



An = sign is kind of like a seesaw So remember, whatever you do to one side you need to do to the other.

Solve means we find the value of unknown number (variable) Opposite operations:

- opposite of addition is ______
- opposite of subtraction is _____

x + 3 = 5	g – 2 = 4	10 = 2 + j	5 = y – 7

We can use the same method with fractions *remember to use a common denominator*

Review:

$$\frac{3}{5} - \frac{1}{2} = \frac{2}{3} + \frac{1}{2} =$$

$x - \frac{5}{6} = \frac{2}{6}$	$m + \frac{1}{8} = \frac{3}{4}$	$\frac{4}{5} = c + \frac{6}{10}$

LG 8 Adapted - Algebra

Expectation #1: Solve one-step linear equations with rational coefficients.

<u>Algebraic equations</u> are equations that have a letter or symbol that represents an unknown number. The goal of algebra is to find out what that unknown number is.

All techniques we use to find the unknown number <u>try to get the letter (variable)</u> <u>alone</u>. This way we know what one of the variables is worth.

Solving Algebraic equations

Example 1: Adding x + 5 = 10We have a variable added with a number. To get the variable alone, we can subtract away the number (5). But what we do to one side, we equally do to the other side.



Example 2: Subtracting y - 5 = 10

We have a variable added with a number. To get the variable alone, we can add 5 to make it zero. But what we do to one side, we equally do to the other side.



TA:

Practice!

1) a) x + 4 = 12 b) z - 5 = 9 c) h + 4 = -2

 $_{\sf d)}-6+c=-3$ $_{\sf e)}2=i+9$ $_{\sf f)}3+4=j+12$

_{g)}
$$14 - 2 = g - 5$$
 _{h)} $a + 3 = 26 + 7$ _{i)} $f - 6 = 40 - 6$

Answers: a) x = 8 b) z = 14 c) h = -6 d) c = 3 e) i = -7 f) j = -5 g) g = 17 h) a = 30 i) f = 40





2) For these ones, you will need to remember how to add and subtract fractions! Example:

 $P \;+ rac{1}{4} = rac{1}{2}$

We subtract ¼ on each side

$$P=rac{1}{2}-$$

Make the bottoms the same by multiplying so they are both out of 4. This can be done by multiplying each side by 2.

a)
$$K-\frac{2}{5}=\frac{3}{5}$$
 b) $F+\frac{1}{2}=\frac{7}{8}$ c) $C-\frac{3}{8}=\frac{5}{16}$

d)
$$\frac{2}{9} + F = \frac{1}{3}$$
 e) $\frac{1}{15} = B - \frac{4}{5}$ f) $\frac{2}{3} = \frac{1}{4} + I$

 $C' = I(J) = \frac{S_1}{S_1} = g(a) = \frac{b}{T} = J(P) = \frac{1}{11} = J(D) = \frac{S_2}{S_1} = J(P) = \frac{1}{2}$

Solve the following equations:

a)
$$x = \frac{1}{3} + \frac{4}{6}$$
 b) $a + \frac{1}{2} = \frac{5}{2}$ c) $y + \frac{1}{3} = \frac{8}{6}$
d) $w - \frac{4}{3} = \frac{10}{6}$ e) $b - \frac{2}{6} = \frac{7}{3}$ f) $r - \frac{1}{4} = \frac{2}{3}$

a)
$$x = rac{1}{3} + rac{4}{6}$$
 b) $a + rac{1}{2} = rac{5}{2}$ c) $y + rac{1}{3} = rac{8}{6}$

x=1 a=2 y=1

d)
$$w - \frac{4}{3} = \frac{10}{6}$$
 e) $b - \frac{2}{6} = \frac{7}{3}$ f) $r - \frac{1}{4} = \frac{2}{3}$
w=3 b=3 $r = \frac{11}{12}$

Math 9 Notes - LG 8 Solving One Step Equations – Multiplication & Division (& a lil' 2-step) Watch: <u>https://youtu.be/Y2ZXS3dOnzs</u>



Solve means we find the value of unknown number (variable) Opposite operations:

- opposite of multiplying is ______
- opposite of dividing is ______

Remember t	that fractions are division! $\frac{x}{2}$ is the same as $x \div 2$
$5x = 15 \qquad 8 = 2x \qquad \frac{x}{3}$	$= 10 \qquad \qquad \frac{x}{2} = 6$

