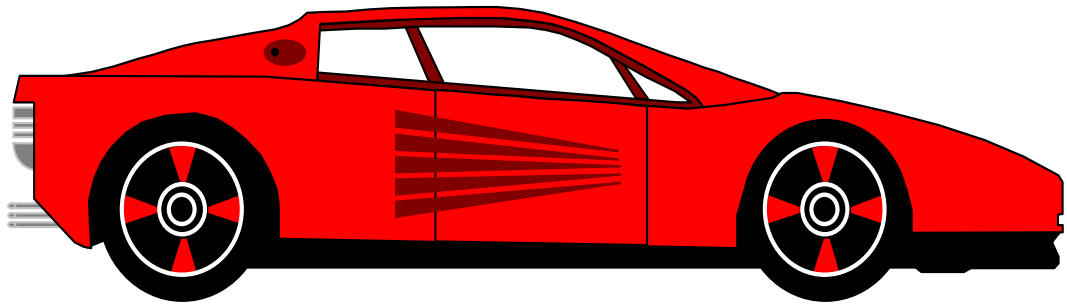


Applied Problems - Fractions

Auto Body and Paint Technician

Applied Problem Booklet

Applied Math I



Applied Problems – Fractions

1. Arrange the drill bits in order from smallest (left) to largest (right):

$$\frac{3}{8} \quad \frac{7}{16} \quad \frac{5}{16} \quad \frac{11}{32}$$

2. Three drill bit sizes are listed below. Arrange them in order from smallest to largest:

$$\frac{1}{2} \quad \frac{7}{16} \quad \frac{3}{8}$$

3. You need to drill a hole for a $\frac{7}{8}$ " bolt. Will a $\frac{15}{16}$ " drill bit make a hole that is a little larger or a little smaller than the bolt?

4. Using a steel rule which is calibrated to the nearest 32nd of an inch, a repair person measures a distance of $1\frac{20}{32}$ ". Reduce this fraction to lowest terms.

5. A $\frac{9}{16}$ " wrench is *larger* or *smaller* than a $\frac{7}{8}$ " wrench?

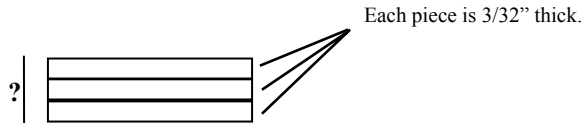
6. About $\frac{2}{3}$ gallon of primer is used for each painting job. If this is taken from a 6-gallon supply, how many jobs can be completed?

7. If $\frac{1}{3}$ of the total cost of a repair job is material, how much is the material cost in a job that totals \$375?

8. The refinishing procedure for a particular fender requires $2\frac{1}{4}$ hrs. How long would it take to do four such refinishing jobs?

9. A body mechanic spends $3\frac{1}{2}$ hrs on sanding and buffing projects. If each operation requires about $\frac{1}{2}$ hour, how many of these jobs can be completed?

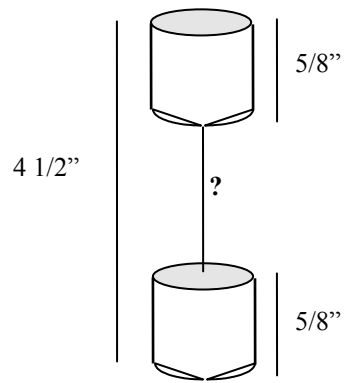
10. Three pieces of frame metal, each $\frac{3}{32}$ " thick are bolted together. What is the combined (total) thickness of the metal pieces?



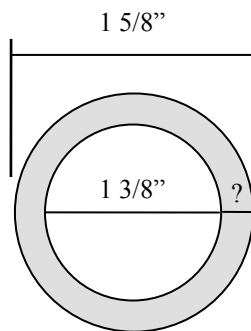
11. You work a flexible 40-hour week. So far this week, you have worked $8\frac{3}{4}$, $7\frac{1}{2}$, 8, and $9\frac{1}{4}$ hours. How many hours do you need to work on the last day of the week?

12. The depth of a tire tread is $\frac{1}{4}$ ". How much more can the tire wear, if the tire should be replaced when the tread depth is $\frac{3}{32}$ "?

13. What is the distance between these two pins?



14. A radiator hose has an outside diameter of $1\frac{5}{8}$ " and an inside diameter of $1\frac{3}{8}$ ". What is the thickness of the wall of the hose?



Applied Problems – Decimals

1. A hose that connects to a power steering pump has an inside diameter of $7/16"$. Convert this measurement to decimal form. (nearest thousandth)

2. Rewrite each drill size to decimal form: (three decimal places)

$1/4"$	0.25"
$3/8"$	
$5/16"$	
$7/16"$	
$13/32"$	

When you complete the table, *circle the largest drill bit size.*

3. The clearance between two parts is supposed to be $3/64"$. What is this measurement in decimal form? (nearest ten-thousandths)

4. Four sheets of sheet metal have the following thicknesses: *Change these to decimal form and arrange them in order from thinnest to thickest.*

$1/8"$ $11/64"$ $3/16"$ $7/32"$

5. A piston has a diameter of $3.703"$. What is this written as a fraction with a denominator of 64?

6. Change each valve shim measurement into a fraction with a denominator of 64.

0.060"	
0.030"	
0.015"	

7. Calculating the displacement of a remanufactured 4-cylinder engine yields an answer of 125.0128 cubic inches. Round this answer to the nearest thousandth.

