EVALUATE EXPRESSIONS

FIND THE VALUE OF THE EXPRESSION

SOLVE EQUATIONS

FIND THE VALUE OF THE VARIABLE (X)

3.2 Solve Two-Step Equations

Goal · Solve two-step equations.

Your Notes

TO SOLVE EQUATIONS YOU ISOLATE X.

IDENTIFYING OPERATIONS FOR 2 STEP EQUATIONS

Identify the operations involved in the equation

$\boxed{3}x \boxed{+7} = 19.$

FIRST ALWAYS SIMPLIFY BOTH SIDES

(1) STEP 1 : UNDO ADD / SUBTRACTION

(2) STEP 2 : UNDO MULT / DIVISION

(3) YOU MUST ALWAYS CHECK BY SUBSTITUTING IN THE ORIGINAL EQUATION.

Example 1 *Solve a two-step equation*

When solving a two-step equation, apply the inverse operations in the reverse order of the order of operations.

Solve $3x + 7 = 19$.

Solution

$3x + \cancel{7} = 19$ Write original equation.

$\quad -7 \quad -7$ Subtract 7 from each side.

$\frac{\cancel{3}x}{\cancel{3}} = \frac{12}{3}$ Simplify.

Divide each side by 3

$x = 4$ Simplify.

The solution is Circle it.

CHECK

$3x + 7 = 19$ Write original equation.

$3(4) + 7 \stackrel{?}{=} 19$ Substitute 4 for x.

$12 + 7 \stackrel{?}{=} 19$ Multiply 3 by 4.

$19 = 19$ ✓ Simplify. Solution checks.

Your Notes

Checkpoint Solve the two-step equation. Check your solution.

1. $\frac{r}{4} - 12 = -5$ $+12 \quad +12$ $4\left(\frac{R}{4}\right) = 7 \cdot 4$ $R = 28$	2. $7k - 14 = 42$ $+14 \quad +14$ $\frac{7K}{7} = \frac{56}{7}$ $K = 8$

Show all steps

C: $\frac{28}{4} - 12 = -5$
$7 - 12 = -5$
$-5 = -5$ ✓

C: $7(8) - 14 = 42$
$42 = 42$ ✓

← MINIMUM WORK FOR Checks

Example 2 *Solve a two-step equation by combining like terms*

ALWAYS SIMPLIFY BOTH SIDES FIRST.

Solve $4a + 3a = 63$.

Solution

$4a + 3a = 63$ ← Write original equation.

Combine like terms. $4a+3a=7a$

$\frac{7a}{7} = \frac{63}{7}$ Divide each side by 7.

$a = 9$ Simplify.

The solution is ___.

CHECK

$4a + 3a = 63$ Write original equation.

C: $4(9) + 3(9) \stackrel{?}{=} 63$ ← Check in orig EQ

$36 + 27 \stackrel{?}{=} 63$ ← START USE CALC FOR ARITHMETIC

$63 = 63$ ✓ ← Show EQUATION Checks

Checkpoint Solve the equation. Check your solution.

3. $5z + 4z = 36$ $\frac{9Z}{9} = \frac{36}{9}$ $Z = 4$	4. $5b - 2b = 9$ $\frac{3B}{3} = \frac{9}{3}$ $B = 3$

C: $5(4) + 4(4) = 36$
$36 = 36$ ✓

C: $5(3) - 2(3) = 9$
$15 - 6 = 9$
$9 = 9$ ✓

3.3 Solve Multi-Step Equations

Goal · Solve multi-step equations.

Your Notes

Example 1 *Solve an equation by combining like terms*

Solve $3t + 5t - 5 = 11$.

Solution

SIMPLIFY

$8T - 5 = 11$ Write original equation.

Combine like terms.

$+5 \quad +5$ Add 5 to each side.

$8T = 16$ Simplify.

$\frac{8T}{8} = \frac{16}{8}$ Divide each side by 8.

$T = 2$ Simplify.

The solution is ___.

STEP I

ALWAYS SIMPLIFY BOTH SIDES

Check: $3(2) + 5(2) - 5 = 11$

$11 = 11$ ✓

Example 2 *Solve an equation using the distributive property*

Solve $5a + 3(a + 2) = 22$.

Show All Steps

$5a + 3a + 6 = 22$

$8a + \cancel{6} = 22$

$\cancel{-6} \quad -6$

$\frac{8a}{8} = \frac{16}{8}$

$a = 2$

C: $5(2) + 3(2+2) = 22$

$10 + 3(4) = 22$

$10 + 12 = 22$

$22 = 22$ ✓

Checkpoint Solve the equation. Check your solution.

1. $9d - 4d - 2 = 18$

$5D - 2 = 18$
$+2 \quad +2$
$\frac{5D}{5} = \frac{20}{5}$
$D = 4$

C: $9(4) - 4(4) - 2 = 18$
$36 - 16 - 2 = 18$
$18 = 18$ ✓

2. $2x + 7(x - 3) = 6$

$2x + 7x - 21 = 6$
$9x - 21 = 6$
$+21 \quad +21$
$\frac{9x}{9} = \frac{27}{9}$
$x = 3$

C: $2(3) + \cancel{7(3-3)}^{0} = 6$
$6 = 6$ ✓

3. $40 = 2(10 + 4k) + 2k$

$40 = 20 + 8K + 2K$
$40 = 10K + 20$
$-20 \quad -20$
$\frac{20}{10} = \frac{10K}{10}$
$K = 2$

C: $40 = 2(10 + 4(2)) + 2(2)$
$40 = 2(18) + 4$
$40 = 40$ ✓

Example 3 *Multiply by a reciprocal to solve an equation*

Solve $\frac{3}{4}(a - 5) = 9$.

