

9th Grade Assignment – Week #20

Note: For the upcoming “Midyear Review” unit you will need a unit conversion table. You will also need it for this week’s Lecture #2. I have included my unit conversion table (from my 8th grade workbook) on the next page.

Group Assignment: (for Tuesday or Thursday)

- Work together on the more challenging word problems from **Problem Sets #7, #8, and #9.**
- *Puzzle!* The below puzzle is like the one from last week – it contains four equations, written both horizontally and vertically. Determine what numbers go into the four boxes in order to make all four equations work.
(I can think of two different methods for solving this: one uses algebra, and the other takes advantage of this hint: each box is filled with the square root of a whole number.)

$$\begin{array}{r} \square \times \square = 12 \\ \times \quad \times \\ \square \div \square = 5 \\ \parallel \quad \parallel \\ 30 \quad 4 \end{array}$$

Individual Work

- The major focus for your work this week is to prepare for the test. The best way to prepare is to practice doing word problems on your own and in your group. There are many word problems in the remaining problem sets.
Do what you can with the word problems in **Problem Sets #7, #8, and #9.**
Remember that you may wish to do some of the more challenging ones with your group.

Conversion Table

* Denotes that it should be memorized as given in parentheses.

Weight

- * 1 lb = 16 oz
- * 1 kg \approx 2.2046 (2.2) lb
- * 1 oz \approx 28.35 g
- 1 g \approx 0.0353 oz
- 1 lb \approx 0.4536 kg
- * 1 U.S. ton = 2000 lb
- * 1 metric ton = 1000 kg

Volume

- * 1 tablespoon = 3 teaspoons
- * 1 fl oz = 2 tablespoons
- * 1 cup = 8 fl oz
- * 1 pt = 2 cups = 16 fl oz
- * 1 qt = 2 pt = 32 fl oz
- * 1 gal = 4 qt = 128 fl oz \approx 3.785 *l*
- * 1 ml = 1 cm³ (exactly!)
- * 1 *l* \approx 1.0567 (1.06) qt \approx 33.8 fl oz
- 1 fl oz \approx 29.58 ml \approx 1.804 in³
- 1 qt \approx 57.75 in³ \approx 0.9464 *l*
- 1 gal \approx 231.0 in³ \approx 0.134 ft³
- 1 ft³ = 1728 in³ \approx 7.481 gal
- 1 in³ \approx 0.554 fl oz \approx 16.39 cm³
- 1 m³ = 1000 *l* \approx 35.31 ft³
- 1 cord (of wood) = 128 ft³

Area

- * 1 acre \approx area of square with side of 70 yards
- * 1 hectare = 10,000 m² (100m \cdot 100m) \approx 2.471 acres
- 1 acre = 4840 yd² \approx 0.405 hectare
- 1 mile² = 640 acres \approx 2.590 km²
- 1 ft² = 144 in²
- 1 m² = 10,000 cm² \approx 10.764 ft²
- 1 in² \approx 6.452 cm²

Length

- * 1 yd = 36 in
- * 1 in \approx 2.5400 (2.54) cm
- * 1 m \approx 3.2808 (3.28) ft
- * 1 mile = 5280 ft \approx 1.6093 (1.61) km
- * 1 km \approx 0.6214 (0.62) mi
- 1 cm \approx 0.39370 in
- 1 m \approx 39.370 in \approx 1.093yd
- 1 ft \approx 0.3048m

Speed

1 m/s = 3.6 km/h \approx 2.237 mph \approx 3.281 ft/sec

Density¹

Density conversion factors:

$$1 \frac{\text{g}}{\text{cm}^3} = 1000 \frac{\text{kg}}{\text{m}^3} \approx 62.43 \frac{\text{lb}}{\text{ft}^3} \approx 0.578 \frac{\text{oz}}{\text{in}^3}$$

$$1 \frac{\text{oz}}{\text{in}^3} \approx 1.73 \frac{\text{g}}{\text{cm}^3}$$

Water¹ (at a maximum density of 4°C)

$$= 1 \frac{\text{g}}{\text{cm}^3} \text{ or } 1 \frac{\text{kg}}{\text{liter}} \text{ or } 1000 \frac{\text{kg}}{\text{m}^3}$$

$$\approx 0.578 \frac{\text{oz}}{\text{in}^3} \text{ or } 1.043 \frac{\text{oz}}{\text{fl oz}}$$

$$\approx 62.43 \frac{\text{lb}}{\text{ft}^3} \text{ or } 8.345 \frac{\text{lb}}{\text{gal}}$$

Air $1.29 \frac{\text{oz}}{\text{ft}^3}$ or $1.29 \frac{\text{kg}}{\text{m}^3}$ (coincidentally!)