8. After calculating the cross-sectional area of a hydraulic hose, a mechanic gets an answer of 0.6205 square inches. Round this answer to the nearest hundredth.
9. Due to a collision, a car tilts from side to side. The height on one side is 1.310 m, while the other side is 1.298 m. The correct height of this car should be the *average* of the two dimensions given above. Find this corrected height.
10. A customer is charged \$465.00 for a repair job. \$183.50 is for labor and \$112 is reserved for profit and overhead. How much of the total bill is for parts?
11. In estimating the time needed for repairing a car, a body mechanic finds that the parts manual lists the following times for these tasks:
2.8 hrs for removing and installing a new fender
2.3 hrs for removing and installing a new door
3.7 hrs for refinishing work
What is the total time for this job?
12. The length of an autobody shop is divided into six stalls of equal width. If each stall is 2.4 m wide, what is the total length of the shop?
13. The coverage estimate for a certain paint is 0.005 gallons per square foot. How much paint is needed to cover 85 square feet?
14. The repair work on a car takes 6.7 hrs of shop time. If the shop rate is \$21.75 per hour, what will be the labor charge to the customer?
15. A paint sprayer is capable of dispensing paint at a rate of 0.3 gal/min. How much paint is applied in 3 minutes?

Applied Problems – Percents

Listed below are three problems involving percents and paint mixtures.

EXAMPLE: A paint container says to thin it by 70% in order to make a sprayable mix. If you have two gallons of paint, how much thinner will you have to add?

***The amount of paint (2 gal) is the BASE

***The RATE is 70%

***The amount of thinner needed is the PART.

$$\text{Set-up: } \frac{P}{2} = \frac{70}{100}$$

P = 1.4 gallons of thinner

EXAMPLE: Paint instructions say to thin it by 80% to create a sprayable mix. How much thinner will you have to add to 1.5 gal of paint?

***The amount of paint (1.5 gal) is the BASE

***The RATE is 80%

***The amount of thinner needed is the PART.

$$\text{Set-up: } \frac{P}{1.5} = \frac{80}{100}$$

P = 1.2 gallons of thinner

EXAMPLE: 4 gallons of thinner are mixed with 2.5 gallons of paint to create a sprayable mixture. Of this sprayable mix, the thinner represents what percent?

***The total amount of sprayable mix is the BASE: 6.5 gal

***Since you are interested in what % the thinner is of the total sprayable mix, call 4 gallons the PART.

***Determine the RATE.

$$\text{Set-up: } \frac{4}{6.5} = \frac{R}{100}$$

The thinner represents 61.5% of the total sprayable mixture.

Applied Problems – Percents

1. An auto engine is rated at 180 hp and is found to deliver only 145 hp to the transmission. What is the efficiency of this system? (nearest tenth)
2. The directions on a can of paint instruct you to thin it by 70%. How much thinner would you need to add to 2 gallons of paint? (nearest tenth)
3. A motor uses 2.5 kilowatts of electrical power and delivers 2.2 kw of mechanical power. Determine the efficiency. (nearest tenth of a percent)
4. The owner of a shop estimates that 90% of its work is paid for by insurance companies. If the monthly receipts for that shop are \$3,630, how much money comes from the insurance companies? (nearest penny)
5. Directions call for a certain paint to be thinned by 80%. How much thinner is needed to mix with $\frac{3}{4}$ gal. of paint? (nearest tenth)
6. Directions call for a certain paint to be thinned by 120%. If you start with 2 gallons of paint, how much thinner should be added?
7. Three gallons of thinner are mixed with 2.5 gallons of paint. In this total mix, the thinner represents what part of the sprayable paint (paint & thinner)?
8. A mixture of 4 gallons of paint and thinner are needed to make a sprayable mix. If the paint should be 55% of the sprayable mix, how many gallons of paint and thinner are needed to make this sprayable mix? (nearest tenth)
9. An auto frame-straightening machine lists for \$24,000. If it is offered with a discount of 12%, and the tax rate is 5%, how much will you have to pay for the machine?

Applied Problems - Measurement

1. none

Applied Problems – Formulas

1. An electrical tool operates from a 120-volt line and is listed as having 15 ohms of resistance. Use the formula: $I = \frac{V}{R}$ to find the current that would flow in this tool.
2. How much voltage is battery supplying if it provides 5 amps of current to a tool listed as having 2.4 ohms of resistance? Use: $V = IR$
3. An air compressor can supply 114 psi of pressure. How much total force would be developed if the pressure is evenly distributed over an area of 3.5 sq. in.? Use $F=PA$
4. This formula allows you to calculate the spring rate of coil springs: $K = \frac{w^4g}{8nd^3}$

Where K is the spring rate in lbs./in.,
 w is the diameter of spring wire in inches,
 g is a constant value for steel (use 12,000,000),
 n is the number of active coils,
 d is the diameter of the coil

For this problem use:

$$w=.395$$

$$n=8.5$$

$$d=3$$

$K=$ _____ pounds/inch (nearest whole number)

Technical Applications for Proportions

Let's look at some situations where proportions can be used to solve problems in technically oriented fields.

