

Name: Key  
 Algebra

Date: \_\_\_\_\_  
 Band: \_\_\_\_\_

### Solving Equations Study Guide

**LT#1: Solve one-step equations in one variable.**

1. What is the solution of  $\frac{y}{2} + 5 = 8$ ?

$$\begin{array}{r} \frac{y}{2} + 5 = 8 \\ -5 \quad -5 \\ \hline 2 \cdot \frac{y}{2} = 3 \cdot 2 \\ \boxed{y = 6} \end{array}$$

Solve each equation. Check your answer.

2.  $x + 5 = -2$

$$\begin{array}{r} x + 5 = -2 \\ -5 \quad -5 \\ \hline \boxed{x = -7} \end{array}$$

3.  $a - 2.5 = 4.5$

$$\begin{array}{r} a - 2.5 = 4.5 \\ +2.5 \quad +2.5 \\ \hline \boxed{a = 7} \end{array}$$

4.  $3b = 42$

$$\begin{array}{r} 3b = 42 \\ \frac{3}{3} \quad \frac{3}{3} \\ \hline \boxed{b = 14} \end{array}$$

5.  $5 \cdot \frac{n}{5} = 13 \cdot 5$

$$\boxed{n = 65}$$

6. Five friends equally split a restaurant bill that comes to \$32.50. How much does each pay?

$m = \$$  each friend pays

$$\begin{array}{r} 5m = 32.50 \\ \frac{5}{5} \quad \frac{5}{5} \\ \hline \boxed{m = 6.50} \end{array}$$

**LT#2: Solve two-step equations in one variable.**

Solve each equation. Check your answer.

1.  $7x - 2 = 22.5$

$$\begin{array}{r} 7x - 2 = 22.5 \\ +2 \quad +2 \\ \hline 7x = 24.5 \\ \frac{7}{7} \quad \frac{7}{7} \\ \hline \boxed{x = 3.5} \end{array}$$

2.  $\frac{y}{4} - 3 = -4$

$$\begin{array}{r} \frac{y}{4} - 3 = -4 \\ +3 \quad +3 \\ \hline 4 \cdot \frac{y}{4} = -1 \cdot 4 \\ \boxed{y = -4} \end{array}$$

3.  $8 + 3m = -7$

$$\begin{array}{r} 8 + 3m = -7 \\ -8 \quad -8 \\ \hline 3m = -15 \\ \frac{3}{3} \quad \frac{3}{3} \\ \hline \boxed{m = -5} \end{array}$$

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

$$\begin{array}{r} -\frac{3d}{4} + 5 = 11 \\ -5 \quad -5 \\ \hline 4 \cdot \frac{-3d}{4} = 6 \cdot 4 \\ -3d = 24 \\ \frac{-3}{-3} \quad \frac{-3}{-3} \\ \hline \boxed{d = -8} \end{array}$$

**LT#3: Solve multi-step equations in one variable.**

1. What is the solution of  $(12 = 2x + \frac{4}{3} - \frac{2x}{3}) \cdot 3$

$$\begin{aligned} 36 &= 6x + 4 - 2x \\ 36 &= 4x + 4 \\ -4 &\quad -4 \end{aligned}$$

$$\begin{aligned} 32 &= 4x \\ \frac{32}{4} &\quad \frac{4}{4} \\ \boxed{8} &= x \end{aligned}$$

Solve each equation. Check your answer.

2.  $7(s - 5) = 42$

$$\begin{aligned} 7s - 35 &= 42 \\ +35 &\quad +35 \\ \hline 7s &= 77 \\ \frac{7s}{7} &\quad \frac{77}{7} \\ \boxed{s} &= 11 \end{aligned}$$

3.  $3a + 2 - 5a = -14$

$$\begin{aligned} -2a + 2 &= -14 \\ -2 &\quad -2 \\ \hline -2a &= -16 \\ \frac{-2a}{-2} &\quad \frac{-16}{-2} \\ \boxed{a} &= 8 \end{aligned}$$

4.  $-4b - 5 + 2b = 10$

$$\begin{aligned} -2b - 5 &= 10 \\ +5 &\quad +5 \\ \hline -2b &= 15 \\ \frac{-2b}{-2} &\quad \frac{15}{-2} \\ \boxed{b} &= -7.5 \end{aligned}$$

5.  $3.4t + 0.08 = 1.1$  ← should be 1.1

$$\begin{aligned} -0.08 &\quad -0.08 \\ \hline 3.4t &= 1.02 \\ \frac{3.4t}{3.4} &\quad \frac{1.02}{3.4} \\ \boxed{t} &= 0.3 \end{aligned}$$

6.  $10 = \frac{c}{3} - 4 + \frac{c}{6}$

$$\begin{aligned} 60 &= 2c - 4 + c \\ 60 &= 3c - 4 \\ +4 &\quad +4 \\ \hline 64 &= 3c \\ \frac{64}{3} &\quad \frac{3c}{3} \\ \boxed{21.3} &= c \end{aligned}$$

7.  $(\frac{2x}{7} + \frac{4}{5} = 5) \cdot 35$

$$\begin{aligned} 10x + 28 &= 5 \\ -28 &\quad -28 \\ \hline 10x &= -23 \\ \frac{10x}{10} &\quad \frac{-23}{10} \\ \boxed{x} &= -2.3 \end{aligned}$$

Write an equation to model each situation. Then solve the equation.

