Adult Learning Academy
Pre-Algebra Workbook

UNIT 4: RATIOS AND PROPORTIONS

LEARNING OBJECTIVES

1. **Ratios:**

   - ☐ Express ratios using 3 different types of notation: words, colons (**:**), and fractions
   - ☐ Place terms in the correct order when writing and converting ratios
   - ☐ Simplify ratios, including ratios involving fractions
   - ☐ Write equivalent ratios

2. **Proportions:**

   - ☐ Compare ratios and determine if they are true proportions
   - ☐ Solve proportion problems by setting up proportions and solving for unknown values
   - ☐ Use proportional reasoning to perform measurement conversions

3. **Word Problems:**

   - ☐ Set up and solve word problems involving ratios, rates and proportions, including applications to the transportation industry

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UNIT 4 VIDEO & EXERCISE LIST

Topic	Website	Videos	Exercises
Ratios	www.khanacademy.org	Introduction to Ratios	Expressing Ratios as Fractions
		Ratios as Fractions in Simplest Form	Ratio Word Problems
		Simpifying Rates and Ratios	
Proportions	www.khanacademy.org	Writing Proportions	Writing Proportions
		Understanding Proportions	Proportions 1
	-		
Unit 4 Review PowerPoint	www.stlcc.edu	Unit 4 Review Flashcard Ppt on Blackboard	
Compass Practice	http://www.hostos.cuny.edu/oaa/compass/pre-alg_prac10.htm		Proportions

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4.1 Measurement Conversions

Use a reliable website to fill in these conversions. They will be helpful as you solve proportion problems.

1 pound = _____ ounces

1 gallon = _____ quarts

1 quart = _____ pints

1 quart = _____ ounces

1 cup = _____ ounces

1 tablespoon = _____ teaspoons

1 teaspoon = _____ milliliters

1 kilogram ≈ _____ pounds

1 foot = _____ inches

1 yard = _____ feet

1 mile = _____ feet

1 mile = _____ yards

1 inch ≈ _____ centimeters

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4.2 CAREER APPLICATIONS: STEM

1. Gear ratio is the number of teeth each gear represents when two gears are used in a machine. For example, a pinion gear has 8 teeth and a spur gear has 28 teeth. The gear ratio is 8:28, which simplifies to 2:7. Simplify each gear ratio below:

   a. 40:4 _____

   b. 55:11 _____

   c. 168:14 _____

   d. 52:13 _____

   e. 48:8 _____

2. Check the following ratios to see if they are true proportions. Write yes or no on the line provided. (hint: cross multiply and compare products)

   a. 50:30 = 5:3 _____

   b. 100:4 = 25:1 _____

   c. 16:15 = 8:7 _____

   d. 90:45 = 9:5 _____

   e. 18:3 = 9:1.5 _____

3. Which car below gets the highest MPG, or miles per gallon?

Honda Civic
Drove 224 miles on 7 gallons

Toyota Corolla
Drove 335 miles on 15 gallons

Ford Fiesta
Drove 620 miles on 20 gallons

4. In fluid mechanics, the MACH number is the ratio of the speed of an object to the speed of sound. The speed of sound is about 760 miles per hour.

   The Gulfstream G650, one of the fastest civil aircraft ever, flies at 800 miles per hour. What MACH is this? (round to the nearest tenth)

5. It took 3 ½ hours to drive 70 miles. About how long will it take to drive 100 miles?

6. It cost $2100 for 12 tires. How much would 18 tires cost?

7. Fuel for a 2-cycle engine requires a mixture of gas and oil. If you need 4 ounces of oil for every 128 ounces of gas, how much oil should be added to 32 ounces of gas?

8. The following problems involve carbohydrates, fats, and protein. Use the information given below to complete the proportions.

   Carbohydrates → 4 calories per 1 gram
   Fats → 9 calories per 1 gram
   Proteins → 4 calories per 1 gram

   a. 27 calories of fat = _____ grams

   b. 88 calories of protein = _____ grams

   c. 360 calories of carbohydrates = _____ grams

   d. _____ calories in 12 grams of protein

   e. _____ calories in ½ gram of carbohydrates

   f. _____ calories in 16.25 grams of fat

9. To estimate the number of fish in a lake, scientists cannot possibly count every fish. Instead, they use proportions. They cast a net, catch a bunch of fish, and tag each one. Then they release the tagged fish. Later, they come back to the same spot and put out their net again. They count the number of tagged fish in the net, compared to the number of total fish in the net. They use this ratio of tagged fish in the net to set up a proportion:

$$\frac{tagged\ fish\ in\ net\ (2nd\ catch)}{total\ fish\ in\ net\ (2nd\ catch)} = \frac{tagged\ fish\ in\ the\ area\ (from\ initial\ catch)}{total\ fish\ in\ the\ area}$$