Solution

$\left(\frac{4}{3}\right)\frac{3}{4}(a - 5) = \frac{9}{1}\left(\frac{4}{3}\right)$ Write original equation.

Mental step $1 \cdot (a - 5) = 36/3$

$\boxed{\text{Multiply each side by } \frac{4}{3}.}$

$a - 5 = 12$
$+5 \quad +5$
$a = 17$

2 WAYS TO SOLVE THIS PROBLEM
① DISTRIBUTE 3/4
② MULTIBLY BOTH SIDES BY THE RECIPROCAL

C: $\frac{3}{4}(17 - 5) = 9$
$3/4(12) = 9$
$9 = 9$ ✓

Checkpoint Solve the equation. Check your solution.

$\boxed{5}$ $\frac{1}{2}(4x - 2) = 7$

$2x - 1 = 7$
$+1 \quad +1$
$\frac{2x}{2} = \frac{8}{2}$
$x = 4$

C: $\frac{1}{2}(4 \cdot 4 - 2) = 7$
$\frac{1}{2}(16 - 2) = 7$
$\frac{1}{2}(14) = 7$
$7 = 7$ ✓

3.2 HW #'s 6–18 (EVEN)

6) $G=8$

8) $Q=1$

10) $W=20$

12) $Z=-12$

14) $n=21$

16) $P=6$

18) $X=6$

3.3 HW #'s 8 → 16 (EVEN), 19, 33, 38

8) $Z=-5$

10) $m=-7$

12) $Z=2$

14) $m=3$

16) $C=5$

19) $D=12$

38) KI: \$32.50 /ticket
plus \$3.30/ticket
plus \$5.90 per order
Total spending = \$220.70

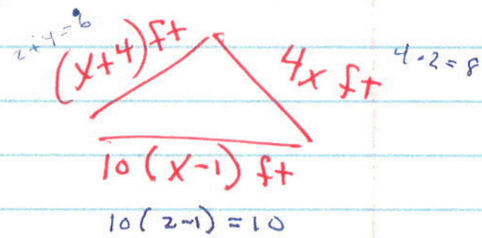
DEFINE VARIABLE:
X = # tickets bought

DEFINE EQ:
$(\$32.50+\$3.30)X+5.90=220.70$

$X=6$

BOUGHT 6 TICKETS

33) KI
$P = 288$ inches $= 24$ ft



6
+8
+10
24 ft

$P = 24 = (x+4)+4x+10(x-1)$

$24 = x+4+4x+10x-10$

$24 = 15x-6$

$+6 \quad +6$

$30 = 15x$

$\frac{30}{15} = \frac{15x}{15}$

$x=2$

The sides are 6 ft, 8 ft, 10 ft

3.4 Solve Equations with Variables on Both Sides

Goal • Solve equations with variables on both sides.

EQUATIONS HAVE 3 TYPES OF SOLUTIONS

Your Notes

① 1 SOLUTION $\boxed{X = \#}$

② NO SOLUTION $\boxed{X = \phi}$

③ ALL REAL NUMBERS

VOCABULARY

Identity means that an EQUATION IS TRUE FOR ANY VALUE OF X.

SOLUTION → $\boxed{X = \text{all real numbers}}$ OR $\boxed{X = \mathbb{R}}$

Example 1 *Solve an equation with variables on both sides*

Solve 15 + 4*a* = 9*a* − 5.

Collect variables on one side of the equation and constant terms on the other to solve equations with variables on both sides.

Solution

$15 + 4a = 9a - 5$ — **Write original equation.**

$-4a \quad -4a$ — **Subtract** 4A **from each side.**

$15 = 5A - 5$ — **Simplify.** (2 STEP EQUATION)

$+5 \quad +5$ — ① **Add** 5 **to each side.**

$20 = 5A$ — **Simplify.**

$\frac{20}{5} = \frac{5A}{5}$ — ② **Divide each side by** 5**.**

$A = 4$ — **Simplify.**

The solution is ___.

① ALWAYS SIMPLIFY BOTH SIDES

② GET THE VARIABLE ON ONE SIDE

CHECK

$15 + 4(4) \stackrel{?}{=} 9(4) - 5$ — $\boxed{\text{In original equation.**}}$ **Substitute** 4 **for *a*.**

$15 + 16 \stackrel{?}{=} 36 - 5$ — **Multiply.**

$31 = 31$ ✓ — **Solution checks.**

Your Notes

Example 2 *Solve an equation with grouping symbols*

Solve $4t - 12 = 6(t + 3)$.

Solution

$4t - 12 = 6(t + 3)$ — Write original equation.

$4T - 12 = 6T + 18$ — Distributive property

$-4T \quad -4T$ — Subtract $4T$ from each side.

$-12 = 2T + 18$

$-18 \quad -18$ — Subtract 18 from each side.

$-30 = 2T$ — Divide each side by 2.

$\frac{-30}{2} = \frac{2T}{2}$

$\boxed{T = -15}$

C: $4(-15) - 12 = 6(-15 + 3)$

$-72 = -72$ ✓

Checkpoint Solve the equation. Check your solution.

