| MA 4B/4C | Mathematics Embedded Credit |
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| Cape Career \& Technology Center | Last Update: April 2017 |
| Topic: Ratio and Proportion | Focus: Basic Operations and <br> Applications |


| Show-Me Standards: MA5, MA6, | MO Grade Level Expectations: | NCTM Standards: 2A, 3A, 20A, |
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| G3-4 | N3E10, N3E8, N2D9 | 20B |

OBJECTIVE: Students will be able to perform basic operations and complete applications for ratios and proportions.

## Introduction:

There are three important words related to the subject of 'Ratios and Proportions'.
1 RATIO: the expression of a relationship between two or more numbers using division.

- Can Be WRITTEN: $A$ to $B ; A: B$; or $A / B$ - all of these forms are equal. Fractions are the most common way that ratios are written.
- "Same Ratio, Different Expression": The same ratio can be expressed many different ways: $\frac{1}{2}=\frac{2}{4}=\frac{3}{6}=\frac{4}{8}=\frac{5}{10}=\frac{15}{30}$, etc.
PROPORTION: the comparison of two equal ratios that are expressed with different numbers.
- Can Be WRITTEN: $\frac{a}{b}=\frac{c}{d}$, or $a: b:: c: d$
- Be CAREFUL: Units of measure in one ratio should always be written exactly the same as the units in the other ratio.
- EXAMPLES: $\frac{\text { dollars }}{\text { hour }}=\frac{\text { dollars }}{\text { hour }}, \frac{\text { miles }}{\text { gallon }}=\frac{\text { miles }}{\text { gallon }}, \frac{\text { cents }}{\text { pound }}=\frac{\text { cents }}{\text { pound }}$
- "Cross Multiplication": The method used to transpose numbers in a proportion. Cross multiplication removes the division from an equation. To cross multiply, multiply each denominator by the opposite numerator; the equate the two products. $\frac{a}{b}=\frac{c}{d}=(a * d=b * c)$
VARIATION: an equation that relates one variable to one or more other variables.


## EXAMPLE:

A car uses 18 gallons to travel 270 miles. At this rate, how many miles can be driven using 24 gallons? Also, what it the average miles per gallon?

Step \#1: Set Up a Proportion. (let the new distance $=x$ mi.)
$\frac{270 \mathrm{mi} .}{18 \mathrm{gal} .}=\frac{x \mathrm{mi} .}{24 \mathrm{gal} .}$

Step\#2: Solve the Equation Using Cross Multiplication.
$(270 \mathrm{mi}).(24 \mathrm{gal})=.(18 \mathrm{gal}).(x m i$.
$6480=18 x$
$360=x$
Step \#3: Check the solution. Does the answer create a proportion that is equal?

$$
\frac{270 \mathrm{mi} .}{18 \mathrm{gal} .}=\frac{360 \mathrm{mi} .}{24 \mathrm{gal} .}=15 \frac{\mathrm{mi} .}{\mathrm{gal} .}
$$

On a certain machine, pulleys between the motor shaft and machine shaft have an RPM ratio of $3: 5$. If the motor turns at 300 RPM, how fast does the machine shaft turn?

Step \#1: Set Up a Proportion.
$\frac{3 R P M}{5 R P M}=\frac{300 R P M}{x R P M}$
Step \#2: Solve the Equation Using Cross Multiplication.

$$
\frac{3 R P M}{5 R P M}=\frac{300 R P M}{x R P M}
$$

$3 x=5(300)$
$3 x=1500$
$x=500$
machine shaft $=500$ RPM
Step \#3: Check the Solution. Does the answer create a proportion that is equal?

$$
\frac{3 R P M}{5 R P M}=\frac{300 R P M}{500 R P M}=\frac{3}{5}
$$

## PROBLEMS:

1. You are completing computer repairs for your business. You travel 152 miles in 4 hours. With the same average rate of speed how long will it take to travel 247 miles?
2. The building and grounds instructor notices that you are not very busy during your class. He measures your shadow and tells you that it is 3 ft . long (your height is 5 ft .). He measures the shadow from the building you are working on and tells you that the shadow from the building measures 9 ft . He tells you to calculate the height of the wall. Wanting to show you are intelligent, what height do you tell him the wall is?
3. A sample hearing test on your day care students shows that out of 30 students 6 had hearing difficulties. With this failure rate, how many students in your area will have to be tested to secure the services of the Health Department in working with your students? The Health Department brochure indicates that they will come into an area that has 24 students who failed a hearing test.
4. You are heading off to college. It is the first time you have u look on the map and see that the 'scale of miles' says $3 / 4$ " equals 15 miles. How many miles are you approximately away from your destination if on the map you are 7" from your college's town?
5. A picture measures $2 \frac{1}{4}$ " high by $3 \frac{1}{4}$ " wide. If it is enlarged to have a width of 10 inches, what will be its height?
6. A medicinal juice mixture is mixed in a ratio of 3 parts pineapple juice, 1 part apple juice, and 2 parts medicine. If the container you are mixing the medicine in holds 3 quarts, how many ounces of each is needed to fill the container? (Note: 1qt. $=32 \mathrm{ozs}$.)
