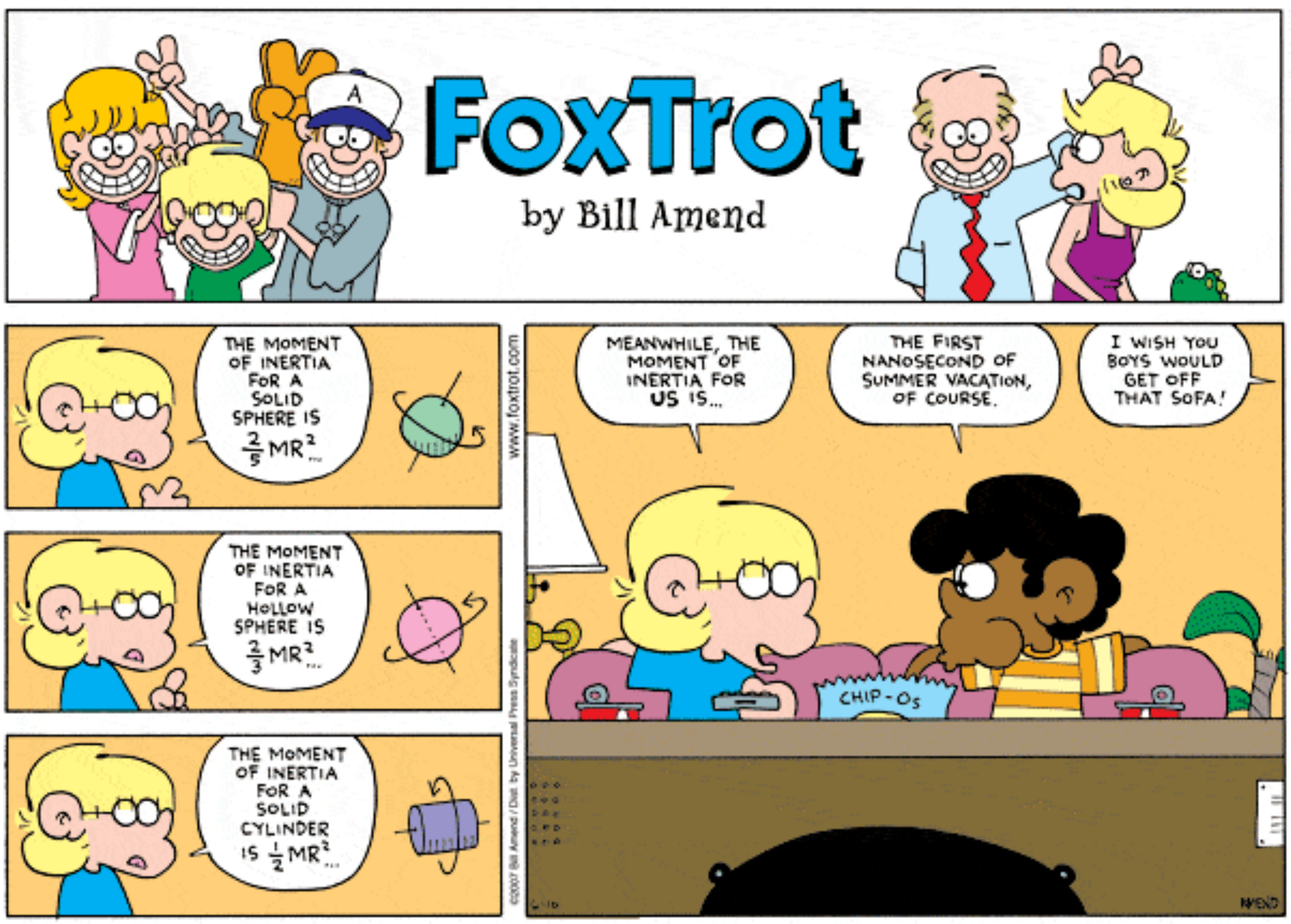
Name:___________________________________

AP Physics 1
Summer Assignment Packet
Summer of 2018
Mr. Ecsedy

You'll see two parts to this summer's AP Physics 1 work. We're looking for you to prepare by doing some math with letters, and conduct a mini-experiment that you will model using your graphing calculator or the online graphing calculator, Desmos.



Name:____

Math with Letters! (aka Physics Math!)
Use the following questions to practice your math manipulation skills.

1. Solve the following equation for x. Express your answer as a single fraction.

$$\frac{1}{x}+\frac{1}{y}=\frac{1}{z}$$

2. If $\frac{1}{x}+\frac{1}{y}=\frac{1}{z}$ and $w=x+y$, give the product zw in terms of x and y.

3. Suppose $c=\frac{k}{d^2}$ for some constant k.

a) If d is increased by a factor of 3, what happens to c (give an answer such as "c is …. by a factor of …. ") ?

b) If d is decreased by a factor of 2, what happens to c (give an answer such as "c is …. by a factor of …. ") ?

