

GRADE NINE MATH - SOLVING LINEAR EQUATIONS

- KEY TERMS:**
- equation
 - constant
 - variable
 - opposite operation
 - opposite operation
 - numerical coefficient
 - distributive property

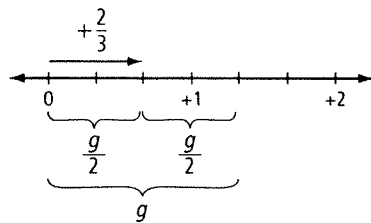
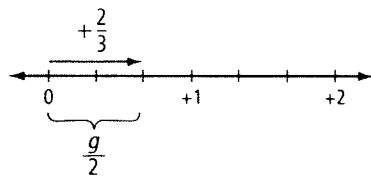
Students will be able to model and solve problems, using linear equations.
 Students will be able to solve and check a linear equation symbolically.

Key Ideas

- You can solve equations in various ways, including

- using diagrams

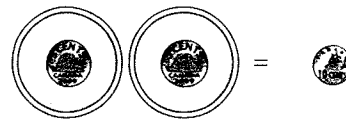
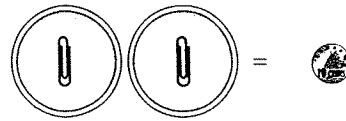
$$\frac{g}{2} = \frac{2}{3}$$



$$g = \frac{4}{3} \text{ or } 1\frac{1}{3}$$

- using concrete materials

$$2x = 0.10$$



$$x = 0.05$$

- using an algebraic method

$$\frac{-1.4}{p} = -0.8$$

$$p \times \left(\frac{-1.4}{p} \right) = p \times (-0.8)$$

$$-1.4 = p \times (-0.8)$$

$$\frac{-1.4}{-0.8} = \frac{p \times (-0.8)}{-0.8}$$

$$1.75 = p$$

- You can check solutions by using substitution.

$$\text{Left Side} = \frac{-1.4}{p}$$

$$\text{Right Side} = -0.8$$

$$= \frac{-1.4}{1.75}$$

$$= -0.8$$

$$\text{Calculator icon} \ 1.4 \ \text{Calculator icon} \ 1.75 \ \text{Calculator icon} \ -0.8$$

Left Side = Right Side

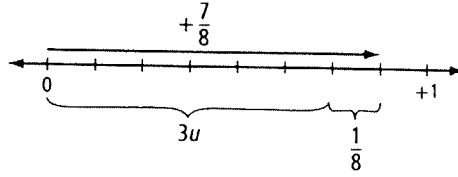
The solution, $p = 1.75$, is correct.

- To check the solution to a word problem, verify that the solution is consistent with the facts given in the problem.

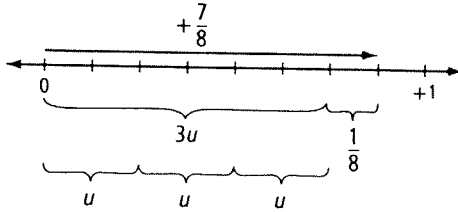
Key Ideas

- You can determine or check some solutions by using a model.

$$3u + \frac{1}{8} = \frac{7}{8}$$



$$3u = \frac{6}{8}$$



$$u = \frac{2}{8} \text{ or } \frac{1}{4}$$

- To isolate the variable in a two-step equation, use the reverse order of operations. Add or subtract first, and then multiply or divide.

$$0.4w - 1.5 = 0.3$$

$$0.4w - 1.5 + 1.5 = 0.3 + 1.5$$

$$0.4w = 1.8$$

$$\frac{0.4w}{0.4} = \frac{1.8}{0.4}$$

$$w = 4.5$$

- To solve two-step equations involving fractions, you may prefer to rewrite the equation and work with integers than to perform fraction operations.

$$\frac{w}{5} - \frac{3}{2} = \frac{1}{10}$$

To work with integers, multiply all terms by a common multiple of the denominators. For the denominators 5, 2, and 10, a common multiple is 10.

$$10 \times \frac{w}{5} - 10 \times \frac{3}{2} = 10 \times \frac{1}{10}$$

$$2w - 15 = 1$$

$$2w - 15 + 15 = 1 + 15$$

$$2w = 16$$

$$\frac{2w}{2} = \frac{16}{2}$$

$$w = 8$$

- You can check solutions by using substitution.

$$\text{Left Side} = \frac{w}{5} - \frac{3}{2} \qquad \text{Right Side} = \frac{1}{10}$$

$$= \frac{8}{5} - \frac{3}{2}$$

$$= \frac{16}{10} - \frac{15}{10}$$

$$= \frac{1}{10}$$

$$\text{Left Side} = \text{Right Side}$$

The solution, $w = 8$, is correct.