1. $3b + 7 = 8b + 2$ $-3B \quad -3B$ $7 = 5B + 2$ $-2 \quad -2$ $\frac{5}{5} = \frac{5B}{5}$ $B = 1$	2. $6d - 6 = \frac{3}{4}(4d + 8)$ $6D - 6 = 3D + 6$ $-3D \quad -3D$ $3D - 6 = 6$ $+6 \quad +6$ $\frac{3D}{3} = \frac{12}{3}$ $\boxed{D = 4}$

C: $3(1) + 7 = 8(1) + 2$

$10 = 10$ ✓

C: $6(4) - 6 = \frac{3}{4}(4 \cdot 4 + ...$

$24 - 6 = 3/4\,(24)$

$18 = 18$ ✓

Example 3 *Identify the number of solutions of an equation*

SPECIAL CASES

Check mentally but do not need to write it

Solve the equation, if possible.

a. $4x + 5 = 4(x + 5)$ — Original equation

$4x + 5 = 4x + 20$ — Distributive property

$-4x \quad -4x$

$5 \neq 20$ (F)

$\boxed{X = \text{NO SOLUTION}}$ or $\boxed{X = \phi}$

When the variable drops out AND THE NUMBERS DO NOT EQUAL THEN THERE IS NO SOLUTION.

b. $6x - 3 = 3(2x - 1)$ — Original equation

$6x - 3 = 6x - 3$ — Distributive property

$-6x \quad -6x$

$-3 = -3$ (T)

$\boxed{X = \text{ALL REAL NUMBERS}}$

When the variable drops out and the numbers are EQUAL THEN THERE IS AN INFINITE NUMBER OF SOLUTIONS.

Check

$X = 0 \longrightarrow -3 = -3$ ✓ 0 is A SOLUTION

$X = 1 \longrightarrow 3 = 3$ ✓ 1 " " "

$X = 2 \longrightarrow 9 = 9$ ✓ 2 " " "

$X = 3 \longrightarrow 15 = 15$ ✓ 3 " " "

$X = 4 \longrightarrow 21 = 21$ ✓ 4 " " "

Your Notes

ADD

$\boxed{5}$ $4x - 3 = 3(x - 1)$

$4x - \cancel{3} = 3x - \cancel{3}$
$+\cancel{3} \quad +3$

$4x = \cancel{3x}$
$-3x \quad -\cancel{3x}$

$x = 0$

C: $4(0) - 3 = 3(0 - 1)$
$-3 = -3$ ✓

Checkpoint Solve the equation, if possible.

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

$\cancel{2T} - 3 = \cancel{2T}$
$-\cancel{2T} \quad -\cancel{2T}$

$-3 \neq 0$

$\boxed{T = \text{NO SOLUTION}}$

$\cancel{2} \cdot \cancel{\frac{1}{2}}(4T - 6) = 2T \cdot 2$
$4T - 6 = 4T$

4. $10m - 4 = -2(2 - 5m)$

$\cancel{10m} - 4 = -4 + \cancel{10m}$
$-\cancel{10m} \quad -\cancel{10m}$

$-4 = -4$ T

$\boxed{X = \text{ALL REAL NUMBERS}}$

BOOK ANSWER: IDENTITY

STEPS FOR SOLVING LINEAR EQUATIONS

Step 1 Use the distributive property to remove any grouping symbols.

Step 2 Simplify the expression on each side of the equation.

Step 3 Use the properties of equality to collect the Varicble terms on one side of the equation and the Constant terms on the other side of the equation.

Step 4 Use the properties of equality to solve for the Varicble

Step 5 Check your Solution in the original equation.

$\boxed{3.4\ \text{HW}}$ PG157 #'s 4 → 14 (E), 18-26 (E), 41, 46

4) $K=1$
C: $2=2$ ✓

6) $m=3$
C: $20=20$ ✓

8) $P=-6$

10) $H=3$
C: $8=8$ ✓

12) $R=5$
C: $84=84$ ✓

14) $n=7$
C: $45=45$ ✓

18) W = NO SOLUTION

20) Z = NO SOLUTION

22) $X=-33$
C: $-656=-656$ ✓

24) Y = ALL REAL NUMBERS

26) G = ALL REAL NUMBERS

46) KI

$\boxed{P=?}$

$3x+7$
$S=3(9)+7=34$

$4x-2$
$S=4(9)-2=34$

$4x-2=3\cancel{x}+7$
$-3x \qquad -3\cancel{x}$

$x-\cancel{2}=7$
$+2 \quad +2$

$x=9$

$P=4(34)=136$

$\boxed{\text{Perimeter}=136\text{ UNITS}}$

41) $14-\frac{1}{5}(J-10)=\frac{2}{5}(25+J)$

$14-\frac{1}{5}J+2=\frac{2}{5}J+10$

$-\cancel{\frac{1}{5}J}+16=\frac{2}{5}J+10$
$+\cancel{\frac{1}{5}J} \qquad +\frac{1}{5}J$

$16=\frac{3}{5}J+\cancel{10}$
$-10 \qquad -\cancel{10}$

$\frac{5}{3}\cdot 6=\frac{\cancel{3}}{\cancel{5}}J\left(\frac{\cancel{5}}{\cancel{3}}\right)$

$30/3=J$

$J=10$

C: $14-\cancel{\frac{1}{5}(10-10)}=\frac{2}{5}(25+10)$
$\frac{2}{\cancel{5}}(\cancel{35})$
$14=14$ ✓

3.5 Write Ratios and Proportions

Goals • Find ratios and write and solve proportions.

