AP Statistics – Horsepower Lab **Name: ____** **Block: ____**

1. Find the vertical distance.

   a) Measure the height of one step. __________ cm

   b) Count the number of stairs. ___________ stairs

   c) Multiply part a and part b to get an approximation of the vertical height. _________cm

   d) Convert vertical height to meters. height = __________meters

2. Have someone time you for three trips up the stairs.

   My times are: 1)___________seconds 2)___________seconds 3)_____________seconds

3. Compute your mass in kilograms *(divide your weight in pounds by 2.2)*.

   My mass = __________kg

4. Compute the force in newtons. (F = mg) m = mass in kg, g = gravity in m/s^2 = 9.8

   Force = _________ newtons

5. Compute work in joules. Work = force x distance. (That's #4 x #1d)

   work = ____________ joules

6. Compute power in watts. $P = \frac{\text{joules}}{\text{seconds}}$. Use your fastest time.

   P = _____________watts

7. Compute your horsepower. 1 hp = 746 watts. (divide #6 by 746) Round to nearest hundredths place.

   hp = _______________

8. Add your results to the community data.

Part I: Mass vs. Horsepower (copy these values from the screen)

Predictor	Coefficient	Std Error	t statistic	P Value
Constant				
Mass				
R-squared:		**Se:** (std dev of error)		**n =** (sample size)

1. Write the linear regression equation in context.

2. Identify the slope of the regression equation (including units!) and interpret what this value means in context.

3. Identify the *y*-intercept of the regression equation and interpret this value in context.

4. Is there a pattern in the residual plot? What does this tell you?

5. Identify the correlation coefficient. Interpret this value in context.

6. Interpret the R^2 value for this regression in context.

7. There is a value labeled "s_e", which is referred to the "standard error of the residuals". Identify and interpret this value in context.

(Use the values from the computer printout for these next two problems)

8. Is there statistical evidence of a linear association between mass and horsepower? Conduct an appropriate test at the 5% level of significance. You may assume that the conditions for inference have been checked and verified.

9. Construct and interpret a 95% confidence interval for the slope of the regression line. Again, assume that the necessary conditions have been checked and verified.

Part II: Time vs. Horsepower (copy these values from the screen)

Predictor	Coefficient	Std Error	t statistic	P Value
Constant				
Time				
R-squared:		Se: (std dev of error)	n = (sample size)	

1. Write the linear regression equation in context.

2. Identify the slope of the regression equation (including units!) and interpret what this value means in context.

3. Identify the *y*-intercept of the regression equation and interpret this value in context.

4. Is there a pattern in the residual plot? What does this tell you?

5. Identify the correlation coefficient. Interpret this value in context.

6. Interpret the R^2 value for this regression in context.

7. There is a value labeled "s_e", which is referred to the "standard error of the residuals". Identify and interpret this value in context.

(Use the values from the computer printout for these next two problems)

8. Is there statistical evidence of a linear association between time and horsepower? Conduct an appropriate test at the 5% level of significance. You may assume that the conditions for inference have been checked and verified.

9. Construct and interpret a 95% confidence interval for the slope of the regression line. Again, assume that the necessary conditions have been checked and verified.

Regression Notes (a reprint from first semester)

Since there are a **PLETHORA** of things that you need to ~~memorize~~ learn how to interpret in this unit, here is a quick reference (keep this safe!). *(Anywhere you see anything in "quotations" or see a blank, fill it in with the appropriate value/context/units/etc. ALWAYS interpret IN CONTEXT!)*

Slope

For each increase of 1 "unit" in "*x*", the model predicts an increase/decrease of _______ "units" in "*y*".

*(NEVER write "there **will be** an increase…" Be sure to write "**the model predicts** an increase…")*

***y*-intercept**

The model predicts that at an "*x*" value of zero, the "*y*" value will be _______.

Residual plot

"No pattern" is a good thing! If we see a clear curve in the residual plot, that means we are using the wrong type of model. Maybe try a logarithmic or exponential model instead (we'll tackle this in chapter 10).

Correlation coefficient (*r*)

(take the square root of R-squared – if the slope is negative, make this value negative as well)

This value indicates the strength (see next sentence) and direction (positive or negative) of the linear association between "*x*" and "*y*". This value must be between -1 and +1. An *r*-value of exactly 1 (or -1) means that the points form a perfectly straight line (which never happens with real-world data).

General suggestion:

- If $|r| < 0.5$, the association is "weak"
- If $|r| > 0.8$, the association is "strong"
- If $0.5 < |r| < 0.8$, the association can be called "moderately strong" or "moderately weak"

R^2 value (coefficient of determination)

The percent of the variation in "*y*" that can be explained by the linear model for "*x*" and "*y*".

Residual ($e = y - \hat{y}$)

Observed (actual) "*y*" value minus predicted (hat) "*y*" value.
Also the vertical distance between the actual point and the regression line.

(To find the predicted ($\hat{y}$) value, plug the *x*-value of the point into the regression equation)

Standard error of residuals (s_e)

Typical difference between the observed and predicted "*y*" values for the points in this regression.

(sometimes in a regression computer printout, this is simply labeled as "s")