Name: _____

Class: _____

Due Date: _____

Physics Topic 1D Math – Errors and Precision

Understandings

- Random error
- Systematic error
- Accuracy
- Precision
- Uncertainties in measurements
- Standard deviation
- Uncertainties
- Best fit line

Answer the following questions. The solutions to this worksheet can be found on the YouTube channel Go Physics Go.

1. C: Define *random error* and give two examples.

2. C: Define *systematic error* and give two examples.

3. C: Determine if the following errors are *random* or *systematic*:

    a. Parallax error (Example: Your eyes are not parallel to the water level when measuring the height of water above the base of the water bottle.)
    b. Zero offset error (Example: The bathroom scale to determine your mass does not begin at zero.)
    c. A meter stick which does not begin at zero
    d. A slow running clock
    e. Measuring the time for a leaf to reach the ground using an accurate stopwatch

4. C: Define *accuracy* and give an example of high accuracy and low accuracy.

5. C: Define *precision* and give an example of high precision and low precision.

6. C: Below are a set of dartboards. An x on a dartboard represents a measurement. Mark seven measurements on each dartboard which shows

low precision and low accuracy,	high precision and low accuracy,	low precision and high accuracy, and	high precision and high accuracy.
			

7. C: List the rules with regards to determining the uncertainties in measurements for analog and digital instruments. Give examples.

8. C: State the equation and give the meaning of *standard deviation σ.*

9. C: What is the equation to determine the uncertainty of many measurements?

10. E: Determine the mean and uncertainty of the following time measurements:

    2.24 s, 2.29 s, 2.34 s, 2.17 s, 2.29 s, 2.21 s, 2.45 s, 2.36 s, 2.33 s, 2.34 s

11. E: Calculate the *absolute uncertainty*, *fractional uncertainty*, and *percent uncertainty* for a measured length of 87.65 ± 0.43 m.

12. **E: Use a pencil and ruler!** A *displacement vs. time* graph of an object moving with a constant speed in a straight line is given below. Draw a best fit line, estimate the slope and y-intercept, and finally give an equation of the speed of the object in the form $y = mx + b$ which is equivalent to $x(t) = mt + x_i$. The squares have a vertical unit of 1 m and horizontal unit of 1 s.