Your Notes

VOCABULARY

Ratio The use of division to compare 2 QUANTITIES

Proportion 2 RATIOS THAT ARE EQUIVALENT. EXAMPLE → $\frac{1}{2} = \frac{20}{40}$

RATIOS

1. A ratio uses Division to compare two quantities.
2. The ratio of two quantities, a and b, where b is not equal to 0, can be written in three ways:

   $\frac{a}{b}$ $\qquad$ $a:b$ $\qquad$ a to b

3. Each ratio is read "the ratio of a to b".
4. Ratios should be written in Simplest form. EXAMPLE → $\frac{40}{60} = \frac{2}{3}$

Example 1 *Write a ratio*

Cell Phone Use A person makes 6 long distance calls and 15 local calls in 1 month.

a. Find the ratio of long distance calls to local calls.

b. Find the ratio of long distance calls to all calls.

Solution

a. $\frac{\text{long distance calls}}{\text{local calls}} = \frac{6}{15} = \frac{2}{5}$

b. $\frac{\text{long distance calls}}{\text{all calls}} = \frac{6}{21} = \frac{2}{7}$

all calls = 6+15

Your Notes

Checkpoint Shawn and Myra are selling tickets to their school's talent show. Shawn sold 36 tickets, and Myra sold 44 tickets. Find the specified ratio.

1. The number of tickets Shawn sold to the number of tickets Myra sold

$\frac{\text{SHAWN}}{\text{MYRA}} = \frac{36}{44} = \boxed{\frac{9}{11}}$

2. The number of tickets Myra sold to the number of tickets Shawn and Myra sold

$\frac{\text{MYRA}}{\text{TOTAL}} = \frac{44}{80} = \boxed{\frac{11}{20}}$

Example 2 *Solve a proportion*

Solve the proportion $\frac{y}{15} = \frac{3}{5}$.

Use the same methods for solving equations to solve proportions with a variable in the numerator.

Solution

$\frac{y}{15} = \frac{3}{5}$ Write original proportion.

CROSS MULTIPLY AND DIVIDE

$\frac{\cancel{5}Y}{\cancel{5}} = \frac{3 \cdot 15}{5}$

$\boxed{Y = 9}$

Checkpoint Solve the proportion. Check your solution.

3. $\frac{9}{4} = \frac{c}{28}$	4. $\frac{a}{32} = \frac{7}{8}$
$\frac{\cancel{4}C}{\cancel{4}} = \frac{9 \times 28}{4}$	$\frac{\cancel{8}A}{\cancel{8}} = \frac{7 \cdot 32}{8}$
$\boxed{C = 63}$	$A = 28$

C: $9/4 = 63/28$
$2.25 = 2.25$ ✓

C: $28/32 = 7/8$
$.875 = .875$ ✓

Your Notes

Example 3 *Solve a multi-step problem*

Swimming Pool A empty swimming pool is being filled with water. After 5 minutes the pool has 400 gallons of water. If the pool has a volume of 11,200 gallons, how long does it take to fill the empty pool?

Solution

Step 1 **Write** a proportion involving two ratios that compare the amount of water in the pool to the amount of time.

$$\frac{400}{5} = \frac{\boxed{11{,}200}}{x} \begin{array}{l} \leftarrow \text{gallons} \\ \leftarrow \text{minutes} \end{array}$$

Ratio is gallons to MINUTES

Step 2 **Solve** the proportion.

$$\frac{\cancel{400}x}{\cancel{400}} = \frac{5(11{,}200)}{400}$$

$$x = 140$$

The pool is full after 140 minutes. OR 2 HOURS AND 20 MIN

Checkpoint Complete the following exercise.

Homework

5. An Olympic sized pool has a volume of 810,000 gallons. If it is filled at the same rate as the pool in Example 3, how long will it take to fill the pool?

Rate: $\frac{400 \text{ gallons}}{5 \text{ minutes}} = \frac{810{,}000 \text{ gal}}{M}$

M = # Minutes

$$\frac{\cancel{400}M}{\cancel{400}} = \frac{5(810{,}000)}{400}$$

M = 10,125 minutes

168.75 hrs

Key – 2014
Revised So No Calc needed

3.6 Solve Proportions Using Cross Products

Goal • Solve proportions using cross products.

Your Notes

VOCABULARY

Cross product

$$\frac{a}{b} = \frac{c}{d}$$

Cross Product: $\underbrace{a \cdot d}_{} = \underbrace{b \cdot c}_{}$

=

NOTE IF THE CROSS PRODUCTS ARE EQUAL THEN IT IS A TRUE PROPORTION.

CROSS PRODUCTS PROPERTY

Words The cross products of a proportion are EQUAL.

Example $\frac{5}{6} = \frac{10}{12}$ $6 \cdot 10 = 60$ They are EQUAL
$5 \cdot 12 = 60$

Algebra If $\frac{a}{b} = \frac{c}{d}$ where $b \neq 0$ and $d \neq 0$, then $ad = bc$.

Your Notes

Example 1 ***Solve a proportion using cross products***

Solve the proportion $\frac{5}{y} = \frac{15}{75}$.

Solution

$\frac{5}{y} = \frac{15}{75}$ **Write original proportion.**

$\frac{15y}{15} = \frac{\cancel{5}^{1} \cdot 75}{\cancel{15}\,3}$ **Cross products property**

$\boxed{y = 25}$ **Simplify.**

The solution is ____.