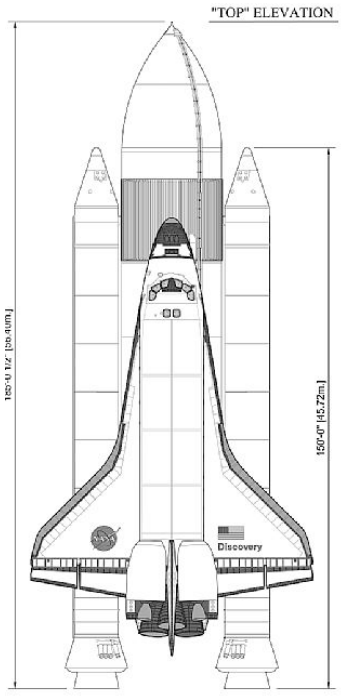
a. Say that you caught and tagged 200 fish initially. The second time you cast the net, you caught 250 fish, and 25 of them were already tagged. How many fish do you estimate to be in the lake?

b. Say that you caught and tagged 500 fish initially. The second time you cast the net, you caught 200 fish, 10 of whom were tagged. Estimate the population of fish in the lake.

c. A biologist catches and tags 50 frogs in a marsh. The following week, she catches 25 frogs, and two of them have a tag. Estimate the population of frogs in the marsh.

10. Three out of ten people have high blood pressure. In a typical crowd of 400 people, how many would be likely to have high blood pressure?

11. An engineer must make accurate scale drawings before constructing full-size objects. In this drawing, the scale is 1:72. Thus, every inch in the drawing corresponds to 72 inches when the shuttle is built.



a. The nose cone is 1.25 inches long in the drawing. How long is it on the actual shuttle?

b. The actual shuttle has a wingspan of 78 feet. What should the wingspan be in the drawing? (Remember, there are 12 inches in a foot.)

12. Healthcare workers who administer medicine must have a clear understanding of how to compute dosage calculations. A certain medicine must be administered in the ratio of 10 cc per every 25 pounds. Compute the amount of medicine (cc) needed for the following patients. Their weight in pounds is given. Round to the nearest tenth.

a. 50 pounds _____

b. 100 pounds _____

c. 200 pounds _____

d. 8 pounds _____

e. 135 pounds _____

f. 57 pounds _____

g. 277 pounds _____

ANSWER KEY

1a. **10:1**
1b. **5:1**
1c. **12:1**
1d. **4:1**
1e. **6:1**

2a. **Yes;** 50 x 3 = 30 x 5
2b. **Yes;** 100 x 1 = 4 x 25
2c. **No;** 16 x 7 ≠ 15 x 8
2d. **No;** 90 x 5 ≠ 45 x 9
2e. **Yes;** 18 x 1.5 = 3 x 9

3. Highest MPG is the **Honda Civic**
Honda Civic = 224 ÷ 7 = **32 MPG**
Toyota Corolla = 335 ÷ 15 = 22.3 MPG
Ford Fiesta = 620 ÷ 20 = 31 MPG

4. $\frac{760 \text{ mph}}{\text{Mach } 1} = \frac{800 \text{ mph}}{\text{x}}$; so $760x = 800$

$x = \frac{800}{760} =$ **Mach 1.05**

5. $\frac{3.5\ hours}{70\ miles} = \frac{x\ hours}{100\ miles}$; so $70x = 350$

x = 5 hours

6. $\frac{\$2100}{12\ tires} = \frac{\$x}{18\ tires}$; so $12x = 37{,}800$

x = $3,150

7. $\frac{4\ oz\ oil}{128\ oz\ gas} = \frac{x\ oz\ oil}{32\ oz\ gas}$; so $128x = 128$

x = 1 oz oil

8a. $\frac{9\ calories}{1\ gram\ fat} = \frac{27\ calories}{x\ grams}$; **x = 3 grams**

8b. $\frac{4\ calories}{1\ gram\ carbs} = \frac{88\ calories}{x\ grams}$; **x = 22 grams**