Cross Multiplication - use when two fractions are equal to each other (equivalent fractions)

	5_	5
8	6	6

$\frac{x}{3} = \frac{4}{6}$	$\frac{25}{5} = \frac{20}{x}$	$\frac{1}{12} = \frac{x}{60}$

ONE STEP – CROSS MULTIPLY & DIVIDE

	$\frac{1}{2} = \frac{1}{10}$	$\frac{1}{2} = \frac{5}{10}$	$\frac{1}{2} = \frac{5}{2}$	$\frac{1}{2} = \frac{5}{10}$
You try:	$\frac{2}{3} = \frac{1}{12}$		$\frac{1}{3} = \frac{4}{6}$	$\frac{1}{5} = 4$



5=? (7 92=1(2 72=m(p 9=6(2 91=X(9 7=x(b signere







		Answer Key	
		One-Step Equations: Integers	Level 1: S1
Solv	ve each equat	tion.	
1)	10 = z + 6	2) $8y = 48$	
	z = 4	y = 6	
3)	q – 12 = 1	4) $18 = \frac{a}{2}$	
	q = 13	a = 36	
5)	$\frac{r}{3} = 7$	6) 11 = m − 4	
	r = 21	m = 15	
7)	t – 19 = 2	8) $1 + s = 3$	
	t = 21	s = 2	
9)	24 = 4c	$10) \frac{V}{5} = 9$	
	c = 6	v = 45	

Math 9 Notes - LG 8 Solving Two Step Equations – Whole Numbers Watch: <u>https://youtu.be/njfnZLqyRvk</u>



Opposite of addition is ______ & the opposite of subtraction is ______

Opposite multiplication is ______ & the opposite of division is ______.

When doing an inverse (opposite) operation we do it in the OPPOSITE order of BEDMAS! This means we do _______ before ______.

Goal: to solve for x (\	will look like x =)	+ - then	x ÷
4x - 2 = 10	5 = - 3 - 2x	$2 + \frac{x}{3} = 17$	$9 = \frac{y}{3} - 5$

Examples with the variable as the denominator (on the bottom):

$\frac{15}{x} = 3$	$\frac{14}{y} = 7$	$2 + \frac{12}{x} = 8$

Side skill: turning whole numbers into fractions

You can turn any number into a fraction by putting it over 1. Example and Practice:



Cross multiply! But how?

Example:

$$\frac{20}{x} = 5$$

Step 1: Turn the 5 into a fraction (make it over 1)



Step 2: Multiply each bottom by the top <u>on the other side of the</u> <u>equals sign.</u> The answer to the multiply goes in the top spot.



For the one with "x", imagine there is an invisible "1" in front of it.





Solve the rest normally:





TA:

Practice:

 $\frac{32}{-}=4$ a) \boldsymbol{g}

> Step 1: turn 4 into a fraction over 1. Step 2: divide each side by 4.

b)
$$\frac{55}{z} = 11$$

c)
$$rac{27}{d}=-3$$
 d) $rac{24}{2n}=4$

$$\stackrel{
m e)}{=} rac{30}{3y} = 5$$

$$rac{24}{2p}=4$$

 $\begin{array}{c} {}^{\rm f)} \quad \frac{7}{a} = 8 \end{array}$ Warning, answer may be a fraction.

Whole Numbers Over 1 and Cross Multiply

Make these numbers into fractions.

a)	5	b)	13	c)	2
d)	134	e)	1013	f)	1302031

Solve the following with cross multiplication.

.

(a)
$$rac{8}{x}=2$$
 (b) $rac{12}{x}=3$ (c) $rac{20}{x}=10$

d)
$$6 = \frac{18}{x}$$
 e) $7 = \frac{21}{y}$ f) $\frac{6}{x} = \frac{2}{3}$
g) $\frac{3}{4} = \frac{9}{a}$ h) $\frac{5}{6} = \frac{10}{c}$ i) $\frac{72}{6c} = 6$

TA:

Answers

Make these numbers into fractions.