C: $\frac{5}{25} = \frac{15}{75}$ ← reduce fractions

$\frac{1}{5} = \frac{1}{5}$ ✓

STEP I

KI:

3T food with 16 oz water

80 oz to feed plants

STEP II

VARIABLE

$X = \#$ of T of plant food

↑ must have UNITS

Example 2 ***Write and solve a proportion***

Plant Food To feed your plants, you need to mix 3 tablespoons of plant food with 16 ounces of water. If it takes 80 ounces of water to feed all of your plants, how many tablespoons of plant food are needed? ← DEFINE VARIABLE

~~**Solution**~~

Step ~~1~~ 3 Write a proportion involving two ratios that compare the amount of plant food with the amount of water.

$\frac{3}{16} = \frac{X}{80}$ ← amount of plant food / ← amount of water

Step ~~2~~ 4 Solve the proportion.

$\frac{16X}{16} = \frac{3 \cdot \cancel{80}^{5}}{\cancel{16}\,1}$ **Write proportion.**

Cross product property

$X = 15$ **Simplify.**

STEP 5 WRITE ANSWER IN A SENTENCE

You need 15 tablespoons of plant food for 80 ounces of water.

Your Notes

Checkpoint Solve the proportion. Check your solution.

1. $\frac{5}{n} = \frac{25}{45}$

$\frac{\cancel{5}\cdot 45}{25} = \frac{\cancel{25}n}{\cancel{25}}$

$5 \quad n=9$

C: $\frac{5}{9} = \frac{25}{45}$ $\div 5$

$\frac{5}{9} = \frac{5}{9}$ ✓

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

$6(b-2) = 3b$

$6b - 12 = 3b$

$-6b \quad -6b$

$\frac{-12}{-3} = \frac{-3b}{-3} \rightarrow b=4$

C: $\frac{6}{4} = \frac{3}{4-2}$

$\frac{3}{2} = \frac{3}{2}$ ✓

3. In Example 2, suppose it takes 120 ounces to feed all of the plants. How many tablespoons of plant food are needed?

$\boxed{\frac{3}{16} = \frac{x}{120}} \rightarrow \frac{16x}{16} = \frac{3(\cancel{120}^{30})}{\cancel{16}_4}$

$x = \frac{90}{4} = 22.5$

Need 22.5 tablespo. of plant food

KI:

Example 3 *Use a scale model*

Scale Model An architect creates a scale model of a school. The school is 50 feet high. The ratio of the model to the actual school is 1 foot to 75 feet. Estimate the height of the model.

Scale factor: 1 ft = 75 ft

Variable

H = height of the model (ft)

Solution

Write and solve a proportion to find the height h of the scale model.

scale factor

$\frac{H}{50} = \frac{1}{75}$ ← height of model (feet) / ← actual height (feet)] Ratio

$\frac{\cancel{75}H}{\cancel{75}} = \frac{50}{75}$ **Cross products property**

Simplify.

$H = 2/3$

The height of the scale model is $2/3$ foot, or 8 inches.

$\frac{2}{\cancel{3}_1} \cdot \cancel{12}^4$

Checkpoint Complete the following exercise.

4. In Example 3, suppose the ratio of the model to the actual school is 1 foot to 100 feet. Estimate the height of the model.

scale factor

$\frac{\text{MODEL}}{\text{ACTUAL}} = \frac{H}{50} = \frac{1}{100}$

$\frac{\cancel{100}H}{\cancel{100}} = \frac{50}{100}$

$H = 1/2$ ft or 6 in

HEIGHT OF THE MODEL IS 1/2 ft or 6 in

N 3.6 HW | Pg 171 #'s 13, 19-25, 33-34

(13) $\frac{11}{w} = \frac{33}{w+24}$

$11(w+24) = 33w$

$264 = 22w$

$\boxed{w = 12}$

C: $\frac{11}{12} = \frac{33}{12+24}$

$\frac{11}{12} = \frac{33}{36}$

$\frac{11}{12} = \frac{11}{12}$ ✓

(19) $\frac{7}{3} = \frac{2x+5}{x}$

$7x = 3(2x+5)$

$\boxed{x = 15}$

20. $\frac{a}{9a-2} = \frac{1}{8}$

$8a = 9a - 2$

$-a = -2$

$\boxed{a = 2}$

21. $\frac{24}{5z+4} = \frac{4}{z-1}$

$24(z-1) = 4(5z+4)$

$4z = 40$

$\boxed{z = 10}$

22. $\frac{c-8}{-2} = \frac{11-4c}{11}$

$11(c-8) = -2(11-4c)$

$11c - 88 = -22 + 8c$

$3c = 66$

$\boxed{c = 22}$

23. $\frac{k-8}{7+k} = \frac{-1}{5}$

$5(k-8) = -1(k+7)$

$5k - 40 = -k - 7$

$6k = 33$

$\boxed{k = 5.5}$

24. $\frac{2}{-3} = \frac{4v+4}{2v+14}$

$2(2v+14) = -3(4v+4)$

$4v + 28 = -12v - 12$

$16v = -40$

$\boxed{v = -2.5}$

25. $\frac{m+1}{4} = \frac{3m+6}{7}$

$7(m+1) = 4(3m+6)$

$7m + 7 = 12m + 24$

$-17 = 5m$

$\boxed{m = -3.4}$

C: $-.6 = -.6$ ✓

KS: $\frac{\text{Biscuits}}{\text{Floor}}$

x = # c flour

33. $\frac{12 \text{ Biscuits}}{2 \text{ C Flour}} = \frac{30 \text{ Biscuits}}{x \text{ C Flour}}$

