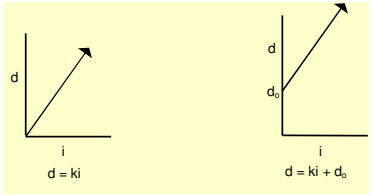
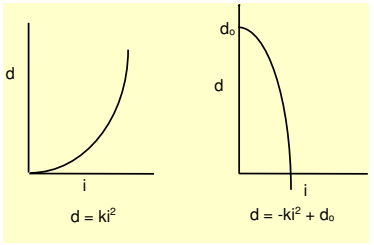
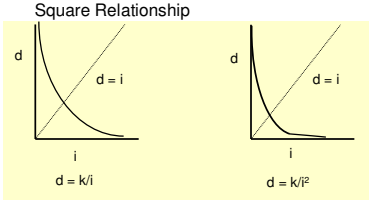
Mathematics and Process Skills Review Notes

Objective	Notes	Summary
1. Transpose a simple equation quickly and efficiently.	♦ You will need to keep in mind the order of operations. In order to undo multiplication you will need to divide. In order to undo addition you will need to subtract and vice versa. ♦ You should be able to solve for any variable on the STAAR formula chart.	
Sample Question: ♦ **Solve for the variable "d" in the following equation:** $F = \frac{Gm_1m_2}{d^2}$ ➢ **Solve for the variable "t" in the following equation:** $v_f = v_i + at$ ➢ **Solve for the variable "a" in the following equation:** $d = v_i t + \frac{1}{2}at^2$	➢ Solve for the variable "d" in the following equation: $F = \frac{Gm_1m_2}{d^2}$ ➢ Solve for the variable "t" in the following equation: $v_f = v_i + at$ ➢ Solve for the variable "a" in the following equation: $d = v_i t + \frac{1}{2}at^2$	
2. Distinguish physics from other areas of science.	♦ Physics is a science which describes and explains the interaction of matter and energy. ♦ Physicists gather information and organize it in words or in mathematical symbols. ♦ Some of the major areas of physics are: mechanics, thermodynamics, vibrations and wave phenomena, optics, electromagnetism, relativity and quantum mechanics.	
Sample Question: **Which of the following would not be included in a study of physics: Lenses, mirrors, magnets, genetic, or acceleration?**	♦ **Which of the following would not be included in a study of physics: Lenses, mirrors, magnets, genetic, or acceleration?**	
3. Recognize that all measured quantities have uncertainties.	♦ All measurements are in error to some degree. ♦ Human error – mistakes made in reading an instrument, or recording the results. ➢ To avoid, take repeated measurements to be certain they are consistent. ➢ Measurements must be made by looking at the device straight on. ➢ If they are not read straight on, an error due to parallax is possible. o Parallax is the apparent shift in position of an object as it's viewed from different angles. ♦ Method error – measurements taken by different methods. ➢ To avoid this error, you should standardize the method of taking measurements.	
	♦ Instrument error – equipment not in good working order. ➢ It is important to be careful with equipment. ♦ External error – some equipment changes due to external causes such as temperature influencing the length of a metal ruler	
Sample Question: ♦ **A graduated cylinder is marked with the notation at "20° C". Why is this information important?**	♦ A graduated cylinder is marked with the notation at "20° C". Why is this information important?	
4. Distinguish between accuracy and precision.	♦ The uncertainty of a measurement can be expressed in terms of accuracy or precision. ♦ Accuracy of a measuring device depends upon how well the value obtained by using the instrument agrees with the accepted value. ♦ When a measurement is to be made, the measuring device should first be checked for accuracy. ➢ This can be done by using the instrument to measure quantities whose values are known. o The measured values are then compared to the known values. o This is known as calibrating the instrument. ♦ Precision is the degree of exactness with which the measurement is made or stated. ♦ The precision of a measuring instrument is limited by the smallest division on its scale. ♦ Errors in measurements affect the accuracy of a measurement. ♦ But the precision is not affected since values are still stated in terms of the smallest division on the instrument. ♦ The accuracy of measurements can be determined by comparing your results with the accepted value. ♦ The percentage error, or relative error, of a measured value can be found with the following equation: $Relative\ Error = \frac{Experimental - Accepted}{Accepted} \times 100\%$	
Sample Question ♦ **These values were obtained as the mass of a bar of metal: 8.83 g; 8.84 g; 8.82 g. The known mass is 10.68 g. In terms of precision and accuracy describe this data.** ♦ **In a game of horseshoes, one horseshoe lands on the post. Four horseshoes land nowhere near the post. The one horseshoe on the post was thrown** ♦ **What was the precision of the scaled instrument which made the following measurement:**	♦ These values were obtained as the mass of a bar of metal: 8.83 g; 8.84 g; 8.82 g. The known mass is 10.68 g. In terms of precision and accuracy describe this data. ♦ In a game of horseshoes, one horseshoe lands on the post. Four horseshoes land nowhere near the post. The one horseshoe on the post was thrown ♦ What was the precision of the scaled instrument which made the following measurement: 3.024 g?	

