

NAME: _____ Score _____/10

Please **print** your name**There are questions on the back of this page.****MULTIPLE CHOICE** – Any number of the options may be correct.You are to select (circle) **ALL** that are correct.

1. Addition of Real Numbers is a
 - a. unary operation
 - b. binary operation
 - c. unary relation
 - d. binary relation

2. The number $\frac{3}{4}$ is
 - a. a natural number
 - b. a whole number
 - c. an integer
 - d. a rational number
 - e. an irrational number
 - f. a real number
 - g. a complex number

3. An equation may be
 - a. an identity
 - b. a contradiction
 - c. a conditional equation
 - d. an inequality
 - e. equivalent to another equation
 - f. equal to another equation

4. Write the formula for the area of a triangle. (Remember a formula must be an equation)
5. What mathematical principle justifies the sentence in bold blue capital letter in the following process?

Question: A health clinic uses a solution of bleach to sterilize petri dishes in which cultures are grown. The sterilization tank contains 100 gal. of a solution of 2% ordinary bleach mixed with pure distilled water. New research indicates that the concentration of bleach should be 5% for complete sterilization. How much of the solution should be drained and replaced with bleach to increase the bleach content to the desired level.

Solution:

Let x be the amount of solution to be drained.

Then x is also the amount of bleach to be added.

The amount of bleach initially in the tank is 2% of 100 gal. or 2 gal.

The amount of bleach drained will be 2% of x or $0.2x$ gal.

After draining x gal. of bleach the tank contains $2 - 0.2x$ gal. of bleach.

After adding x gal. of bleach, the tank contains $(2 - 0.2x) + x$ gallons of bleach.

The amount of bleach in the final solution is $(2 - 0.2x) + x$ gallons.

The amount of bleach in the final solution is 5% of 100 gal. or 5 gallons.

We now have two expressions for the same quantity; **THEY MUST BE EQUAL.**

Therefore $(2 - 0.2x) + x = 5$ which may be solved by ordinary means.

$$(2 - 0.2x) + x = 5$$

$$2 + 0.98x = 5$$

$$0.98x = 3$$

$$x = \frac{3}{0.98} \approx 3.06$$

Correct to two decimal places, 3.06 gallons of 2% bleach solution must be drained from the 100 gallon tank and replaced with 3.06 gallons of bleach to obtain 100 gallons of 5% bleach solution.