$x = 5$

Need 5 cups flour

WP proportion → $\frac{12}{2} = \frac{30}{x}$

34. $\frac{7.2 \text{ min}}{8 \text{ photo's}} = \frac{x \text{ min}}{20 \text{ photo's}}$ = $\frac{\text{Min}}{\text{Photo}}$ KS

$x = 18$

x = # photo

Will take 18 min. to upload 20 photo's

WP Proportion $\frac{7.2}{8} = \frac{x}{20}$

KI: $\frac{CM}{KM}$

$\boxed{\text{N 3.6 X HW}}$ EXTRA CREDIT

Pg 172 #'s 35-39

$\boxed{D = \text{distance in KM}}$

$\boxed{35}$ $\frac{1\,cm}{15\,Km} = \frac{6\,cm}{D}$ $\boxed{\text{DISTANCE} = 90\text{ Km}}$

$\boxed{36}$ $\frac{1\,cm}{15\,Km} = \frac{3.2\,cm}{D}$ $D = 48$ $\boxed{\text{Distance is 48 Km}}$

$\boxed{37}$ $\frac{1\,cm}{15\,Km} = \frac{.5\,cm}{D}$ $D = 7.5$ $\boxed{\text{Distance is 7.5 Km}}$

$\boxed{38}$ $\frac{1\,cm}{15\,Km} = \frac{4.7\,cm}{D}$ $D = 70.5$ $\boxed{\text{DISTANCE is 70.5 Km}}$

$\boxed{39}$ KI: MODEL 1m : 25m
EMPIRE STATE is 443.2 m
What is the height of the model?

H = Model height (m)

$$\frac{1}{25} = \frac{H}{443.2}$$

$$H = \frac{443.2 \times 1}{25}$$

$$H = 17.728$$

Model is 17.73 ~~8~~ m tall

2 METHODS TO SOLVE PROPORTIONS

① PROPORTION METHOD
② WRITE AN EQUATION TO SOLVE

3.7 Solve Percent Problems

Goal • Solve percent problems.

Your Notes

SOLVING PERCENT PROBLEMS USING PROPORTIONS METHOD I

You can represent "*a* is *p* percent of *b*" by using the proportion

$\frac{a}{b} = \frac{p}{\boxed{100}}$ OR $\boxed{\frac{IS}{OF} = \frac{\%}{100}}$

where *a* is a part of the base __b__ and __P/100__ or *p*%, is the __percent__

METHOD I

Example 1 *Find a percent using a proportion*

What percent of 50 is 33?

Solution

Write a proportion when 50 is the base and 33 is part of the base.

$\frac{33}{50} = \frac{P}{100}$ ← **Write proportion.**

$\frac{\cancel{50}P}{\cancel{50}} = \frac{33 \cdot \cancel{100}^{2}}{\cancel{50}_{1}}$

$P = 66\%$

SOLVE
Cross products property

33 is __66%__ of 50.

Don't forget % sign

METHOD I: $\frac{IS}{OF} = \frac{\%}{100}$

Your Notes

Checkpoint Use a proportion to answer the question.

1. What percent of 80 is 28?

$\frac{P}{100} = \frac{28}{80} \Rightarrow \frac{80P}{80} = \frac{28 \cdot 100}{80}$

$P = 35\%$

2. What percent of 90 is 36?

$\frac{P}{100} = \frac{36}{90} \Rightarrow \frac{90P}{90} = \frac{36 \cdot 100}{90}$

$P = 40\%$

METHOD II

THE PERCENT EQUATION

You can represent "*a* is *p* percent of *b*" by using the equation:

EQ: $a = P\% \cdot b$

where *a* is a part of the base b and *p*% is the percent.

TRANSLATE

"IS" means =

"OF" means multiply

Variables

P = percent

N = number

Example 2 *Find a percent using the percent equation*

What percent of 250 is 100? ① WORDS

TRANSLATE

$P \cdot 250 = 100$ Write percent equation.

$\frac{P \cdot 250}{250} = \frac{100}{250}$ ② SOLVE IT

$P = \frac{100}{250} = \frac{2}{5}$ % → decimals

2/5 divide

$5\overline{)2}$

$P = .4$ Write decimal as a percent.

100 is 40% of 250 $P = 40\%$

CHECK with proportion method

$\frac{P = 40}{100} = \frac{100}{250}$

$40 \cdot 250 = 100 \cdot 100$ Crossproducts

$10{,}000 = 10{,}000$ ✓

Your Notes

Example 3 *Find a part of a base using the percent equation*

WRITE

What number is 75% of 300?

Solution

$N = .75 \cdot 300$ Write percent equation.

Change %'s to decimals!!

$\boxed{N = 225}$

C: $\frac{225}{300} = \frac{75}{100}$

$225(100) = 300(75)$

$22{,}500 = 22{,}500$ ✓

225 is 75% of 300

Checkpoint Use the percent equation to answer the question.