Direct Relationships

You will recall from your work so far that in direct relationships increasing one quantity results in an increase in the other related quantity. It is also true that decreasing a quantity will result in a decrease in the related quantity.

Some examples of direct relationships include:

- *crop yield & field size*
- *coverage of paint & quantity of paint needed*
- *quantity of product & price*
- *volume of an object & weight*
- *length of an object & weight*
- *length of wire & electrical resistance*
- *concentration of a mixture & amounts of the products in the mixture*
- *tagged animals & population*

Naturally, there are many more examples than this short list shows.

Inverse Relationships

You will also recall from your work in this section that in inverse relationships, an increase in one quantity results in a decrease in the related quantity. It is also true that decreasing one quantity results in an increase in the related quantity.

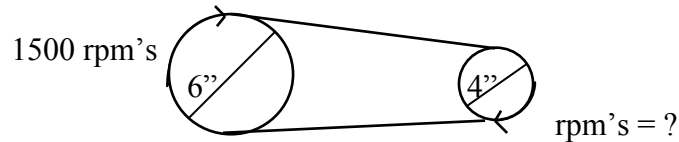
Some examples of inverse relationships include:

- *pulley size (diameter) & rpm's*
- *gear size (# of teeth) & rpm's*
- *force on a lever & distance from the fulcrum (pivot point)*
- *volume of a gas & pressure*
- *# of manufacturing machines & time to complete a given job*
- *etc...*

Listed below are technically oriented problems that can be solved with proportions. Decide if each situation is a direct or inverse relationship and solve the problem.

1. A 2 ft long heater element wire has a resistance of 1.65 ohms. If the wire were 7 ft long, how much resistance would it have?

2. A pulley that is 6 inches in diameter that rotates at 1500 rpm's is connected to a 4-inch diameter pulley. How fast is the smaller pulley turning?



3. If a 3 ft long piece of angle iron weighs 8.5 lbs, how much would a structure weigh that uses 22 ft of this angle iron?

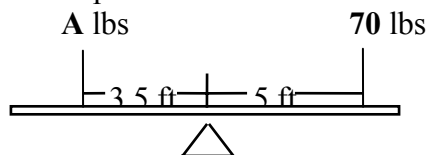
4. A 28 tooth gear that is turning at 300 rpm's is meshed with a gear that want to turn 125 rpm's. How many teeth should be on this gear?

5. A $\frac{1}{3}$ acre test plot of corn had a yield of 40 bushels. If you plant 150 acres of this corn, how many bushels of corn should you get?

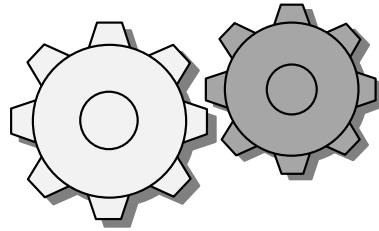
6. If you pour 3 qts of pesticide into a tank of water, you get a 15% concentration mix. If you want a 25% mix, how many quarts of pesticide would be added to the tank of water?

7. The coverage of two gallons of paint is supposed to be 575 sq ft. How much would be needed to cover 1200 sq ft?

8. How much weight would have to be placed at "A" in order for this lever to balance?



9. Gears A (40 teeth) and B (70 teeth) mesh together. If Gear A turns at 200 rpm's, how fast will Gear B turn?



10. A metal alloy is made of 95% iron and 5% zinc. If you have 70 lbs of iron on hand, how much zinc do you need to make this alloy?

11. Paint and thinner is to be mixed in the ratio of 2 to 5. If you have 1 gallon of paint, how much thinner do you need?

12. 200 cubic inches of a gas at a pressure of 20 psi is compressed down to 120 cubic inches. What is the pressure of the gas now?

13. If you have an 8-inch diameter pulley that turns at 2000 rpm's and you want to connect it to a pulley that will turn at 3000 rpm's, how big should the other pulley be?

14. Enamel and reducer should be mixed at the rate of 6 to 5. If you have two quarts of enamel, how much reducer is needed?

15. At Lila's Pizza Place, a 9" diameter pizza (area of 64 sq in) is priced at \$6.50. In order to be consistent in price with the 9" pizza, what should be the price of a 12" (113 sq in) pizza? *(In this problem, consider if you want to work with the diameters of the pizzas or the areas. Does it make any difference which measure you pick?)*

16. With 4 CNC machines, a customer's order for steel hubs can be completed in 6 days. If another CNC machine is added, how long will it take to complete the customer's order?

Calculating Ingredients of a Sprayable Mixture

Many times you are given the ratios or “parts” of different components to make a sprayable mixture. Sometimes there will be two components, sometimes three. Using the math techniques you have already learned in this course, there is a method to determine the number of milliliters of each component to use to make a stated volume of sprayable mix.

Example 1: Make up 800 ml of a sprayable mix that is 1 part DAU color, 1 part DT reducer, and 1 part DAU-3 hardener.