Aluminum $169 \frac{\text{lb}}{\text{ft}^3}$ or $2.70 \frac{\text{g}}{\text{cm}^3}$

Iron $443 \frac{\text{lb}}{\text{ft}^3}$ or $7.10 \frac{\text{g}}{\text{cm}^3}$

Mercury $843 \frac{\text{lb}}{\text{ft}^3}$ or $13.5 \frac{\text{g}}{\text{cm}^3}$

Gold $1204 \frac{\text{lb}}{\text{ft}^3}$ or $19.3 \frac{\text{g}}{\text{cm}^3}$

Useful Distances

Radius of the Earth:	3960 mi (6371 km)
Circumference of the Earth:	24880 mi (40,030 km)
Surface Area of the Earth:	197,000,000 mi ² (510,000,000 km ²)
Total land area of the Earth:	57,500,000 mi ² (149,000,000 km ²)
Radius of the Sun:	432,000 mi (696,000 km)
Radius of the Moon:	1080 mi (1738 km)
Distance to the Moon:	239,000 mi (384,400 km)
Distance to the Sun:	93,000,000 mi (150,000,000 km)
One light year:	5.8784x10 ¹² mi (9.46x10 ¹² km)
Distance to the nearest star:	2.53x10 ¹³ mi (4.07x10 ¹³ km)

Temperature Conversions

$$C = \frac{5}{9} (F - 32)$$

$$F = \frac{9}{5} C + 32$$

¹ Density always reads as weight per volume. For example, the density of gold is 1204 lb/ft³, which tells us that a cubic foot of gold weighs 1204 pounds. The density of gold can also be given as 19.3 g/cm³, which says that a cubic centimeter weighs 19.3 grams.

- Note that water has a density of exactly 1 oz/fl.oz. at 212°F when it is *least* dense.
- It is perhaps more useful to give densities in terms of g/cm³ because we can easily compare it to water, which has a density of exactly 1 g/cm³ (1 cm³ of water weighs 1 gram). For example, with gold's density of 19.3 g/cm³, we can say that gold is 19.3 times heavier than water.

Problem Set #7

Group Work

- 1) Tickets at a concert cost \$8 for section A and \$4.25 for section B. 4500 tickets were sold for a total of \$30,000. How many tickets of each type were sold?
- 2) Joe earns \$10.50/hr at a restaurant and \$8/hr at a movie theater. Last week, between the two jobs, he worked 17 hours and earned \$159.75. How many hours did he work at each job?

Homework

Section A

Find the common solution.

- 3) $x + 8y = 17$
 $5x + 8y = 3$
- 4) $4x + 2y = 10$
 $2x - 3y = 1$
- 5) $3x + 5y = 3$
 $2x - 3y = 5$
- 6) $y - 3x = 4$
 $y - 3x = 7$
- 7) Hannah is 8 and her father is 30. How long will it be until Hannah is half her father's age?
- 8) It took Tim 17 minutes to drive 11 miles to get to the park. He then walked $2\frac{1}{2}$ miles in 51 minutes, and lastly, ran $1\frac{1}{2}$ miles in 12 minutes. What was his average speed for the whole trip?
- 9) Kate has a pocketful of dimes and quarters. How many quarters are there if there are a total of 29 coins and they are worth \$4.70?

Section B

- 10) On Saturday, Ben jogged for $2\frac{1}{2}$ hours. On Sunday, he jogged for two hours, but went 2 km further, and jogged at a rate that was 3 km/h faster than he did on Saturday. How far did he jog on Saturday?
- 11) Jeff biked for two hours at 4 mph and then biked for two hours at 18 mph. What was his average speed?
- 12) Mary biked up an 18-mile hill at 4 mph and came back down (the same route) at 18 mph. What was her average speed?
- 13) Max biked up a 3-mile hill at 4 mph and came back down at 18 mph. What was his average speed?
- 14) Margaret biked up a hill at 4 mph and came back down at 18 mph. What was her average speed?
- 15) There are two numbers. One number is 60 greater than the other. The greater number is one-quarter of the lesser. Find the numbers.