Check w/ proportion

3. What percent of 75 is 60?

$\frac{P \cdot 75}{75} = \frac{60}{75} = \frac{12}{15} = \frac{4}{5}$

$P = 4/5 \rightarrow P = 80\%$

C: $\frac{80}{100} = \frac{60}{75}$

$80(75) = 60(100)$

$6{,}000 = 6{,}000$ ✓

4. What number is 40% of 80?

$N = .4 \cdot 80$

$N = 32$

C: $\frac{32}{80} = \frac{40}{100}$

$3{,}200 = 3{,}200$ ✓

Example 4 *Find a base using the percent equation*

25 is 12.5% of what number?

Change 12.5% $\rightarrow$ .125

Solution

Write percent equation.

$\frac{25}{.125} = \frac{.125 \cdot N}{.125}$

$\boxed{N = 200}$

25 is 12.5% of 200.

C: $\frac{12.5}{100} = \frac{25}{200}$

$2{,}500 = 2{,}500$ ✓

Your Notes

Checkpoint Use the percent equation to answer the question.

5. 60 is 25% of what number?

EQ

$$\frac{60}{.25} = \frac{.\cancel{25} \cdot N}{.\cancel{25}}$$

$$n = \frac{6000}{.25}$$

Proportion

$$\frac{60}{N} = \frac{25}{100}$$

$$\frac{\cancel{25}N}{\cancel{25}} = \frac{60 \cdot \cancel{100}^{4}}{\cancel{25}_{1}}$$

$$\boxed{N = 240}$$

6. 75 is 150% of what number?

EQ

$$\frac{75}{1.50} = \frac{1.\cancel{50} \cdot N}{1.\cancel{50}}$$

$$n = \frac{750\cancel{0}}{1.5\cancel{0}}$$

$$n = \frac{750}{15} = \frac{150}{3}$$

Proportion

$$\frac{75}{N} = \frac{150}{100}$$

$$\frac{\cancel{150}N}{\cancel{150}} = \frac{75 \cdot \cancel{100}^{4\ 2}}{\cancel{150}_{6\ 3}}$$

$$n = \frac{150}{3}$$

$$\boxed{N = 50}$$

TYPES OF PERCENT EQUATIONS

Percent Problem	Example	Equation
1 Find a percent.	What percent of 252 is 84?	$P \cdot 252 = 84$
2 Find part of a base.	What number is 30% of 90?	$N = .30 \cdot 90$
3 Find a base.	16 is 20% of what number?	$16 = .20 \cdot N$

IS → =

OF → ×

Change %'s to decimals

Homework

EVEN'S ON
NEXT PAGE

n3.7 HW Pg 179 #'s 1, 2, 3-17 (odd)

1 IN THE STATEMENT: 54 is 15% OF 360

ANSWER: Percent is 15.
Part (IS) is 54.
Base (OF) is 360.

$$\frac{\text{IS (PART)}}{\text{OF (BASE)}} = \frac{P}{100}$$

2 "28 is 35% OF 80" → Proportion: $\frac{28}{80} = \frac{35}{100}$

28 → a, Goes in Numerator
35% → P, percent is .35
80 → b, Goes in denominator

#'s 3 $\frac{IS}{OF} = \frac{P}{100}$

3 $\frac{27}{75} = \frac{P}{100}$ $P \cdot 75 = 27$

$P = 36$

36%

5 $\frac{35}{100} = \frac{N}{80}$ $N = .35 \cdot 80$

$\boxed{N = 28}$

#'s 9-17 % EQUATIONS

7 $\frac{81}{N} = \frac{54}{100}$ $\boxed{N = 150}$

$81 = .54 \cdot N$

9 $P \cdot 80 = 56$ $\boxed{\frac{56}{80} = \frac{P}{100}}$

$P = .7$

$P = 70\%$

11 $P \cdot 153 = 9.18$

$P = .06$

$P = 6\%$ $\boxed{\frac{P}{100} = \frac{9.18}{153}}$

13 $N = 1.15 \cdot 60$ $\boxed{\frac{N}{60} = \frac{115}{100}}$

$\boxed{N = 69}$

15 $7 = .28 \cdot N$

$\boxed{N = 25}$ $\boxed{\frac{7}{N} = \frac{28}{100}}$

17 $41.8 = .44 \cdot N$

$\boxed{N = 95}$ $\boxed{\frac{41.8}{N} = \frac{44}{100}}$

3.7 (EVENS) pg 179

	EQ	Proportion
4	$P \cdot 120 = 66$ $P = .55$	$\frac{66}{120} = \frac{P}{100}$ $P = 55\%$
6	$N = .60 \cdot 85$ $N = 51$	$\frac{60}{100} = \frac{N}{85}$
8	$42 = 2.00 \cdot N$ $N = 21$	$\frac{200}{100} = \frac{42}{N}$
10	$P \cdot 225 = 99$ $P = .44$	$\frac{P}{100} = \frac{99}{225}$ $P = 44\%$
12	$N = .18 \cdot 150$ $N = 27$	$\frac{18}{100} = \frac{N}{150}$
14	$N = .82 \cdot 215$ $N = 176.3$	$\frac{82}{100} = \frac{N}{215}$
16	$189 = .9 \cdot N$ $N = 210$	$\frac{90}{100} = \frac{189}{N}$

KEY

3.8 Rewrite Equations and Formulas

Goal • Write equations in function form and rewrite formulas.

