AP Statistics – Quiz Review – Transformation on regression with advanced regression

Name_____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

**Solve the problem.**

1) For the model $\ln \hat{y} = 1.03 + 3.2x$, predict y when $x = 2$. Round to two decimal places.   1) _____
   A) 0.87
   B) 1685.81
   C) 2.01
   D) $\hat{y}$ is undefined for $x = 2$.
   E) 7.43

2) For the model $\sqrt{\hat{y}} = 4.7 + 0.9x$, predict y when $x = 2$. Round to two decimal places.   2) _____
   A) 2.55   B) 6.5   C) 43.48   D) 42.25   E) 41.44

Provide an appropriate response.

3) The relationship between two quantities x and y is examined, and the association is shown in the   3) _____
   scatterplot below.
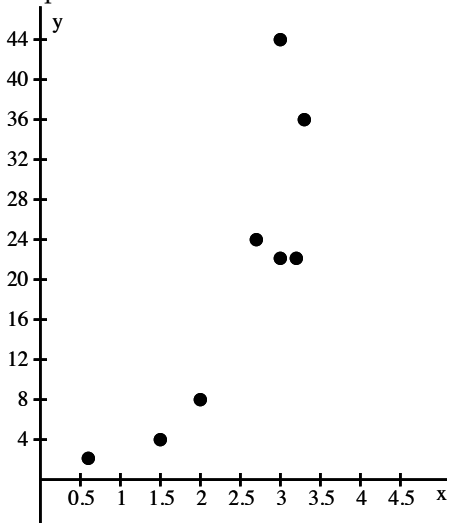
   Describe the association between these variables shown in the scatterplot.
   A) Fairly quadratic, weak relationship
   B) Fairly linear, weak relationship
   C) Fairly linear, strong relationship
   D) Fairly exponential, strong relationship
   E) Fairly exponential, weak relationship

Solve the problem.

4) The consumer price index (CPI) is a measure of the relative cost of goods in the a given country for a particular year. The table below shows the CPI for a country for the stated years beginning in 1940.

Year	CPI
1940	13.6
1950	24.1
1960	29
1970	38.8
1980	82
1990	130.7
2000	172.2

Re–express the CPI. Then determine the regression equation and correlation coefficient for the re–expressed data.

A) Re-expression: $-\dfrac{1}{CPI}$; $y = 0.0571x - 37.4282$, $r^2 = 0.976$

B) Re-expression: $\log(CPI)$; $y = 0.0187x - 35.0882$, $r^2 = 0.9794$

C) Re-expression: $-\log(CPI)$; $y = -0.0187x - 35.0882$, $r^2 = 0.9609$

D) Re-expression: $\dfrac{1}{CPI}$; $y = 0.0298x - 32.7482$, $r^2 = 0.9794$

E) Re-expression: $\dfrac{1}{\log(CPI)}$; $y = 0.0187x - 35.0882$, $r^2 = 1.0818$

Provide an appropriate response.

5) A company's sales increase by the same amount each year. This growth is . . .
  A) power
  B) quadratic
  C) linear
  D) logarithmic
  E) exponential

6) It's easy to measure the circumference of a tree's trunk, but not so easy to measure its height. Foresters developed a model for ponderosa pines that they use to predict the tree's height (in feet) from the circumference of its trunk (in inches): $\ln \hat{h} = -1.2 + 1.4(\ln c)$. A lumberjack finds a tree with a circumference of 60"; how tall does this model estimate the tree to be?
 A) 19'   B) 5'   C) 11'   D) 93'   E) 83'