- To check the solution to a word problem, verify that the solution is consistent with the facts given in the problem.

Key Ideas

- To isolate the variable in an equation of the form $a(x + b) = c$, you can

- use the distributive property first

$$\begin{aligned} 4(r - 0.6) &= -3.2 \\ 4r - 2.4 &= -3.2 \\ 4r - 2.4 + 2.4 &= -3.2 + 2.4 \\ 4r &= -0.8 \\ \frac{4r}{4} &= \frac{-0.8}{4} \\ r &= -0.2 \end{aligned}$$

- divide first

$$\begin{aligned} 4(r - 0.6) &= -3.2 \\ \frac{4(r - 0.6)}{4} &= \frac{-3.2}{4} \\ r - 0.6 &= -0.8 \\ r - 0.6 + 0.6 &= -0.8 + 0.6 \\ r &= -0.2 \end{aligned}$$

- To solve equations involving grouping symbols and fractions, you can rewrite the equation and work with integers instead of performing fraction operations.

$$\begin{aligned} \frac{q - 1}{2} &= \frac{3}{4} \\ 4 \times \frac{q - 1}{2} &= 4 \times \frac{3}{4} \\ 2(q - 1) &= 3 \\ 2q - 2 &= 3 \\ 2q - 2 + 2 &= 3 + 2 \\ 2q &= 5 \\ \frac{2q}{2} &= \frac{5}{2} \\ q &= \frac{5}{2} \end{aligned}$$

- You can check solutions by using substitution.

$$\begin{aligned} \text{Left Side} &= \frac{q - 1}{2} & \text{Right Side} &= \frac{3}{4} \\ &= \left(\frac{5}{2} - 1\right) \div 2 \\ &= \left(\frac{5}{2} - \frac{2}{2}\right) \div 2 \\ &= \frac{3}{2} \times \frac{1}{2} \\ &= \frac{3}{4} \end{aligned}$$

Left Side = Right Side

The solution, $q = \frac{5}{2}$, is correct.

- You can solve and check equations with variables on both sides by applying the algebraic techniques learned in earlier sections.

$$\begin{aligned} 3(0.5t + 1.3) &= 2(0.4t - 0.85) \\ 1.5t + 3.9 &= 0.8t - 1.7 \\ 1.5t + 3.9 - 0.8t &= 0.8t - 1.7 - 0.8t \\ 0.7t + 3.9 &= -1.7 \\ 0.7t + 3.9 - 3.9 &= -1.7 - 3.9 \\ 0.7t &= -5.6 \\ \frac{0.7t}{0.7} &= \frac{-5.6}{0.7} \\ t &= -8 \end{aligned}$$

Check:

$$\begin{aligned} \text{Left Side} &= 3(0.5t + 1.3) & \text{Right Side} &= 2(0.4t - 0.85) \\ &= 3[0.5(-8) + 1.3] & &= 2[0.4(-8) - 0.85] \\ &= 3(-4 + 1.3) & &= 2(-3.2 - 0.85) \\ &= 3(-2.7) & &= 2(-4.05) \\ &= -8.1 & &= -8.1 \end{aligned}$$

Left Side = Right Side

The solution, $t = -8$, is correct.

Gr. 9 Math - Solving Linear Equations - Review

1. Solve and check. show your work.

a) $3(2.1b - 1.2) = 4(0.7b + 0.85)$

b) $4(4.1c - 0.875) = 6(1.8c + 1.75)$

c) $\frac{3}{4}x - 3.2 = 5.3 - \frac{2x}{3}$

d) $4(6x - 2) = 2\left(\frac{3x}{4} + 5\right)$

2. Identify the errors in the following solution. Then, provide a correct solution.

$$\frac{3h-6}{3} = \frac{2(3h-7.75)}{2.5}$$

$$h-6 = \frac{6h-15.5}{2.5}$$

$$-3.5h = -0.5$$

$$h = 7$$

3. A local tour company is offering a weekend travel package special at 30% off the regular price. This is a savings of \$87.45. What is the regular price of the package?
4. A mobile phone plan charges \$0.06 per minute for calls during the day and \$0.02 per minute for calls during the evening. If the bill for one month was \$17.86, and 182 min of evening calls were made, how many daytime minutes were used?