4. Use the quadratic formula to solve the following equation for x in terms of g, h, and v:

$$\frac{g}{2}x^2+vx+h=0$$

Name:____

5. Given $x^2 + y^2 = 1$, $a = rx$, and $b = ry$, show that $a^2 + b^2 = r^2$.

6. Given right triangle ABC with the right angle at C and AB=1 and AC=x, write an expression for BC in terms of x.

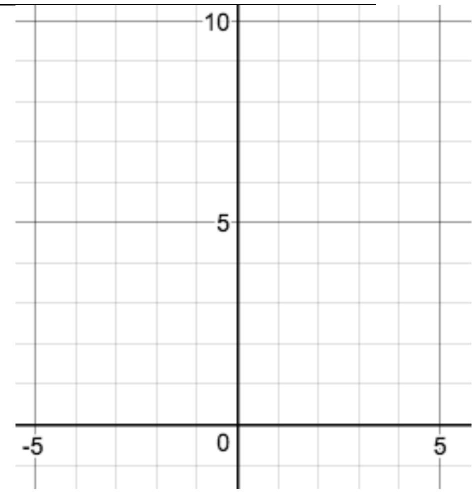
7. If 1 ngultrum = 12 ouguiya, 3 ouguiya = 4 hryvna, and 7 nakfa = 5 ngultrum, how many nakfa are in 240 hryvna? Show your steps.

8. Draw a right triangle ABC with the right angle at C, AB=65, and tan(A) = $\frac{5}{12}$. Find the lengths of AC and BC.

9. Right triangle DEF is a 30-60-90 triangle with the right angle at F and the 30 degree angle at D. If DE = 10, find DF and EF.

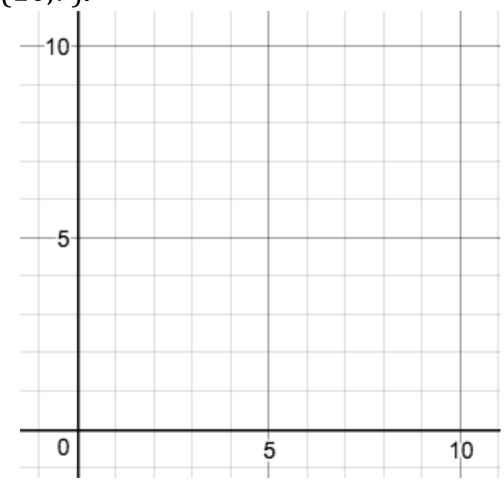
Name:_______________________________________

10. Draw a parallelogram with one vertex at (0,0), another vertex at (2,3) and a third vertex at (-1,4). The fourth vertex is in Quadrant I. Show how to find the location of the fourth vertex and give its coordinates.



11. A trapezoid has vertices at (0,0), (0,3), (10,0), and (10,7).

a) Find the slope of the segment of the trapezoid that is neither horizontal nor vertical.



b) Find a value k such that if you draw a horizontal line at y=k across the trapezoid from x=0 to x=10, the area of the rectangle drawn will equal the area of the trapezoid.

c) Would you have the same such value of k if instead of having a line segment from (0,3) to (10,7), you had the curve $y=0.04x^2 + 3$ as the part of the figure that is neither horizontal nor vertical? If not, would your value for k be higher or lower than your answer for (b)? Justify your answer.

Name:_______________________________________

12. Suppose $w = \sqrt{\frac{a}{b}}$.

a) If a is increased by a factor of 4, does w increase or decrease? By what factor does w change? Justify your answer.

b) If b is increased by a factor of 4, does w increase or decrease? By what factor does w change? Justify your answer.

13.) If x and y are given in the following chart:

x	y
30	6
60	3
120	1.5

a) Find a relationship between x and y. Express your answer as y=(some function of x)

b) If x is multiplied by 4, what happens to y?

Name:____

14.) If x and y are given in the following chart:

x	y
18	3
50	5
98	7

a) Find a relationship between x and y. Express your answer as y=(some function of x)

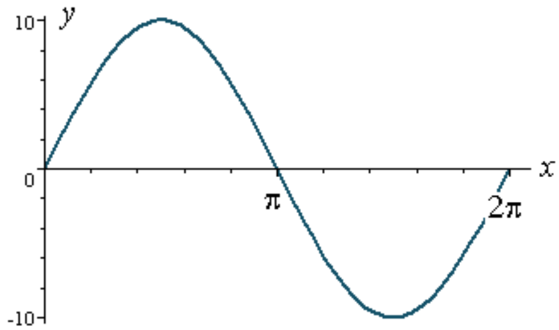
b) If x is multiplied by 4, what happens to y?