Problem Set #8

Group Work

- 1) A thief crosses a bridge at 9:37pm going 60 mph in a car. At 9:49pm, a police car chasing the thief and going 75 mph crosses the same bridge. Assuming that the cars maintain their speeds, at what time, and how far from the bridge, does the police car catch the thief?

Homework

Section A

- 2) Find the common solution:
- a) $3x + y = 5$
 $4x + 7y = 1$
- b) $-3x + 2y = 1$
 $-2x - 3y = -6$
- 3) The difference of two numbers is 5, but the sum of their squares is 157. Find the two numbers.
- 4) Four boxes of apples and six boxes of pears cost \$90. Two boxes of apples and five boxes of pears cost \$61. How much does one box of pears cost?
- 5) Sal drives up a 5 mile hill in 12 minutes. He then turns around and drives down the hill in 8 minutes. What was the average speed for his entire trip?
- 6) One number is one less than twice another number. Twice the sum of the numbers is 49. Find the two numbers.

Section B

- 7) Find two numbers such that they are in a ratio of 4:5 and their average is 18. Find the two numbers.
- 8) Bill is five years younger than Len. In two years, Len will be twice as old as Bill. How old is Bill now?
- 9) Maria has a handful of quarters, dimes, and nickels worth a total of \$2.40. There are a total of 20 coins and $2\frac{1}{2}$ times as many nickels as dimes. How many of each type of coin are there?
- 10) Thomas and Keith start out 12 miles apart. At what time do they pass each other if they both start biking toward each other at 2:20pm, and Thomas bikes at 15 mph and Keith bikes at 21 mph?
- 11) Find the common solution:
 $3y - x = 6$
 $6y = 2x + 12$
- 12) Give an equation that has both (3,1) and (5,4) as a solution.

Problem Set #9

Group Work

$$C = \frac{5}{9} \cdot (F - 32)$$

$$F = \frac{9}{5} \cdot C + 32$$

- 1) Use the above formulas to answer the following questions:
 - a) Convert 95°F to °C
 - b) Convert 10°C to °F
 - c) Convert 43°F to °C
 - d) Convert 43°C to °F

Graphing

- 2) Follow these instructions:
 - a) Take a full-size sheet of graph paper and put it in a “portrait” orientation.
 - b) Draw the horizontal axis near the bottom of the page. Label it “Celsius”, and have the range of the numbers on the axis go from 0 to 60.
 - c) Draw the vertical axis near the left side of the page. Have the range of the numbers on the axis go from 30 to 150, and label it “Fahrenheit”.
 - d) Plot each of the four answers from problem #1 on the graph.
- 3) Use the graph you have just created to estimate the following questions:
 - a) Convert 140°F to °C
 - b) Convert 0°C to °F
 - c) Convert 77°F to °C
 - d) Convert 20°C to °F
 - e) Convert 50°C to °F

Homework

Section A

- 4) Find the common solution:
$$4x + 3y = 1$$
$$-3x + 5y = -2$$
- 5) The sum of two numbers is 32. The larger number is 12 greater than twice the smaller. Find the numbers.
- 6) Find three consecutive integers whose sum is -63.
- 7) Find two numbers with a ratio 2:3 and average of 35.
- 8) Bill is four times as old as Clara. In four years he will be three times as old as her. How old is Clara now?
- 9) In the morning, Jane travels to work at an average speed of 45 mph. She takes the same route home but only averages 30 mph. If her total travel time is 1 hour and 15 minutes, how far is Jane’s place of work from her home?
- 10) On a given flight, an airline offers two types of seats: first class for \$500 and economy for \$300. 110 tickets were sold for a total value of \$38,400. How many first class seats were sold?

Section B

- 11) Keith is 25% as old as Bill. After how many years will Keith be 40% as old as Bill if Keith is 14 now?
- 12) A store is making a trail mix by mixing nuts (which cost \$5.50/lb) and dried fruit (which cost \$4.20/lb). At what ratio should they be mixed in order to get a trail mix worth \$5.00 per pound?
- 13) At 1:15pm Sam left his house, biking at 12 mph. After getting a flat tire, he walked back home at 3 mph, arriving at 2:30pm. How far from home did his bike break down?
- 14) A train leaves Bigtown at 70 mph toward Smallville (545 miles away) at 1:20pm. At 1:50pm, another train leaves Smallville, heading for Bigtown, at 50 mph. At what time, and how far from Bigtown, do they pass one another?
- 15) Derive an average speed formula given R_1 is the rate of speed traveling between two points, and R_2 is the rate of speed returning back along the same route.