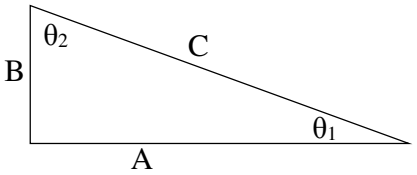
3.024 g? ♦ **If your lab partner is using a cylinder that is marked to the nearest ten ml and tells you that there is 100 ml of water in the graduated cylinder. How should this amount be recorded on your lab sheet?**	♦ If your lab partner is using a cylinder that is marked to the nearest ten ml and tells you that there is 100 ml of water in the graduated cylinder. How should this amount be recorded on your lab sheet?	
5. Distinguish between dependent and independent variables.	♦ The independent or manipulated variable is any quantity that an experimenter can change at will. ♦ It is carefully varied during the experiment. ♦ It is placed in the first column of the data table. ♦ It is plotted horizontally on the x-axis, or abscissa. Remember: This is the MIX of DRY MIX… Manipulated, Independent on the X-axis. ♦ The dependent or responding variable is any quantity that changes in response to the experimenter's manipulation of one or more independent variables. ♦ It is measured for each variation of the independent variable. ♦ It is placed in the second column of the data table. ♦ It is plotted vertically on the y-axis, or ordinate. Remember: This is the DRY of DRY MIX… Responding, Dependent on the Y-axis.	
Sample Question: **An experiment is done to determine the relationship between length and period of a pendulum. The length of the pendulum is varied and the period of the pendulum is measured.** **What is the independent variable in this experiment?** **What is the dependent variable in this experiment** **What information from this experiment goes in the first column of the data table?** **What information from this experiment goes in the second column of the data table?**	An experiment is done to determine the relationship between length and period of a pendulum. The length of the pendulum is varied and the period of the pendulum is measured. What is the independent variable in this experiment? What is the dependent variable in this experiment What information from this experiment goes in the first column of the data table? What information from this experiment goes in the second column of the data table?	

6. Recognize linear, parabolic and hyperbolic curves on graphs.	♦ Linear Relationships – Direct Relationship  ♦ Quadratic Relationships – Direct Square Relationship  ♦ Hyperbolic Relationship - Inverse Relationships or Inverse Square Relationship  	
Sample Question **Sketch a graph based on the data below.** **What type of relationship exists between force and**	\ **Sketch a graph based on the data below.** **What type of relationship exists between force and acceleration?**	

