Relay Training Center Seminar

Pre-Class Student Worksheet

The math involved with this class is really a practical application of high school Trigonometry.

You probably never thought that you would use this stuff.

The math is not hard.

The math does NOT get any more complex than is presented in the following examples.

But, if it has been a while since you used your high school Trigonometry then a review of the following examples will help because during the class we need to understand at this level.

I. Algebra:
   a. During this class we will work with the different iterations of Ohm's Law. It is important for the student to be able to algebraically manipulate between the three possible renditions of Ohm's Law.
      i. Given Ohm's Law (for a DC circuit): I = E/R
         1. Find E
         2. Find R
      ii. Given Ohm's Law (for an AC circuit): I = E/Z
         1. Find E
         2. Find Z

II. Trigonometry –

a. Pythagorean Theorem - During this class we will calculate apparent, real and reactive power in an AC circuit. These three quantities are related to one another as the sides of a right triangle are related to one another. To find the length of the hypotenuse in a right triangle one can use the principles of the Pythagorean Theorem.
    i. Given: $C^2 = A^2 + B^2$; Given: A = 3; Given: B= 4
        1. Find C
    ii. Given: $C^2 = A^2 + B^2$; Given: A = 6; Given: C= 10
        1. Find B
    iii. Given: $(\text{Apparent Power})^2 = (\text{Watts}^2 + \text{VARs}^2)$; Given: Watts = 3; Given: VARs = 4
        1. Find Apparent Power

b. Simple Trig Functions – During this class we will utilize Trigonometry functions to find the length of sides and size of angles in various triangles.
    i. Sine of an angle is the ratio of the length of sides – specifically the ratio of the Opposite Side divided by the Hypotenuse. Thus a right triangle that has an angle that is adjacent to the hypotenuse of length 5 and that angle is also opposite of the side of length 4 would therefore have a "Sine" of 4/5 (or 0.8).
        1. Sin^{-1} is the calculator function used to find the angle for the given "Sine"
            a. In this case "0.8 $\text{Sin}^{-1} = 53.13^\circ$"
    ii. Cosine of an angle is the ratio of the length of sides – specifically the ratio of the Adjacent Side divided by the Hypotenuse. Thus a right triangle that has an angle that is adjacent to the hypotenuse of length 5 and that angle is also adjacent to a side of length 3 would therefore have a "Cosine" of 3/5 (or 0.6).
        1. Cos^{-1} is the calculator function used to find the angle for the given "Cos"
            a. In this case "0.6 $\text{Cos}^{-1} = 53.13^\circ$"
    iii. Tangent of an angle is the ratio of the length of sides – specifically the ratio of the Opposite Side divided by the Adjacent Side. Thus a right triangle that has an angle that is opposite of the side of length 4 and adjacent to the side of length 3 would therefore have a "Tangent" of 4/3 (or 1.333).
        1. Tan^{-1} is the calculator function used to find the angle for the given "Tangent"
            a. In this case "1.333 $\text{Tan}^{-1} = 53.13^\circ$"
    iv. The above exercise showed that for a 3-4-5 right triangle, one could utilize any one of the three basic Trig functions to find the two unknown angles in the right triangle. Keep in mind that there are 180 degrees in any triangle plus you know that there are 90 degrees in the known "right angle" therefore the final unknown angle is $90 - 53.13 = 36.87^\circ$.

v. Given a right triangle with a hypotenuse of length 6 at an angle (above the horizontal) of 60˚ (Suggestion: DRAW THE TRIANGLE)
    1. Find the length of the adjacent side (horizontal side of the triangle)
    2. Find the length of the opposite side (vertical side of the triangle)

vi. Given a right triangle with a hypotenuse of length 13 at an angle (above the horizontal) of 75˚ (Suggestion: DRAW THE TRIANGLE)
    1. Find the length of the adjacent side (horizontal side of the triangle)
    2. Find the length of the opposite side (vertical side of the triangle)

vii. Given a right triangle with a horizontal side of length 3 and an angle (above the horizontal) of 53.13˚ (Suggestion: DRAW THE TRIANGLE)
    1. Find the length of the hypotenuse
    2. Find the length of the opposite side (vertical side of the triangle)

viii. Given a right triangle with a vertical side of length 4 and there is also an angle (above the horizontal) of 53.13˚ between the horizontal side and the hypotenuse (Suggestion: DRAW THE TRIANGLE)
    1. Find the length of the hypotenuse
    2. Find the length of the adjacent side (horizontal side of the triangle)