Step 1: Find the total number of parts by adding all the stated “part” numbers.

$$1 + 1 + 1 = 3$$

One part each for DAU color, DT reducer, and DAU hardener

Step 2: Find the fraction each ingredient is out of the total mixture.

Put the number of parts of each ingredient over the total (3) found in Step 1.

In this example, each ingredient will make up 1/3 of the total mix;
1 part for each, over the total of 3.

$$1/3 = \text{DAU color}$$

$$1/3 = \text{DT reducer}$$

$$1/3 = \text{DAU hardener}$$

Step 3: Find the number of milliliters of each ingredient.

Multiply the total mix (800 ml) by the fraction of each ingredient from Step 2

$$\text{DAU color} = 800 \text{ ml} \times 1/3 = 266.66\text{ml (round to nearest 5 ml)} = 265 \text{ ml}$$

$$\text{DT reducer} = 800 \text{ ml} \times 1/3 = 266.66\text{ml (round to nearest 5 ml)} = 265 \text{ ml}$$

$$\text{DAU hardener} = 800 \text{ ml} \times 1/3 = 266.66\text{ml (round to nearest 5 ml)} = 265 \text{ ml}$$

This will give you a total mix of 795 ml. That is close enough to 800 for our purpose.

Example 2: 2020 clear is mixed in the ratio: 2 parts 2020 clear, 1 part DT reducer, and 1 part DU hardener. How many ml of each are needed for a 1000 ml mix?

Step 1: Find the total number of parts by adding all the stated “part” numbers.

$$2 + 1 + 1 = 4$$

2 parts for 2020 clear, 1 part each for DT reducer, and DU hardener

Step 2: Find the fraction each ingredient is out of the total mixture.

Put the number of parts of each ingredient over the total (4) found in Step 1.

$$2/4 \text{ or } 1/2 = 2020 \text{ clear}$$

$$1/4 = \text{DT reducer}$$

$$1/4 = \text{DU hardener}$$

Step 3: Find the number of milliliters of each ingredient.

Multiply the total mix (1000 ml) by the fraction of each ingredient from Step 2

$$2020 \text{ clear} = 1000 \text{ ml} \times 1/2 = 500 \text{ ml}$$

$$\text{DT reducer} = 1000 \text{ ml} \times 1/4 = 250 \text{ ml}$$

$$\text{DU hardener} = 1000 \text{ ml} \times 1/4 = 250 \text{ ml}$$

This will give you a total mix of 1000 ml. We didn't need to do any rounding.

Example 3: How much of each ingredient is needed to make 600 ml of mix. The mix ratio is: 1 part DAU color, 1/2 part DT reducer, and 1 part DAU-3 hardener.

Note: You may run into a problem where one or more of the parts are given as fractions, 1/2 part DT reducer in this case. You can eliminate fractional parts by multiplying each ingredient by the denominator of the fraction, 2 in this problem.

$$\begin{array}{l} 1 \text{ part DAU color} \quad \times 2 = 2 \text{ parts DAU color} \\ 1/2 \text{ part DT reducer} \quad \times 2 = 1 \text{ part DT reducer} \\ 1 \text{ part DAU-3 hardener} \quad \times 2 = 2 \text{ parts DAU-3 hardener} \end{array}$$

As long as you multiply each ingredient by the same number the ratio of ingredients will stay the same. Now use the new “part” numbers just like you did in previous examples.

Step 1: Find the total number of parts by adding all the stated “part” numbers.

$$2 + 1 + 2 = 5$$

2 parts for DAU color, 1 part each for DT reducer, and 2 parts for DAU-3 hardener

Step 2: Find the fraction each ingredient is out of the total mixture.

Put the number of parts of each ingredient over the total (5) found in Step 1.

$$\begin{array}{l} 2/5 = \text{DAU color} \\ 1/5 = \text{DT reducer} \\ 2/5 = \text{DAU-3 hardener} \end{array}$$

Step 3: Find the number of milliliters of each ingredient.

Multiply the total mix (600 ml) by the fraction of each ingredient from Step 2

$$\begin{array}{l} \text{DAU color} \quad = 600 \text{ ml} \times 2/5 = 240 \text{ ml} \\ \text{DT reducer} \quad = 600 \text{ ml} \times 1/5 = 120 \text{ ml} \\ \text{DAU-3 hardener} = 600 \text{ ml} \times 2/5 = 240 \text{ ml} \end{array}$$

This will give you a total mix of 600 ml. We didn’t need to do any rounding.

Try some practice problems on the following page. Round ingredient measurements to the nearest 5 ml. Caution, these mixtures are made up! Don’t try them at work!