Force (N)	Acceleration (m/s^2)
1	1
2	2
3	3
4	4

Force (N)	Acceleration (m/s^2)
1	1
2	2
3	3
4	4

acceleration?		
7. Interpret the meaning of linear, parabolic and hyperbolic relationships.	Move your equation until it is set up so that the dependent variable is on the left side of the equal sign and the independent variables are on the right side of the equation. Example: $a = \frac{F}{m}$ where a is the dependent variable but F and m are independent variables ♦ A dependent variable is directly related to an independent variable that is in the numerator of the fraction on the right side of the equation. (If the right side of the equation is not a fraction, keep in mind that is the same as the whole side over the number 1). ➢ If both variables are to the first power, what one does, the other does the same thing. o If the independent variable doubles, the dependent variable also doubles ➢ If the dependent variable is to the first power and the independent variable is to the second power, the dependent variable will do the square of what the independent variable does. o When the independent variable doubles, the dependent variable will quadruple. ♦ A depended variable is inversely related to an independent variable that is in the denominator of the fraction on the right side of the equation. ➢ If both variables are to the first power, what one does the other does the inverse (reciprocal) of it. o If the independent variable is doubled the dependent variable halves ➢ If the dependent variable is to the first power and the independent variable is to the second power, the dependent variable will do the inverse square of what the independent variable does. o If the independent variable doubles, the dependent variable will quarter.	
Sample Questions: ♦ **In the equation I = (V/R), where I is the dependent variable, but V and R are independent variables. How are I and V related?** ♦ **In the equation I = (V/R), where I is the dependent variable, but V and R are independent variables. How are I and R related?** ♦ **In the equation I = (V/R), where I is the dependent variable, but V and R are independent variables. How are V and R related?** ♦ **In the equation I = (V/R), where I is the dependent variable, but V and R are independent variables. If V halves, what happens to I?** ♦ **In the equation I = (V/R), where I is the dependent variable, but V and R are independent variables. If R halves, what happens to I?** ♦ **In the equation I = (V/R), where I is the dependent variable, but V and R are independent variables. If V halves, what happens to R?**	♦ In the equation I = (V/R), where I is the dependent variable, but V and R are independent variables. How are I and V related? ♦ In the equation I = (V/R), where I is the dependent variable, but V and R are independent variables. How are I and R related? ♦ In the equation I = (V/R), where I is the dependent variable, but V and R are independent variables. How are V and R related? ♦ In the equation I = (V/R), where I is the dependent variable, but V and R are independent variables. If V halves, what happens to I? ♦ In the equation I = (V/R), where I is the dependent variable, but V and R are independent variables. If R halves, what happens to I? ♦ In the equation I = (V/R), where I is the dependent variable, but V and R are independent variables. If V halves, what happens to R?	

8. Practice appropriate methods (graphical and algebraic) for the solution of problems growing out of laboratory exercises or problem assignments.	♦ The purpose of a scientific investigation is to discover relationships that may exist among the quantities measured. ♦ Physicists make their work easier by summarizing data in tables and graphs. ♦ Tables organize data and, usually, a clear trend can be seen in the data. ♦ A graph is a pictorial display of data. ♦ The shape of a graph may frequently reveal a relationship that is not apparent from a quick look at the data. ♦ Because a graph usually shows an obvious pattern, a smooth curve is drawn through the data points to make estimations for points without data.	
Sample Question: **Why do scientists perform experiments?**	♦ Why do scientists perform experiments?	
9. Define and apply sine, cosine, and tangent to right angle geometry problems. **(Pre-AP and DI)**	♦ Sine, cosine, and tangent can only be used with a right triangle. ♦ $\sin\theta = \frac{opposite}{hypotenuse}$ $\cos\theta = \frac{adjacent}{hypotenuse}$ $\tan\theta = \frac{opposite}{adjacent}$ ♦ You should be able to solve for any side of a triangle as well as any angle in the triangle.  In the triangle above: Side C is the hypotenuse since is it across from the right angle and is the longest side.. If you are using θ_1 then side A is the adjacent and side B is the opposite. If you are using θ_2 then side B is the adjacent and side A is the opposite.	