15.) Solve the following system for "a" in terms of the other variables. Express your answer as a single fraction. Show your steps. (m and M *are* different)

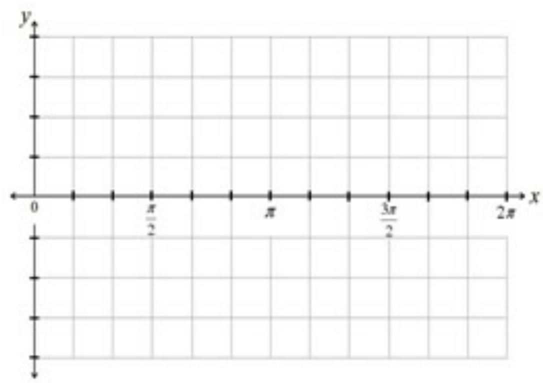
$$mg - T = ma$$
$$T - Mg = Ma$$

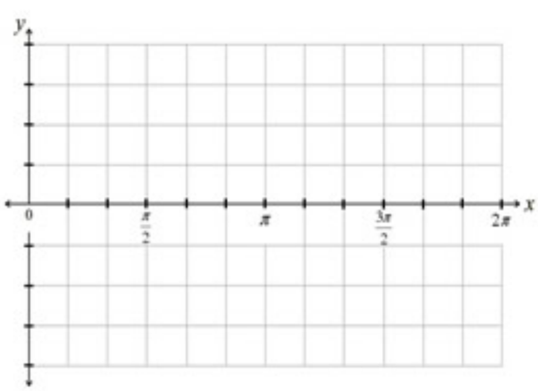
Name:____

16.) If y as a function of x looks like this for $0 \le x \le 2\pi$



What does the graph of -y look like? Draw your graph here and label the y-axis with numbers.

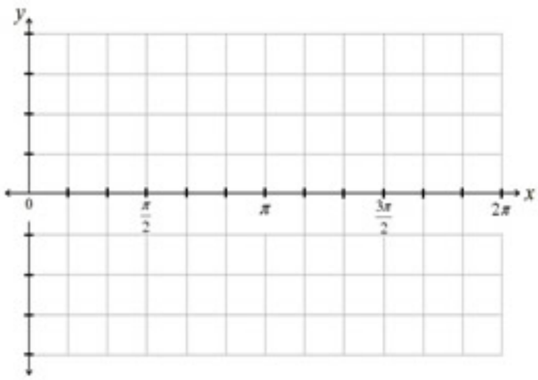




What does the graph of y/2 look like? Sketch the graph here and label your y-axis with numbers.

Name:______________________________________

What does the graph of y^2 look like? Draw your graph here and label the y-axis with numbers?



Name:____________________________________

A Thought Experiment!

1. Imagine you were to drop a ball from a height of 1 meter above the floor and let it bounce once before catching it again. What height do you think it would bounce back up to?

2. Why do you think that?

3. What height do you think it would bounce back up to if you let it bounce twice before catching it?

4. Why do you think that?

Let's Try It Out!

5. Make sure your ruler, dropper, and spotter are in position. Smartphone cameras work well to capture this motion!

6. Drop the ball from a height of 1 meter. Make sure your dropper holds the ball so that the ***bottom*** is above the 1 meter mark.

7. Spot the height that the ***bottom*** of the ball reaches after one bounce. Make sure your dropper only catches the ball after it bounces a few more times (so that they don't disturb its motion).

8. Record the height that the ***bottom*** of the ball reached after one bounce.

9. Raise the ball back up to 1 meter. This time have your spotter spot the height of the ***bottom*** of the ball after its second bounce.

10. Record the height that the ***bottom*** of the ball reached after two bounces.

11. Raise the ball back up to 1 meter. Repeat the measurement process for 3, 4, 5, 6, or even more bounces.

Name:___________________________________

Let's Analyze!

A. What do you notice about the heights in the table?

Ball Bounce Data	
# of bounces	height (units:_________)

Predict the height of the ball after 10 bounces: _________________

Did you have to actually drop the ball and wait for 10 bounces to make this prediction? No? How did you do it then?

To see how good your prediction is, let's try to *scientifically model* the bounce height as a function of the number of bounces. You may either use Desmos.com or your graphing calculator. Either way, create a table, enter your data, and label both axes. Adjust both axes to appropriate scales for viewing your data.

Do you think a linear model will work? Why or why not?

Determine whether a linear, quadratic, or exponential model fits the data best If you are using Desmos, to create a new function,you can either type y1~mx1+b (Notice this is the wiggly line on your keyboard, not the equal sign) or you can type y=mx+ b and then click "all" to create sliders. Then you may move the sliders to fit the data. . (Click on the number 10 if you need to adjust the range of a slider.). If you are using a quadratic model, type y1~a(x1-h)^2+k, or type y=a(x-h)^2+k and use the sliders. If you are using an exponential model type y1~ab^(x1) or type y=ab^x and use the sliders.

Name:_________________________________

Write your models here with the constants filled in:

Linear:

Quadratic:

Exponential:

G. Give the “coefficients of determination” (This is the R^2, since a quadratic model doesn’t have a correlation coefficient) for each model.

Linear: R^2=

Quadratic: R^2 =

Exponential: R^2=

Use each model to predict the height after 10 bounces and after 15 bounces. Which one makes more sense?

Linear 10 bounces:	Quadratic 10 bounces:	Exponential 10 bounces:
Linear 15 bounces:	Quadratic 15 bounces:	Exponential 15 bounces:

H. What is the y-intercept of your function? What does it mean?

Does your function have an x-intercept? If so, what does that mean?

Does your function have a common difference or a common ratio? if so, what does it mean?

Look back at your answers from the “Thought Experiment” we did. Would you update any of your answers now? Which ones? What are your new answers?