1. How many ml of each ingredient must be used to make 800 ml of sprayable mix?
1 part DAU color, 1 ½ parts DT reducer, 1 part DAU-3 hardener

DAU color =
DT reducer =
DAU-3 hardener =

2. How many ml of each ingredient must be used to make 400 ml of sprayable mix?
1 part DAU color, ½ part DT reducer, 2 parts DAU-2 hardener

DAU color =
DT reducer =
DAU-2 hardener =

3. How many ml of each ingredient must be used to make 750 ml of sprayable mix?
2 parts DAU color, 1 ½ parts DT reducer, 1 ½ parts DAU-3 hardener

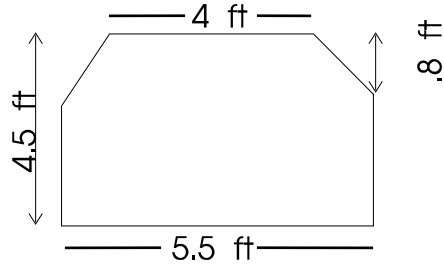
DAU color =
DT reducer =
DAU-3 hardener =

4. How many ml of each ingredient must be used to make 500 ml of sprayable mix?
2 parts DAU color, 1 ½ parts DT reducer, 2 parts DAU-2 hardener

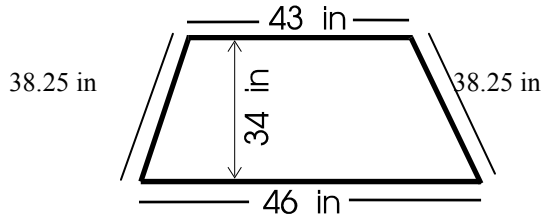
DAU color =
DT reducer =
DAU-2 hardener =

Applied Problems – Geometry

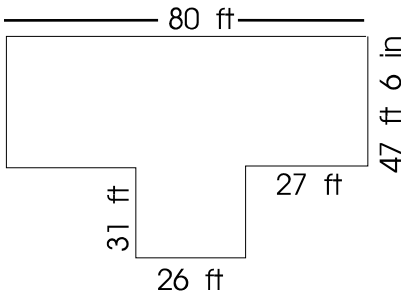
1. Find the area of this carpeting that covers the trunk floor of a car:
 (HINT: Could this object be divided into more simple shapes?)



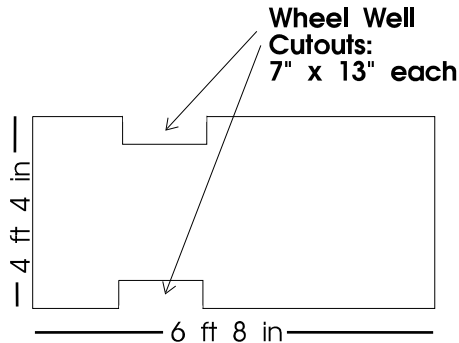
2. Find the length of a gasket needed to fit around the opening of the rear end of a station wagon. The dimensions are given below:



3. Determine the area of a shop with these dimensions:



4. The carpeting needed for back end of a station wagon requires an edging as shown below. Find the length needed for this carpet.



5. A sheet metal fabricator is trying to decide how much weight could be saved by replacing a steel door panel on a stock race car with 22 gauge aluminum. Assume the door panel is rectangular in shape and measures 40" by 48" and weighs 16.5 lbs. The area of this panel is _____ sq. in., which is equal to _____ sq. ft.

A reference table tells the fabricator that 22 gauge aluminum weighs 0.3567 lbs per square foot. Using this information how much would the door panel weigh if it were made from this material? _____ lbs

6. Find the combined area of the top of a car having the following dimensions:

Roof: 5 ft 7 in \times 4 ft 9 in

Hood: 4 ft 6 in \times 4 ft 9 in

Trunk: 3 ft 10 in \times 4 ft 9 in

7. A tire with a 25" diameter makes one complete revolution, how far forward does it move?

8. How many revolutions does the tire above make if it travels one mile?

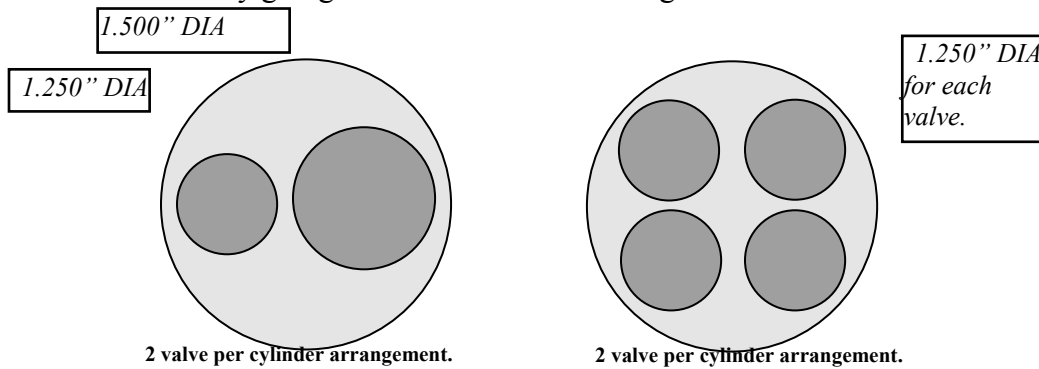
9. If a tire with a diameter of 23" makes one complete revolution, how far forward does it move?

10. How many revolutions does the tire above make if it travels $\frac{1}{4}$ mile?

11. How far does a tractor tire move forward in one revolution. It has a diameter of 42"?

12. A skid pad is circular course with a diameter of 200 ft. used to measure the lateral acceleration of an automobile or truck (lateral acceleration is an indicator of a vehicle's handling capability). If a car goes around this circle one time, how far does it travel?

