Homework #1

1. Demonstrate the following trigonometric identities by setting up cells for values of A and B and entering formulas to test both sides of each identity. Remember that all values are in radians, not degrees.:

   1.1 $cos(A+B) = cos(A)cos(B) - sin(A)sin(B)$

   1.2 $tan(2A) = \frac{2 \cdot tan(A)}{1 - tan^2(A)}$

   1.3 $cos^2(A) = \frac{1}{2}(1 + cos(2A))$

2. Find the built-in Excel functions that accomplish the following mathematical operations and show an example of their use:

   2.1 factorial

   2.2 arctangent

   2.3 convert a decimal integer number to a binary equivalent

   2.4 compute the base-2 logarithm of a number

   2.5 display the current date and time

3. Carry out the following unit conversions using formulas in Excel Do not use the CONVERT function.

   3.1 150 kph = ?? mph (a moderate speed on the autobahn)

   3.2 7 ft – 6 inches = ?? m (this is the altitude of Yao Ming)

   3.3 - 40 ºC = ?? ºF (typical winter temperature in Minnesota)

   3.4 12.4 psi = ?? Pa (typical atmospheric pressure in Boulder)

   3.5 30 mpg = ?? L/(100 km) (this is how they describe gas economy outside the U.S.)

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4. The ideal gas law is $PV = nRT$ where

   P: absolute pressure
   V: volume
   n: number of moles
   T: absolute temperature
   R: gas law constant, $8314.472 \frac{Pa \cdot m^3}{kmol \cdot K}$

   Compute the volume in liters that 10 kmol of a gas occupies if the pressure is 1000 atm and the temperature is 600°C?

5. The volume V of an oblate spheroid (a sphere that is squashed a bit) is given by the formula

$$V = \frac{4}{3}\pi a^2 b$$

where a: major semiaxis
b: minor semiaxis

The radius of the earth at the equator is 6378 km. The polar radius is 6357 km. Compute the volume of the earth and display the result in cubic kilometers. Also, compute and display the percentage of a perfectly spherical (radius = a) earth's volume is the actual volume?

6. Excel's built-in PI() function returns an approximate value for π. Compare this value to a more precise value found from another source to determine how many decimal places of accuracy Excel preserves. How does the value from Excel's PI() function compare to the value computed from

$$4\tan^{-1}(1)$$?

7. Experiment to determine what is the largest positive value that Excel can represent in a cell. Also determine approximately the smallest positive value.

8. If air resistance is neglected, the following formula predicts the range (R) of a projectile fired at an angle θ with an initial velocity u.

$$R = \frac{2u^2}{g}\sin(\theta)\cos(\theta)$$

If the muzzle velocity of a projectile from an M16 rifle is 980 m/s, compute the range for a given angle. Then, by trial-and-error, find the angle that yields a range of 10 miles. You may conclude from your result that it is important to include air resistance in these calculations, but don't attempt to do that here.