a)	$\frac{5}{1}$	b) 13 	3 <u>3</u> 1	c) 2 $\frac{2}{1}$	
d)	134	e) 10	13	f) 13	02031
Solv	$rac{134}{1}$ e the following with (1 cross mult	013 1 iplication.	1	. <u>302031</u> 1
a)	$rac{8}{x}=2$	b)	$rac{12}{x}=3$	c)	$rac{20}{x}=10$
	X= 4		X=4		X=2
d)	$6=rac{18}{x}$	e)	$7=rac{21}{y}$	f)	$rac{6}{x}=rac{2}{3}$
	X=3		y=3		X=9
g)	$rac{3}{4}=rac{9}{a}$	h)	$rac{5}{6}=rac{10}{c}$	i)	$rac{72}{6c}=6$
	a=12		c=12		c=2

TA:

Checking your answer:

Two students are given the question:

12H = 48

Bill thinks the answer is 2. Anisa thinks the answer is 4. Check their answers to see who is right.

Solution: <u>Replace</u> the variable (H) with each of their numbers (Bill's number and then Anisa's number) to check if it makes sense.



1) Determine if the following answers make sense for each equation

a)

$$3 + x = 20, x = 17$$
 b)
 $\frac{f}{4} = 12, f = 32$

 c)
 $5y = 35, y = 6$
 d)
 $E - \frac{1}{3} = \frac{1}{2}, E = \frac{5}{6}$

(v) des p) vo c) vo q) des

TA:

2)Solve the following and check your answer.

a) x+5=10 b) 16=x-5

c)
$$7y=21$$
 d) $rac{n}{4}=8$

e)
$$rac{1}{4}+g=rac{3}{4}$$
 f) $rac{27}{d}=9$

 $\xi = p(J) = \frac{1}{7} = b(J) = 25 = \eta(J) = 25 = f(J) = \frac{1}{7} = f(J) = \frac{1}{7}$

Two step equations are simply questions that require two steps. This often combines the skills you have learned.

When solving each question, use your skills in the opposite order of operations.

Example:

2x + 3 = 11

Step 1: Start by using your adding/subtract skills <u>before</u> using your multiply/divide skills. So, let's subtract away the 3!



$$2x =$$

Step 2: Now, let's use our multiply/divide skills!

$$egin{array}{rl} 2x=8\ \div2&\div2 \end{array}$$



TA:

Practice:

a)
$$2b-2=6$$
 b) $5a+2=12$

Step 1: Add 2 to both sides

Step 2: divide each side by 2

c)
$$3g-5=19$$
 d) $18=5e+3$

e)
$$rac{x}{4}-2=1$$

Step 1: Add 2 to both sides

Step 2: multiply each side by 4

g) 5.5 = 1.5 + 2rStep 1: subtract 1.5 from each side Step 2: divide each side by 2

^{h)} 2d + 3.5 = 10.5

 $\int \frac{d}{6} + 4 = 7$

SE=P(V E=V(B 8)=P(J E)=X(B E=B(P 8=B(D V)=V(A +=9(V) Husners:



Answer Key





Solving Two-Step Equations Multiplication & Division - Negative Coefficients

	Name:		Date:
ß	Solve the equations.		
(1)	-3x + 20 = -10	(2) $25 + 10x = -55$	(3) -33 = 75 + 12x
(4)	$5 = \frac{x}{11} - 1$	(5) 8 = -6 - 2x	(6) $\frac{x}{3} + 8 = 25$
(7)	-8x + 61 = -35	(8) $17 = \frac{x}{5} + 6$	(9) $-6x - 21 = 27$
(10)	$\frac{x}{-8} + 1 = -2$	(11) $1 + \frac{x}{-10} = -3$	(12) $10 = \frac{x}{5} + 2$
(13)	-63 + 9x = 27	(14) $\frac{x}{4} - 5 = -12$	(15) $-5x + 18 = -42$



Solving Two-Step Equations Multiplication & Division - Negative Coefficients

ANSWER KEY



Solve the equations.