13. Most modern cars now have four valves per cylinder since this maximizes the intake and exhaust valve area for each cylinder head (Since each valve is smaller, it also means each valve is lighter in weight, which is another important attribute, but that is another story...). Shown below is a top-view of a combustion chamber with the largest possible area two valve arrangement and the largest possible four valve arrangement. How much more area is added by going with the four valve arrangement?



14. A mechanic has an application where he would like to **double** the flow capability of a steel-braided tube. He knows that to compare flow capability, he must compare the cross-sectional area of the tubing. Currently the car has a dash 8 (-8) hose, which has an inside diameter of 0.438". The mechanic wants to try a dash 16 (-16) hose which has an inside diameter of 0.875". Will going with a tube that has twice the inside diameter double the flow capability?

15. Determine the displacement of a single cylinder engine with these dimensions:
 Bore: 4.25"
 Stroke: 3.8"
 Displacement = _____ cubic inches (round to the nearest tenth)

16. Find the displacement of an *eight-cylinder* engine with these specifications:
Bore: 4"
Stroke: 3.5"
Displacement = _____ cubic inches (round to the nearest tenth)
17. Given the engine in Problem #16, what happens to the total displacement when the bore is increased by 0.030"?
18. How many gallons of paint can be held in a cylindrical container that is 21" high and 14" in diameter? (find the volume in terms of cubic inches first, then use the fact that $1 \text{ gal.} = 231 \text{ cubic inches}$)
19. How many gallons of gas can be held by a rectangular container that is 14" wide, 8" deep, and 7" high?
20. A car with the following trunk measurements will have how many cubic feet of cargo space? width-4ft 10in; depth-3ft; height-1ft 6in (nearest tenth of a cubic foot)
21. What is the displacement of *one* cylinder of a V-6 231 cubic inch engine?

22. Given a V-8 engine with a bore of 3.8" and a stroke length of 3.5", how much will the *total displacement* increase if you put in a stroker kit that increases the stroke length by 0.125"?

23. How much paint (in cubic inches and gallons) can a small spray gun with a canister of height 6" and a diameter of 4.25" hold? (nearest tenth)

Applied Problems – Answer Key

Fractions

- 1.) $5/16$, $11/32$, $3/8$, $7/16$
- 2.) $3/8$, $7/16$, $1/2$
- 3.) larger
- 4.) $1\ 5/8$ "
- 5.) smaller
- 6.) 9 jobs
- 7.) \$125
- 8.) 9 jobs
- 9.) 7 jobs
- 10.) $9/32$ "
- 11.) $6\ 1/2$ hrs
- 12.) $5/32$ "
- 13.) $3\ 1/4$ "
- 14.) $1/8$ "

Decimals

- 1.) 0.438"
- 2.) 0.375, 0.313, 0.438, 0.406
- 3.) 0.0469"
- 4.) 0.125", 0.171875", 0.1875", 0.21875"
- 5.) $3\ 45/64$ "
- 6.) $4/64$, $2/64$, $1/64$
- 7.) 125.013 cubic inches
- 8.) 0.62 square inches
- 9.) 1.304 m
- 10.) \$169.50
- 11.) 8.8 hrs
- 12.) 14.4 m
- 13.) 0.425 gal
- 14.) \$145.73
- 15.) 0.9 minutes

Percents

- 1.) 80.6%
- 2.) 1.4 gal
- 3.) 88%
- 4.) \$3267
- 5.) 0.6 gal
- 6.) 2.4 gal
- 7.) 54.5%
- 8.) 2.2 gal paint, 1.8 gal thinner
- 9.) \$22,176

Measurement

None

Formulas

- 1.) 8 amps
- 2.) 12 volts
- 3.) 399 lbs
- 4.) 159 pounds/inch

Technical Proportions

- 1.) 5.8 ohms
- 2.) 2250 rpms
- 3.) 62.3 lbs
- 4.) 67 teeth (nearest whole)
- 5.) 18,000 bushels
- 6.) 5 qts
- 7.) 4.2 gal
- 8.) 100 lbs
- 9.) 114 rpm's

Sprayable Mixtures

- | | Color | Reducer | Hardener |
|--|-------|---------|----------|
|--|-------|---------|----------|

Geometry

- 1.) 24.15 sq ft
- 2.) 165.5"
- 3.) 4606 sq ft
- 4.) 292"
- 5.) 1920 sq in, 13.3 sq ft., 4.8 lb
- 6.) 9519 sq in *or* 66.1 sq ft
- 7.) 78.5"
- 8.) 807 revolutions
- 9.) 72.22"
- 10.) 219 rev's
- 11.) 131.88"
- 12.) 628 ft
- 13.) Total valve area in the two-valve arrangement is about 3 sq. in. (1.23 sq. in. for the intake and 1.77 sq. in. for the exhaust). The total valve area in the four-valve arrangement is about 4.9 sq. in. (1.23 sq. in. for each of the four valves).
- 14.) The old hose had a cross-sectional area of 0.15 sq in while the new hose selected, has a cross-sectional area of 0.6 sq in. The new hose therefore, has **four times** the cross-sectional area!
- 15.) 53.9 cu in
- 16.) 351.7 cu in
- 17.) Total Displacement goes up to 356.97 cu in
- 18.) 14 gal
- 19.) 3.4 gal
- 20.) 21.8 cu ft
- 21.) 38.5 cu in
- 22.) 317.4 cu in before, 328.7 cu in after installing stroker kit
- 23.) 85 cu in or 0.37 gal