Your Notes

FUNCTION FORM

$y = mx + b$

slope — y intercept

VOCABULARY

Function form IS THE SAME AS $y=mx+B$

* GIVEN AN EQUATION WITH x AND Y YOU ISOLATE Y (Y= ___)

Literal equation are EQUATION WITH 2 OR MORE VARIABLES (AKA Letters)

Example 1 *Rewrite an equation in function form*

Write $2x + 2y = 10$ in function form.

Solution

Solve the equation for y.

$2x + 2y = 10$ ← **Write original equation.** ISOLATE Y

$\frac{2y}{2} = \frac{-2x}{2} + \frac{10}{2}$ **Subtract** $2x$ **from each side.**

$y =$ **Divide each side by** 2. (ALL TERMS DIVIDE BY 2)

The equation $\boxed{y = -x+5}$ is written in function form.

Example 2 *Solve a literal equation*

Solve $a + by = c$ for a.

Solution

$a + by = c$ ← **Write original** literal **equation.** and solve for a

$\quad - by \quad -by$

$a =$ **Subtract** by **from each side.**

The solution is $\boxed{a = c - by}$.

KI

I = interest $'s

P = investment $'s

r = interest rate (% → decimal)

t = years

Formula: $I = PRT$

Your Notes

Example 3 *Solve and use a formula*

The interest I on an investment of P dollars at an interest rate r for t years is given by the formula $I = Prt$.

a. Solve the formula for the time t.

b. Use the rewritten formula to find the time it takes to earn \$100 interest on \$1000 at a rate of 5.0%.

Solution

Solve for t to get a New formula

a. $\frac{I}{Pr} = \frac{Prt}{Pr}$ **Write original formula.**

$\frac{I}{\boxed{PR}} = t$ $\quad t = \frac{I}{Pr}$ **Divide each side by** Pr.

b. Substitute \$100 for I, \$1000 for P, and 5% → .05 for r in the rewritten formula.

$t = \frac{I}{\boxed{Pr}}$ **Write rewritten formula.**

$t = \frac{\boxed{100}}{\boxed{1000} \cdot \boxed{.05}}$ **Substitute.** simplify → $t = \frac{100}{50}$

$t = 2$ **Simplify.**

It will take 2 years to earn \$100 in interest.

Checkpoint Write the equation in function form.

1. $2x + y = 5$ $-2x \quad -2x$ $y = -2x + 5$	**2.** $3 + 3y = 9 - 6x$ $-3 \quad -3$ $\frac{3y}{3} = \frac{6}{3} - \frac{6x}{3}$

$y = -2x + 2$

Variable Term 1st Constant Last

Checkpoint Complete the following exercises.

Homework

3. Solve $a + by = c$ for b.
$-a \quad -a$

$\frac{by}{y} = \frac{c-a}{y}$

$b = \frac{c-a}{y}$

4. In Example 3, solve the equation for P. Find the investment P if $I = \$400$, $r = 4\%$ (.04) and $t = 4$ years.

Write a new formula for P

Use the formula to answer?

$\frac{I}{rt} = \frac{Prt}{rt}$

$\boxed{P = \frac{I}{rt}}$

$P = \frac{I}{rt}$

$P = \frac{400}{.04(4)} = \frac{10000}{.04} = \frac{2,500}{1}$

NAME
Date
Period

$\boxed{3.8}$ pg 187 #1-8, 11-13, 20-22

(1) LITERAL EQUATION (write sentence)

(2) To Solve $I = prt$ for t.

① divide each side by pr

② New formula $\boxed{t = \frac{I}{pr}}$

Bonus

(3)
$$ax = bx - c$$
$$-bx \quad -bx$$
$$ax - bx = -c$$
$$\frac{x(a-b)}{(a-b)} = \frac{-c}{(a-b)}$$
$$\boxed{x = \frac{-c}{a-b}}$$

(4)
$$a(x+b) = c$$
$$ax + ab = c$$
$$-ab \quad -ab$$
$$\frac{ax}{a} = \frac{c-ab}{a}$$
$$\boxed{x = \frac{c-ab}{a}}$$

Cross multiply

(5)
$$\frac{c}{1} = \frac{x+a}{b}$$
$$b \cdot c = x + a$$
$$-a \quad -a$$
$$x = bc - a$$

(6)
$$\frac{x}{a} = \frac{b}{c}$$
$$\frac{ab}{c} = \frac{cx}{c}$$
$$\boxed{x = \frac{ab}{c}}$$

BONUS

7 $\frac{x}{a} + b = c$

$-b \quad -b$

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

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

8 $ax + b = cx - d$

$-cx \quad -cx$

$ax - cx + b = -d$

$-b \quad -b$

$ax - cx = -b - d$

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

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

$\boxed{x = \frac{-b-d}{a-c}}$ or $\boxed{x = \frac{b+d}{c-a}}$

11 $y = -2x + 7$

12 $5x + 4y = 10$

$-5x \quad -5x$

$4y = -5x + 10$

$\frac{4y}{4} = \frac{-5x}{4} + \frac{10}{4}$

$\boxed{y = -5/4x + 5/2}$

13 $y = -3x + 4$

20 $V = lwh$

$\frac{V}{lh} = \frac{lwh}{lh}$

$\boxed{w = \frac{V}{lh}}$

21 $S = 2B + Ph$

$-2B \quad -2B$

$\frac{S-2B}{P} = \frac{Ph}{P}$

$\boxed{h = \frac{S-2B}{P}}$

22 $l = 24f$

$\frac{l}{24} = \frac{24f}{24}$

$f = \frac{l}{24}$