12.2 AP STATS linear transformations ws Name:

Check work with a partner and turn in at the end of class after review.

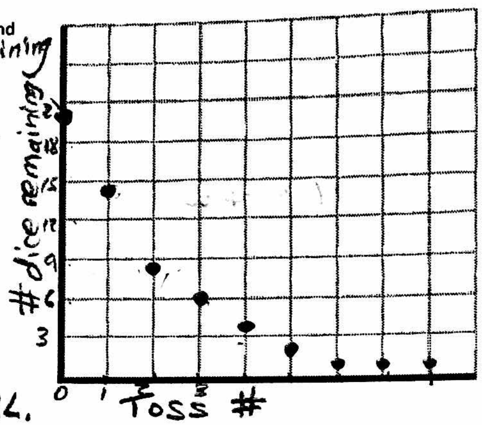
1. The following data were collect by running an experiment in which 20 dice were tossed. All of the dice that showed 2s and 3s were removed, and the remaining dice were tossed. Again, all of the dice showing 2s and 3s were removed, and so, on.

Toss Number	0	1	2	3	4	5	6	7	8
Number of Dice Remaining	20	14	8	6	4	2	1	1	1

a. Make a scatterplot of the data. Graph on the plot below. Find the linear model.

x = toss # $\hat{y}$ = pred. # dice remaining

$\hat{y} = 15.2 - 2.217x$



b. What is the correlation coefficient (r) and the coefficient of determination for this relationship if it were model by a linear least-squares regression line?

$r = -0.9075$

$r^2 = 0.8235$

Explain what r and r^2 means for this situation.

r → means nothing! Not linear, so r is invalid.

r^2 → 82.35% of the variation in # dice remaining can be predicted by the LSRL.

c. What type of model do you think this data represents? Why?

Exp. decay. About 1/3 of dice are removed on each roll.

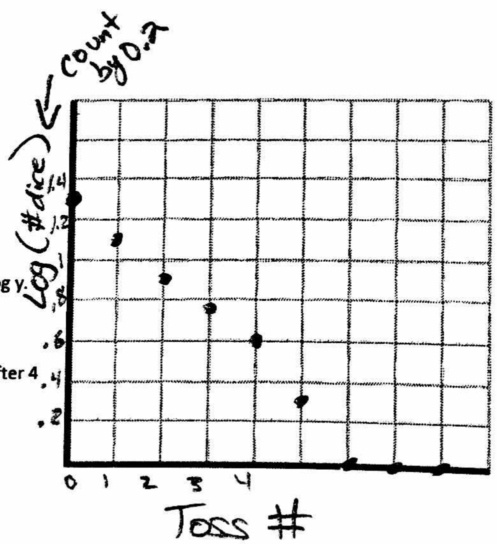
f. What is the exponential regression model?

$\hat{y} = 19.3839(.6575)^x$

g. What is r^2 for the exponential regression model?

$r^2 = .9623$

e. Graph x and log y on the graph here.



f. Write the linear model for the relationship between x and log y.

$\widehat{\log y} = 1.2874 - 0.1821x$

g. Use your model to show the expected number of dice left after 4 rolls. Show your work.

$\widehat{\log y} = 1.2874 - 0.1821(4)$

$\widehat{\log y} = .559$

$10^{\widehat{\log y}} = 10^{.559}$

$\hat{y} = 10^{.559} \approx$ 3.6224 dice

2. Ryan drops a ball from various heights (feet) and records the time (seconds), x, that it take for the ball to hit the ground, using a motion detector. He obtains the data displayed in the table here.

Time	Distance
1.528	11.46
2.015	19.99
3.852	72.41
4.154	84.45
4.625	104.23

a. Look at the time vs. distance data. Is a linear model a good model to use? Explain.

Scatterplot looks decent. Strong r value. However, residual plot shows curved pattern. Try others.

b. Give the Exponential and power model for the data. Provide and interpret the r^2 value as well.

exp: x = time (sec) $\hat{y}$ = pred. dist (feet)

$\hat{y} = 4.3251 + 2.0332x$

$r^2 = 0.9896$

98.96% of the variation in distance can be explained by the exp. model.

power: x and $\hat{y}$ same

$\hat{y} = 4.9339x^{1.9928}$

$r^2 = 0.999994$ wow!

99.9994% of the var. in dist. can be exp. by the power model.

c. Which is the better model and why?

power b/c higher r^2 value.

d. What transformation will you use to straighten the data?

$(x, y) \rightarrow (\log x, \log y)$

e. Write the transformed linear regression model and identify the variables. Graph it here.

$\widehat{\ln y} = 1.5961 + 1.9928(\ln x)$

$r^2 = .999994$

e. Predict the distance a ball would have to fall in order to take 4.2 seconds to hit the ground. Show work.

$\widehat{\ln y} = 1.5961 + 1.9928(\ln 4.2)$

$\widehat{\ln y} = 4.4559$

$\hat{y} = e^{4.4559} =$ 86.1368 ft. $= \hat{y}$

~~f. [illegible]~~