Applied Problems - Quiz

Fractions

1. Last month Steve's Crash Correction Shop completed 24 jobs. Six jobs were on trucks, the rest on cars. What fraction of the jobs completed were car jobs?
2. At Jones Autobody, 4 of the 7 wrecks brought in last week ended up being totaled. At Rick's Wreck Reversal 5 out of 8 ended up being totaled. Which shop had a greater fraction of totals?
3. At Clem's Putty'n Place, $\frac{3}{4}$ of the jobs are on cars, the rest trucks and vans. If half the truck and van jobs are on vans, what fraction of their business is NOT on vans?
4. When measuring collision damage, you find that two round holes, one $\frac{1}{2}$ in. diameter, and the other $1\frac{1}{2}$ in. diameter, have an inside measurement of 32 inches and an outside measurement of 34 inches. What is the center-to-center dimension?
5. The front wheels of a car are toed in $\frac{1}{16}$ inch. Specs call for a $\frac{1}{16}$ inch toe out. How much adjustment is needed?
6. Instructions for an overlay state that the overlay should be trimmed to extend off each end of a panel by $\frac{5}{8}$ inch. The panel measures $21\frac{1}{4}$ inches long. How long should the overlay be cut?
7. If factory specs say that a panel overlap should be $\frac{3}{4}$ inch, and you have only $\frac{3}{8}$ inch overlap, how much more is needed?

Decimals

1. An older car is valued at \$2500. The parts for the repair job on the car will be \$1500. How many hours of labor at \$35 per hour can be completed before the car should be totalled? (round to the nearest tenth hour)
2. If a car weighs 4000 pounds (1816 kg) and each tire has the same amount of weight on it (equal weight distribution), how much weight is on each tire in pounds and kilograms? (round to nearest whole)
3. If a fender is $\frac{1}{16}$ inch thick, and you grind away .031 inch of metal, how thick is the remaining panel?
4. If a fender is 1.6 mm thick, and you grind away 0.79 mm of metal, how thick is the remaining panel?
5. If the maximum filler thickness is 19 mm, and you have already applied a thickness of 12.7 mm, how much more thickness is allowable?
6. A body dimension should be 37.1 inches. Your measurements show a reading of 35.2 inches. If the tolerance is $\frac{1}{16}$ inch, what is the minimum amount you must straighten the body to be within tolerances?
7. If factory specs say that a panel overlap should be $\frac{3}{4}$ inch, and you have only .25 inch overlap, how much more is needed?
8. A repair will require 3.7 hours of labor, charged at \$45 per hour. How much will the total labor bill be for this job (round to the nearest cent)?

Percents

1. Dave's Bodyshop pays \$18.87 per quart for base coat. If they mark it up 35%, how much do they charge the customer per quart? (nearest cent)
2. Bob's Bodywerkes marks a gallon of 2020 clearcoat up \$32.00. If this is a 25% markup, what is **their cost** per gallon?
3. What will the total amount be for a repair estimate on a car if the parts cost is \$176.25 plus 5% tax, and the technician's time is charged at \$45 per hour for a total of 11.5 hours needed to do the job?
4. If a paint is supposed to be reduced one part paint to one part thinner, what is the percentage of reduction?
5. If a 12-inch long metal rod is heated and expands 2 percent in size, how long has it become?
6. If a pulling chain is rated at 2100 pounds, and it should not be strained more than 25 percent over its rating, what is the maximum force that should be applied to the chain?
7. An HVLP spray gun requires air delivered at 10 psi. Your guage shows only 6.3 psi. By what percent is the pressure too low? (nearest whole percent)

Measurement

1. Antifreeze is charged out at \$1.50 per quart. What would the antifreeze charge be for 3 gallons of antifreeze?
2. Battery cable is charged by the foot. How many feet would the customer be charged for if an 18" piece and a 23" piece were used? (round to the NEXT whole foot)
3. If a bolt torque is 100 foot-pounds, what is the torque in inch-pounds?
4. To neutralize an area damaged by acid rain, you need 3 gallons of solution. If you must mix 1 tablespoon of baking soda to 1 quart of water, how many tablespoons will be needed?
5. A gallon of paint is \$96. How much should you charge the customer for paint if you need one quart to do the job?
6. If 450 ml of DBC base coat is needed for a job, how many fluid ounces is this? (round to nearest tenth-use conversion factor sheet)
7. A foreign service manual gives a 12.7 mm spec for a drilled hole; what size English or U.S. drill bit should be used? (to nearest thirty-second inch)
8. A technician made a bevel $\frac{1}{8}$ inch wide, while the specs call for a 6.4 mm wide bevel. How far off is this groove? (nearest tenth millimeter)

Formulas

1. A small hydraulic jack has a pumping plunger that is 1 square inch in area. The ram piston has an area of 5 square inches. If force is directly proportional to area, and you exert 500 pounds of pressure on the pumping plunger through the handle's lever arm, how much weight can you lift with the jack?

