. $3() + 2$, $3(7) + 2$, **23** c. $8 + \frac{1}{6}$, $8 + \frac{24}{6}$, **12**

2. a. 60 b. 7 c. 62 d. 25

3. a. 3, 6, 24 b. 16, 80, 64, 200

4. a. $250 + 5x$ b. \$315

5. a. $\frac{x}{4} + 21$ b. 40 books

6. a. iii b. $11cm - 4cm = 7cm$

7. a. 39 b. 41 c. 7

8. a. -4 b. -10 c. 74 d. 36 e. -39 f. 8
9. a. 2, -2, 11, -8 b. 34, -2, 43, -23 c. 4, 45, -35, 0 d. 7, 0, 2, -7
10. a. -2°C b. -17°C c. -31°C
11. a. 70% (0.7) b. 25% (0.25)

SECTION 3.4

1. a. Correct b. Incorrect c. Correct d. Incorrect e. Correct
2. a. 64 b. 40
3. a. 96 b. 3 c. 57 d. -15 e. -12 f. -68 g. 67

SECTION 3.5

1. a. 1-step b. 2-step c. 2-step d. 1-step e. 2-step
2. a. ii b. vi c. v d. iii e. i f. iv
3. additions and subtractions, multiplications and divisions
4. a. $y = 4$ b. $r = 7$ c. $s = 20$ d. $n = -10$ e. $t = 25$ f. $x = -28$ g. $p = 7$

SECTION 3.6

1. a. $18a + 12$ b. $14 - 10y$ c. $3r + 1$ d. $16m - 3$ e. $x + 20$
2. a. $12y + 1 = 16$ b. $x + 42 = 60$ c. $11 - 4c = 6$ d. $4n - 2 = 1$ e. $r + 16 = 1$
3. a. $w = 4\frac{1}{8}$ b. $h = 1\frac{1}{3}$ c. $v = 45$ d. $r = 2\frac{3}{4}$ e. $y = \frac{13}{20}$ f. $f = 2$
4. a. 10 b. 9 c. 12 d. 8 e. 24 f. 18
5. a. Step 1: 10, Step 2: $15x = 12$, Step 3: $x = \frac{12}{15} = \frac{4}{5}$ b. Step 1: 9, Step 2: $18x - 6 = 4$,
Step 3: $x = \frac{5}{9}$
6. a. Elisa didn't multiply all of the terms on the left side by 4. b. $x = 7\frac{1}{2}$
7. a. $37\frac{1}{2}$ b. $2\frac{2}{3}$ c. $1\frac{1}{8}$ d. $\frac{7}{15}$

SECTION 3.7

1. a. $3a + 15$ b. $45y - 18$ c. $-20r - 40$ d. $16z + 8$ e. $-12 + 20d$

2. a. -11 b. 6 c. 10 d. $-3\frac{1}{2}$ e. $2\frac{3}{4}$
3. a. $2\frac{10}{13}$ b. $5\frac{1}{2}$ c. $-\frac{1}{9}$ d. -19
4. a. $7x + 19$ b. $8y - 7$ c. $-8f - 21$ d. $-z + 51$ e. $9m - 1$
5. a. 3 b. -2 c. $2\frac{1}{2}$
6. a. $-1\frac{13}{20}$ b. $\frac{1}{15}$ c. $1\frac{2}{9}$ d. 35

SECTION 3.8

1. a. Marin is 13 years old and James is 18 years old. b. The integers are 54 and 55. c. The pieces of pipe are 21m, 23m, and 28m long.
2. a. The visiting team scored 7 points. b. The length of the track is 60m and the width is 6m.
3. a. She paid \$0.15 tax on each cupcake. b. Each ticket cost \$80 and each T-shirt cost \$16.
4. a. Many possible answers. Example: Joe bought 2 books and 2 pens. Each book cost \$10. The bill came to \$32. How much did one pen cost? b. Many possible answers. Example: Phoebe needed 2 pieces of wood for a project. The total length of both pieces needed to be 20 cm. The second piece had to be one third of the length of the first. Determine the length of both pieces.