8. You work for 4 h on Saturday and 8 h on Sunday. You also receive a \$50 bonus. You earn \$164. How much did you earn per hour?

$m = \$$  earned per hour

$$4m + 8m + 50 = 164$$

$$\begin{aligned} 12m + 50 &= 164 \\ -50 &\quad -50 \end{aligned}$$

$$\begin{aligned} 12m &= 114 \\ \frac{12m}{12} &\quad \frac{114}{12} \end{aligned}$$

$$\boxed{m} = 9.50$$

9. Online concert tickets cost \$37 each, plus a service charge of \$8.50 per ticket. The Web site also charges transaction fee of \$14.99 for the purchase. You paid \$242.49. How many tickets did you buy?

$t = \#$  tickets

$$37t + 8.50t + 14.99 = 242.49$$

$$\begin{aligned} 45.5t + 14.99 &= 242.49 \\ -14.99 &\quad -14.99 \end{aligned}$$

$$\begin{aligned} 45.5t &= 227.5 \\ \frac{45.5t}{45.5} &\quad \frac{227.5}{45.5} \end{aligned}$$

$$\boxed{t} = 5$$

**LT#4:** Solve equations with variables on both sides.

**LT#5:** Identify equations that are identities or have no solution.

1. What is the solution of  $3x - 7 = 5x + 19$ ?

$$\begin{array}{r} -7 = 2x + 19 \\ -3x \quad -3x \quad -15 \quad -19 \quad -26 = 2x \quad -13 = x \end{array}$$

Solve each equation. If the equation is an identity, write *identity*. If it has no solution, write *no solution*.

2.  $\left(\frac{2}{3}x + 4 = \frac{3}{5}x - 2\right) 15$

$$\begin{array}{r} 10x + 60 = 9x - 30 \\ -9x \quad -9x \\ \hline x + 60 = -30 \\ -60 \quad -60 \\ \hline \boxed{x = -90} \end{array}$$

4.  $3(h - 4) = -\frac{1}{2}(24 - 6h)$

$$\begin{array}{r} 3h - 12 = -12 + 3h \\ -3h \quad -3h \\ \hline -12 = -12 \\ \boxed{\text{identity}} \end{array}$$

3.  $6 - 0.25f = f - 3$

$$\begin{array}{r} +0.25f \quad +0.25f \\ \hline 6 = 1.25f - 3 \\ +3 \quad +3 \\ \hline 9 = 1.25f \\ \frac{1.25}{1.25} \quad \frac{1.25}{1.25} \\ \hline \boxed{7.2 = f} \end{array}$$

5.  $5n = 20(4 + 0.25n)$

$$\begin{array}{r} 5n = 80 + 5n \\ -5n \quad -5n \\ \hline 0 = 80 \\ \boxed{\text{no solution}} \end{array}$$

6. Two buildings have the same total height. One building has 8 floors with height  $h$ . The other building has a ground floor of 16 ft and 6 other floors with height  $h$ . Write and solve an equation to find the height  $h$  of these floors.

$h = \text{height}$

$$\begin{array}{r} 8h = 16 + 6h \\ -6h \quad -6h \\ \hline 2h = 16 \\ \frac{2}{2} \quad \frac{2}{2} \\ \hline \boxed{h = 8} \end{array}$$

7. A train makes a trip at 65 mi/h. A plane traveling 130 mi/h makes the same trip in 3 fewer hours. Write and solve an equation to find the distance of the trip.

$d = \text{distance}$

$$\left(\frac{d}{65} = \frac{d}{130} + 3\right) 130$$

$$\begin{array}{r} 2d = d + 390 \\ -d \quad -d \\ \hline \boxed{d = 390 \text{ mi}} \end{array}$$

**LT#6: Rewrite and use literal equations and formulas.**

1. What is width of a rectangle with area 91 ft<sup>2</sup> and length 7 ft? *do not need to know*

Solve each equation for x.

2.  $ax + bx = -c$

$$x(a+b) = -c$$

$$(a+b) \quad (a+b)$$

$$x = \frac{-c}{(a+b)}$$

3.  $\frac{x+r}{t} + 1 = 0$

$$\frac{x+r}{t} \quad -1 \quad -1$$

$$t \cdot \frac{x+r}{t} = -1 \cdot t$$

$$x+r = -t$$

$$-r \quad -r$$

$$x = -t - r$$

4.  $m - 3x = 2x + p$

$$-3x \quad +3x$$

$$m = 5x + p$$

$$-p \quad -p$$

$$m - p = 5x$$

$$\frac{m-p}{5} = \frac{5x}{5}$$

$$\frac{m-p}{5} = x$$

5.  $\left(\frac{x}{p} + \frac{x}{q} = s\right) pq$

$$xq + xp = s$$

$$x(q+p) = s$$

$$(q+p) \quad (q+p)$$

$$x = \frac{s}{(q+p)}$$

**LT#7: Solve and apply proportions.**

Solve each proportion.