2. Use the formula below to find the theoretical cfm of a single piston compressor with a piston area of 5 square inches, a 3 inch stroke, running at 2000 rpm.:

$$\text{Theoretical displacement in CFM} = \frac{\text{Piston area(sq in)} \times \text{stroke(in)} \times \text{rpm} \times \# \text{ of pistons}}{1728}$$

3. 2020 Clear must be mixed: 2 parts 2020 clear: 1 part DT reducer : 1 part DU hardener
How many milliliters of each must be used to make a 600 ml sprayable mixture?

4. When using DBC base coat, it must be mixed one part DBC to 1 or 1 1/2 parts of DT reducer. Using the 1:1 1/2 ratio, how many mls of each must be used to make a 700 ml sprayable mixture?

5. If the manufacturer states that a 100 psi reading on a pressure guage equals one ton of pulling power, how many **pounds** of pulling power would a reading of 63 psi equal?

6. A pint of material will cover 3 square feet, how much material will cover 23 square feet? (round to next full pint)

7. If a pint of material will cover 2 square meters, how much material will be needed to cover 7 square meters? (round to next full pint)

8. If directions say to reduce a paint 33 percent, and you need one gallon of sprayable mix, what parts of each do you need? (round to next full pint)

Geometry

1. A can of sprayable undercoating will cover 10 square feet. You must spray panels that are 2 x 3 feet, 1.1 x 1.1 feet, and 1 x 2.5 feet. How many cans of undercoating will be needed? (round to next full can)



Autobody & Paint Technician

Answer Key for Applied Problems

Fractions

- 1.) $5/16, 11/32, 3/8, 7/16$
- 2.) $3/8, 7/16, 1/2$
- 3.) larger
- 4.) $1\ 5/8''$
- 5.) smaller
- 6.) 9 jobs
- 7.) \$125
- 8.) 9 jobs
- 9.) 7 jobs
- 10.) $9/32''$
- 11.) $6\ 1/2$ hrs
- 12.) $5/32''$
- 13.) $3\ 1/4''$
- 14.) $1/8''$

Decimals

- 1.) 0.438''
- 2.) 0.375, 0.313, 0.438, 0.406
- 3.) 0.0469''
- 4.) $0.125''$, $0.171875''$, $0.1875''$, $0.21875''$
- 5.) $3\ 45/64''$
- 6.) $4/64, 2/64, 1/64$
- 7.) 125.013 cubic inches
- 8.) 0.62 square inches
- 9.) 1.304 m
- 10.) \$169.50
- 11.) 8.8 hrs
- 12.) 14.4 m
- 13.) 0.425 gal
- 14.) \$145.73
- 15.) 0.9 minutes

Percents

- 1.) 80.6%
- 2.) 1.4 gal
- 3.) 88%
- 4.) \$3267
- 5.) 0.6 gal
- 6.) 2.4 gal
- 7.) 54.5%
- 8.) 2.2 gal paint, 1.8 gal thinner
- 9.) \$22,176

Measurement

None

Answer Key for Applied Problems - continued

Formulas

- 1.) 8 amps
 - 2.) 12 volts
 - 3.) 399 lbs
 - 4.) 159 pounds/inch
- Technical Proportions

- 1.) 5.8 ohms
- 2.) 2250 rpms
- 3.) 62.3 lbs
- 4.) 67 teeth (nearest whole)
- 5.) 18,000 bushels
- 6.) 5 qts
- 7.) 4.2 gal
- 8.) 100 lbs
- 9.) 114 rpm's

Sprayable Mixtures

- | | Color | Reducer | Hardener |
|-----|---------|---------|----------|
| 1.) | 230 ml, | 345 ml, | 230ml |
| 2.) | 115 ml, | 55 ml, | 230 ml |
| 3.) | 300 ml, | 225 ml, | 225 ml |
| 4.) | 180 ml, | 135 ml, | 180 ml |

Geometry

- 1.) 24.15 sq ft
- 2.) 165.5"
- 3.) 4606 sq ft
- 4.) 292"
- 5.) 1920 sq in, 13.3 sq ft., 4.8 lb
- 6.) 9519 sq in *or* 66.1 sq ft
- 7.) 78.5"
- 8.) 807 revolutions
- 9.) 72.22"
- 10.) 219 rev's
- 11.) 131.88"
- 12.) 628 ft
- 13.) Total valve area in the two-valve arrangement is about 3 sq. in. (1.23 sq. in. for the intake and 1.77 sq. in. for the exhaust). The total valve area in the four-valve arrangement is about 4.9 sq. in. (1.23 sq. in. for each of the four valves).
- 14.) The old hose had a cross-sectional area of 0.15 sq in while the new hose selected, has a cross-sectional area of 0.6 sq in. The new hose therefore, has **four times** the cross-sectional area!
- 15.) 53.9 cu in
- 16.) 351.7 cu in
- 17.) Total Displacement goes up to 356.97 cu in
- 18.) 14 gal
- 19.) 3.4 gal
- 20.) 21.8 cu ft
- 21.) 38.5 cu in
- 22.) 317.4 cu in before, 328.7 cu in after installing stroker kit
- 23.) 85 cu in or 0.37 gal