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

7) Doctors studying how the human body assimilates medication inject some patients with   7) _____
penicillin, and then monitor the concentration of the drug (in units/cc) in the patients'
blood for seven hours. The data are shown in the scatterplot. First they tried to fit a
linear model. Now the researchers try a new model, using the re–expression
log(Concentration). Examine the regression analysis and the residuals plot below.
Explain why you think this model is better than the original linear model.

```
Dependent variable is:        LogCnn
No Selector
R squared = 98.0%    R squared (adjusted) = 98.0%
s = 0.0451  with  43 - 2 = 41  degrees of freedom
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Source	Sum of Squares	df	Mean Square	F-ratio
Regression	4.11395	1	4.11395	2022
Residual	0.083412	41	0.002034	

| Variable	Coefficient	s.e. of Coeff	t-ratio	prob
Constant	1.80184	0.0168	107	Š 0.0001
Time	-0.172672	0.0038	-45.0	Š 0.0001

predicted(L/T)

3
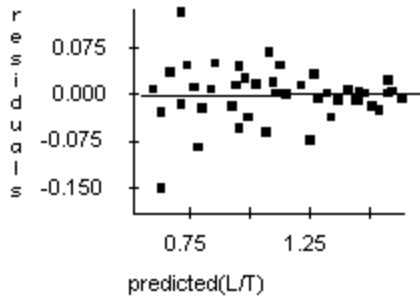
8) Doctors studying how the human body assimilates medication inject some patients with penicillin, and then monitor the concentration of the drug (in units/cc) in the patients' blood for seven hours. The data are shown in the scatterplot. First they tried to fit a linear model. The regression analysis and residuals plot are shown. Using this model, estimate what the concentration of penicillin will be after 4 hours.

8) _____

Dependent variable is: Concentration
No Selector
R squared = 90.8%   R squared (adjusted) = 90.6%
s = 3.472 with 43 - 2 = 41 degrees of freedom

Source	Sum of Squares	df	Mean Square	F-ratio
Regression	4900.55	1	4900.55	407
Residual	494.199	41	12.0536	

Variable	Coefficient	s.e. of Coeff	t-ratio	prob
Constant	40.3266	1.295	31.1	Š 0.0001
Time	-5.95956	0.2956	-20.2	Š 0.0001

predicted(C/T)

4
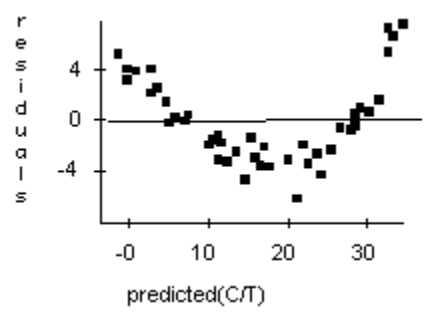
9) QuarkNet, a project funded by the National Science Foundation and the U.S.   9) _____
   Department of Energy, poses the following problem on its website:
   "Last year, deep within the Soudan mine, QuarkNet teachers began a long–term
   experiment to measure the amount of carbon–14 remaining in an initial 100–gram
   sample at 2000–year intervals. The experiment will be complete in the year 32001.
   Fortunately, a method for sending information backwards in time will be discovered in
   the year 29998, so, although the experiment is far from over, the results are in."

   Here is a portion of the data:

Time (yr)	0	2000	4000	6000	8000	10,000	12,000	14,000	16,000	18,000
Mass (g)	100	76	61	47	36	29	22	17	13	10

   A scatterplot of these data looks like:
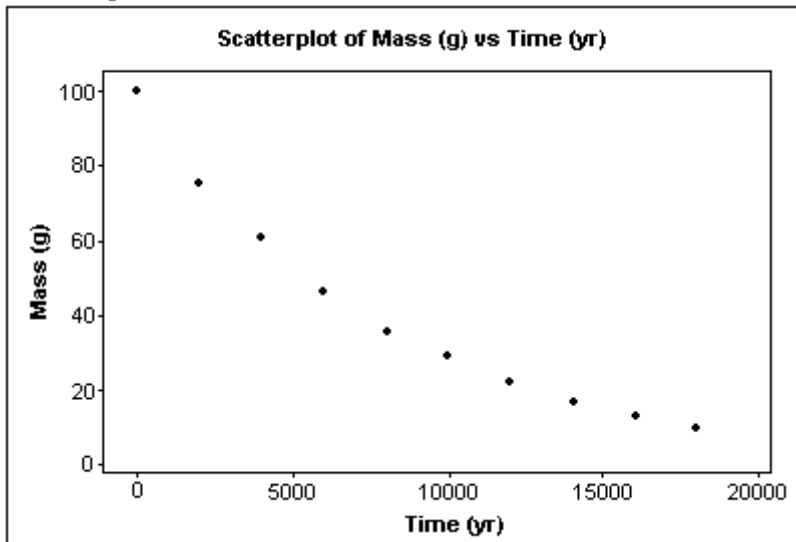
   Can you use your model to predict when 50 g of the sample will be left? Explain.

1) B
2) D
3) D
4) B
5) C
6) D
7) The residuals show a random pattern with no curvature.
8) 16.5 units/cc
9) No. This model is to be used to predict Mass from Time, not Time from Mass. We would need to develop a new model using Mass as the explanatory variable and Time as the response variable to make this prediction.