1.  $\frac{3}{7} = \frac{x}{9}$

$$\frac{7x}{7} = \frac{27}{7}$$

$$x = 3.857...$$

*only terminating decimals contest*

2.  $\frac{-8}{10} = \frac{y}{5}$

$$\frac{-40}{10} = \frac{10y}{10}$$

$$-4 = y$$

3.  $\frac{6}{15} = \frac{a}{4}$

$$\frac{15a}{15} = \frac{24}{15}$$

$$a = 1.6$$

4.  $\frac{3}{-7} = \frac{-9}{t}$

$$\frac{3t}{3} = \frac{63}{3}$$

$$t = 21$$

5.  $\frac{b+3}{7} = \frac{b-3}{6}$

$$7(b-3) = 6(b+3)$$

$$7b - 21 = 6b + 18$$

$$-6b \quad -6b$$

$$b - 21 = 18$$

$$+21 \quad +21$$

$$b = 39$$

6.  $\frac{5}{2c-3} = \frac{3}{7c+4}$

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

$$6c - 9 = 35c + 20$$

$$-6c \quad -6c$$

$$-9 = 29c + 20$$

$$-20 \quad -20$$

$$-29 = 29c$$

$$\frac{-29}{29} = \frac{29c}{29}$$

$$-1 = c$$

**LT#8:** Solve percent problems using proportions.

**LT#9:** Solve percent problems using the percent equation.

1. What percent of 84 is 105?

$$\frac{105}{84} = \frac{P}{100} \quad \frac{84P = 10500}{84 \quad 84}$$

$$P = \boxed{125\%}$$

2. What percent of 37 is 111?

$$\frac{P}{100} = \frac{111}{37} \quad \frac{37P = 11100}{37 \quad 37}$$

$$P = \boxed{300\%}$$

3. What is 72% of 150?

$$\frac{72}{100} = \frac{X}{150} \quad \frac{100X = 10800}{100 \quad 100}$$

$$X = \boxed{108}$$

4. 60% of what number is 102?

$$\frac{60}{100} = \frac{102}{X} \quad \frac{60X = 10200}{60 \quad 60}$$

$$X = \boxed{170}$$

5. A gardener expects that 75% of the seeds she plants will produce plants. She wants 45 plants. How many seeds should she plant?

$$\frac{75}{100} = \frac{45}{X} \quad \frac{75X = 4500}{75 \quad 75}$$

$$X = \boxed{60}$$

6. A charity sent out 700 fundraising letters and received 210 contributions in response. What was the percent of response?

$$\frac{P}{100} = \frac{210}{700} \quad \frac{700P = 21000}{700 \quad 700}$$

$$P = \boxed{30\%}$$

7. In a survey, 60% of students prefer bagels to donuts. If 120 students were surveyed, how many students prefer bagels?

$$\frac{60}{100} = \frac{X}{120} \quad \frac{100X = 7200}{100 \quad 100}$$

$$X = \boxed{72}$$

**LT#10: Find percent change.**

1. A bookstore buys a book for \$16 and marks it up to \$28. What is the markup expressed as a percent change?

$$\% \text{ change} = \frac{|28-16|}{16} \cdot 100 = \frac{12}{16} \cdot 100 = 75\% = \boxed{75\%}$$

Tell whether each percent change is an increase or decrease. Then find the percent change. Round to the nearest percent.

2. Original amount: 27  
New amount: 30

**increase**

$$\% \text{ change} = \frac{|30-27|}{27} \cdot 100 = \boxed{11\%}$$

3. Original amount: 250  
New amount: 200

**decrease**

$$\% \text{ change} = \frac{|200-250|}{250} \cdot 100 = \boxed{20\%}$$

4. Original amount: 873  
New amount: 781

**decrease**

$$\% \text{ change} = \frac{|781-873|}{873} \cdot 100 = \boxed{11\%}$$

5. Original amount: 4.7  
New amount: 6.2

**increase**

$$\% \text{ change} = \frac{|6.2-4.7|}{4.7} \cdot 100 = \boxed{32\%}$$

6. In 1970, the U.S. population was about 205 million people. In 2007, it was about 301 million. What was the percent increase?

$$\% \text{ change} = \frac{|301-205|}{205} \cdot 100 = \boxed{47\%}$$

7. The time from sunrise to sunset on the shortest day of the year in Jacksonville, Florida, is about 10 h 11 min. On the longest day, the time is 14 h 7 min. What is the percent increase?

$$\% \text{ change} = \frac{|847-611|}{611} \cdot 100 = \boxed{39\%}$$

minutes →

8. This morning the temperature was 38°F. This afternoon it is 57°F. Did the temperature increase by 50%? Explain.

$$\% \text{ change} = \frac{|57-38|}{38} \cdot 100 = 50\% \quad \boxed{\text{yes.}}$$