(1) -3x + 20 = -10(2) 25 + 10x = -55(3) -33 = 75 + 12x-3x = -3010x = -80-108 = 12xx = 10x = -8-9 = x

(4)
$$5 = \frac{x}{11} - 1$$
 (5) $8 = -6 - 2x$ (6) $\frac{x}{3} + 8 = 25$
 $6 = \frac{x}{11}$ (7) $66 = x$ (6) $\frac{x}{3} + 8 = 25$
 $7 = x$ (7) $\frac{x}{3} = 17$
 $x = 51$

(7)
$$-8x + 61 = -35$$

 $-8x = -96$
 $x = /2$
(8) $17 = \frac{x}{5} + 6$
 $// = \frac{x}{5}$
 $55 = x$
(9) $-6x - 21 = 27$
 $-6x = 48$
 $x = -8$

(10)
$$\frac{x}{-8} + 1 = -2$$

 $\frac{x}{-8} = -3$
 $x = 24$
(11) $1 + \frac{x}{-10} = -3$
(12) $10 = \frac{x}{5} + 2$
(12) $10 = \frac{x}{5} + 2$
 $8 = \frac{x}{5}$
 $40 = x$

(13)
$${}^{-63} + 9x = 27$$

 ${}^{9x} = 90$
 $x = 10$
(14) $\frac{x}{4} - 5 = -12$
(15) ${}^{-5x} + 18 = -42$
 ${}^{-5x} = -60$
 $x = 12$
 $x = -7$
 $x = -26$

Math 9 Notes - LG 8 Solving Two Step Equations – Distributive Property Watch: <u>https://www.youtube.com/watch?v=bonzMy_1vGs&t=2s</u>



Review:	2(x+3)	(5 – x)(6)	$\frac{1}{2}$ (x – 4)
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Use distributive property 1st and then solve. Remember to use the opposite order of operations.

Distribute	then	+ -	then	x ÷

2(x+1) = 8	3(2x + 4) =18	20 = 4(2x-5)

Expectation #3: Solve multi-step linear equations with rational coefficients (using the distributive law).

Recall distributive property/law: when you have a number outside of the brackets, it means multiply the number into each term inside the brackets.

Below are two methods to solve a question that uses distributive law.

Example:
$$3(x+4) = 18$$

Method 1

Step 1: Multiply the number into each term in the brackets.

So, we end up with:

$$-12$$
 -12



Method 2 *only use when the variable "x" is inside the brackets **Step 1:** Divide each side by the number outside the brackets

$$\mathbf{X}(x+4) = 18 \ \div 3 \ \div 3$$

x + 4 =Step 2: solve the rest with regular algebra rules

Subtraction:

$$egin{array}{ccc} x+4=6\ -2&-2 \end{array}$$

$$x =$$

Practice:

a) 2(x+4) = 16

Step 1: divide each side by 2 Step 2: subtract 4 from both sides

^{b)}
$$5\left(y-2
ight)=25$$

Step 1: multiply 5 by "y" and 2 Step 2: add 10 to both sides Step 3: divide each side by 5

c)
$$30 = 5(x-3)$$

d)
$$32 = 4(2k+2)$$

e)
$$4\left(2x+3
ight)=12$$
 f) $3\left(2h-9
ight)=3$

g)
$$rac{1}{3}(3x+9)=8$$
 Step 1: multiply each side by 3

Step 1: multiply each side by 3 Step 2: subtract 9 from both sides Step 3:?

h)
$$rac{1}{4}(8g+4)=5$$

8=614 5=x(6 5=4(+ 0=x(2 9=x(P b=x(2 L=x(9 H=x(0 yusures

Distributive Property Algebra

Solve the following equations:

a)
$$x=2\left(3+4
ight)$$
 b) $20=2\left(x+5
ight)$ c) $6=3\left(y-3
ight)$

d)
$$12 = 4 \, (z-7)$$
 e) $24 = 3 \, (u+5)$ f) $22 = 2 \, (r+4)$

g)
$$30 = 15 \, (e-1)$$
 h) $4 \, (d+3) = 36$ i) $5 \, (x-1) = 0$

j) 3(2x+4) = 36 k) 6(2x-3) = 6 l) 5(2x-20) = 0

Solve the following equations:

a)
$$x = 2(3 + 4)$$
 b) $20 = 2(x + 5)$ c) $6 = 3(y - 3)$
 $x = 14$ $x = 5$ $y = 5$
d) $12 = 4(z - 7)$ e) $24 = 3(u + 5)$ f) $22 = 2(r + 4)$
 $z = 10$ $u = 3$ $r = 7$
g) $30 = 15(e - 1)$ h) $4(d + 3) = 36$ i) $5(x - 1) = 0$
 $e = 3$ $d = 6$ $x = 1$
j) $3(2x + 4) = 36$ k) $6(2x - 3) = 6$ l) $5(2x - 20) = 0$
 $x = 10$

x=2

x=10