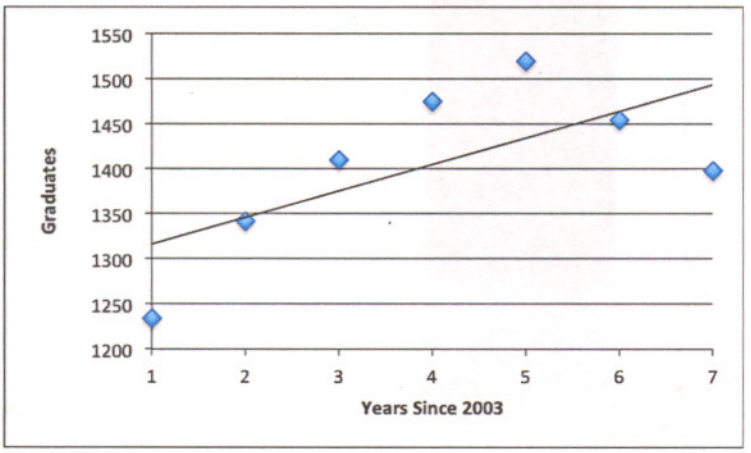
Dr. Katiraie Practice Quiz 2 on Sections 3.1 and 3.2

Name: Solutions Date: By Dr. Katiraie

1. Suppose that a music club charges $12 per CD but offers a 5% discount on orders larger than 10 CDs. Then the cost per order is a linear function of the number of CDs ordered.
   A) True
   B) False

2. Suppose you wrote 250 words of a sociology paper yesterday and today began typing at a rate of 40 words per minute. Then the total number of words typed is a linear function of the number of minutes since you began typing today.
   A) True
   B) False

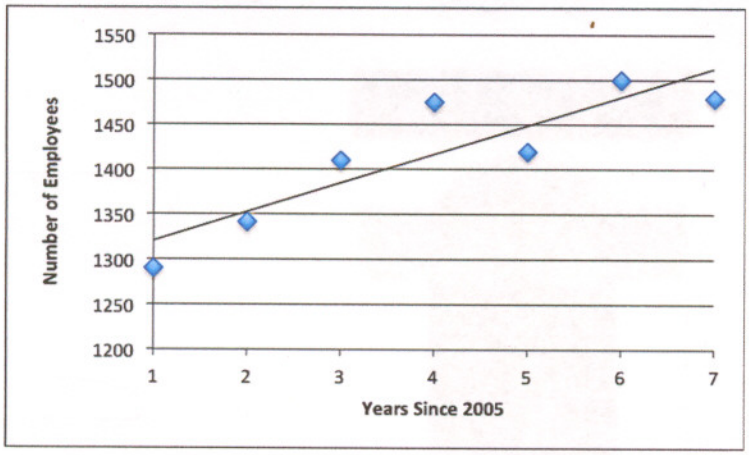
3. Below is a scatterplot and trend line showing the number of high school graduates at a local high school each year since 2003:



Does the trend line appear to offer an appropriate way to analyze the data? Explain your reasoning.

Answer: The trend line is not an appropriate way to analyze the data because the data does not represent a linear relationship. The scatterplot indicates an inconsistent growth rate, so a linear trend line does not represent the data accurately.

4. Below is a scatterplot and trend line showing the number of employees at a mid-size company each year since 2005:



During which years was the number of employees more than would have been expected from the linear trend?

2008, 2009 and 2011.

5. Suppose for a certain site there are initially 30 parts per million of a dangerous contaminant and that a cleaning process removes 5% of the remaining contaminant each day. How much contaminant (in parts per million) is removed after three days?

Amount remained $= 30(1-0.05)^3 = 25.72$ ppm Amt Removed $= 30 - 25.72 = 4.28$ ppm

6. The growth rate of the speed of sound in relation to the temperature in degrees Fahrenheit is a linear function. The speed of sound at 0 degrees Fahrenheit is 1052.3 feet per second. For every 1 degree Fahrenheit rise in temperature, the speed of sound increases by 1.1 feet per second. Identify the initial value of the linear function that gives the speed of sound in terms of temperature.