8c. $\frac{4 \text{ calories}}{1 \text{ gram carbs}} = \frac{360 \text{ calories}}{\text{x grams}}$; **x = 90 grams**

8d. $\frac{4 \text{ calories}}{1 \text{ gram protein}} = \frac{\text{x calories}}{12 \text{ grams}}$; **x = 48 calories**

8e. $\frac{4 \text{ calories}}{1 \text{ gram carbs}} = \frac{\text{x}}{.5 \text{ grams}}$; **x = 2 calories**

8f. $\frac{9 \text{ calories}}{1 \text{ gram fat}} = \frac{\text{x}}{16.25 \text{ grams}}$; **x = 146.25 calories**

9a. $\frac{25 \text{ tagged}}{250 \text{ total}} = \frac{200\ tagged}{x\ total}$; so $25x = 200(250)$

$x = 50{,}000 \div 25 =$ **2000 total fish in the area**

9b. $\frac{10\ tagged}{200\ total} = \frac{500\ tagged}{x\ total}$; so $10x = 200(500)$

$x = 100{,}000 \div 10 =$ **10,000 total fish in the area**

9c. $\frac{2\ tagged}{25\ total} = \frac{50\ tagged}{x\ total}$; so $2x = 25(50)$

x = 625 total frogs in the area

10. $\frac{3 \text{ high BP}}{10 \text{ total}} = \frac{\text{x high BP}}{400\ total}$; so $10x = 1200$

x = 120 people with high BP

11a. $\frac{1\ inch}{50\ miles} = \frac{3\ inches}{x\ miles}$; **x = 150 miles**

11b. *think:* $\frac{1}{2}$ of 50 miles = **25 miles**

11c. $\frac{1\ in.\ paper}{72\ in.\ shuttle} = \frac{1.25\ in.\ paper}{x\ in.\ shuttle}$; so $x = 72(1.25)$

x = 90 inches

11d. $\frac{1\ in.\ paper}{72\ in.\ shuttle} = \frac{x\ in.\ paper}{78\ x\ 12\ in.\ shuttle}$; so $72x = 936$

x = 13 inches on paper

ANSWER KEY (CONT.)

12a. $\frac{10 \text{ cc}}{25 \text{ lbs.}} = \frac{x \text{ cc}}{50 \text{ lbs.}}$; so $10(50) = 25x$

x = 20 cc

12b. $\frac{10 \text{ cc}}{25 \text{ lbs.}} = \frac{x \text{ cc}}{100 \text{ lbs.}}$; so $10(100) = 25x$

x = 40 cc

12c. $\frac{10 \text{ cc}}{25 \text{ lbs.}} = \frac{x \text{ cc}}{200 \text{ lbs.}}$; so $10(200) = 25x$

x = 80 cc

12d. $\frac{10 \text{ cc}}{25 \text{ lbs.}} = \frac{x \text{ cc}}{8 \text{ lbs.}}$; so $10(8) = 25x$

x = 3.2 cc

12e. $\frac{10 \text{ cc}}{25 \text{ lbs.}} = \frac{x \text{ cc}}{135 \text{ lbs.}}$; so $10(135) = 25x$

x = 54 cc

12f. $\frac{10 \text{ cc}}{25 \text{ lbs.}} = \frac{x \text{ cc}}{57 \text{ lbs.}}$; so $10(57) = 25x$

x = 22.8 cc

12g. $\frac{10 \text{ cc}}{25 \text{ lbs.}} = \frac{x \text{ cc}}{277 \text{ lbs.}}$; so $10(277) = 25x$

x = 110.8 cc

RESOURCES

Image used in question 1

Gears is available in the public domain under CC0 Public Domain

Images used in question 3

Honda Civic 1.6 i-DTEC Elegance (IX, Facelift) by © M 93 is licensed under CC-BY-SA-3.0 (DE)

2014 Toyota Corolla 1.8 LE (ZRE172), front left by Mr.choppers is licensed under CC BY-SA 3.0

2009-2010 Ford Fiesta (WS) Zetec 3-door hatchback 01 is available in the public domain

Image used in question 9a

Lake Washington Ship Canal Fish Ladder pamphlet - male freshwater phase Steelhead is available in the public domain under; image cropped and resized

Image used in question 9b

Pickerel Frog by Brian Gratwicke is licensed under CC BY 2.0; cropped from original work

Image used in question 11

Elevations of the Space Shuttle Launch Stack Assembly is available in the public domain

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