(0°F, 1052.3 ft/sec)

A) 1052.3 ft per second
B) 1053.4 ft per second
C) 1051.2 ft per second
D) 1000.0 ft per second

7. The growth rate of the speed of sound in relation to the temperature in degrees Fahrenheit is a linear function. The speed of sound at 0 degrees Fahrenheit is 1052.3 feet per second. For every 1 degree Fahrenheit rise in temperature, the speed of sound increases by 1.1 feet per second. A 20 degree Fahrenheit rise in temperature would provide what increase in the speed of sound?

A) 20 ft per second
B) 21 ft per second
C) 22 ft per second
D) 25 ft per second

(0, 1052.3)

slope $= 1.1 \frac{ft/sec}{°F}$

$20°F * 1.1 \frac{ft/sec}{°F} = 22 \frac{ft}{sec}$

$(0°F, 1052.3\ ft/sec)$

$slope = 1.1\ \frac{ft/sec}{°F}$ $\quad S = 1.1F + 1052.3$

8. The growth rate of the speed of sound in relation to the temperature in degrees Fahrenheit is a linear function. The speed of sound at 0 degrees Fahrenheit is 1052.3 feet per second. For every 1 degree Fahrenheit rise in temperature, the speed of sound increases by 1.1 feet per second. What would the speed of sound be after a 67 degree Fahrenheit rise in temperature?

   A) 73.7 ft per second
   B) 1119.3 ft per seond
   C) 1053.4 ft per second
   D) 1126.0 ft per second

$S = 1.1(67) + 1052.3$

$= 1126\ ft/sec$

9. On rural highways, the average speed S (in miles per hour) is related to the amount of curvature C (in degrees) of the road. Suppose that on a straight road ($C = 0$), the average speed is 47.5 miles per hour and that this decreases by 0.647 mph for each additional degree of curvature. Find the slope of the linear function expressing S in terms of C.

   A) 0.647 mph
   B) - 0.647 mph / Degree
   C) - 1.546 mph
   D) 1.546 mph

$(0, 47.5\ mph)$ $\quad m = -0.647\ \frac{mph}{degree}$

10. On rural highways, the average speed S (in miles per hour) is related to the amount of curvature C (in degrees) of the road. Suppose that on a straight road ($C = 0$), the average speed is 47.5 miles per hour and that this decreases by 0.647 mph for each additional degree of curvature. Find the formula expressing S as a linear function of C.

   A) $S = 0.647C + 47.5$
   B) $S = 47.5C + 0.647$
   C) $S = 47.5C - 0.647$
   D) $S = -0.647C + 47.5$

$S = mC + b$

m: slope; b: y-intercept

11. The half-life of carbon-14 is 5770 years. Suppose we have an organic sample that is 15,000 years old. Determine what percentage of the original amount of carbon-14 remains after 15,000 years.

Amt Remaining $= \text{Initial Amt}\left(\frac{1}{2}\right)^h \Rightarrow \left(\frac{1}{2}\right)^{\frac{15000}{5770}} = 0.16498 \approx 16.5\%$

12. A(n) _____ function is a function that changes at a constant percentage rate.

   A) logarithmic
   B) linear
   C) exponential
   D) increasing

13. The formula for an exponential function y of t is:

A) y = Initial value × Base
B) $y = \text{Initial value} \times \text{Base}^t$
C) $y = \text{Base} \times (\text{Initial value})^t$
D) $y = \text{Initial value} + \text{Base}^t$

$y = \text{Initial value} \times (\text{Base})^t$

14. An exponential function y of t is characterized by the following property: When t increases by 1, to find the new value of y, we multiply the current value by the Base

A) $t + 1$
B) $t - 1$
C) the initial value
D) the base

15. Typically, exponential growth starts rapidly and then increases slowly.

A) True
B) False

16. A quantity grows exponentially when it increases by a constant percentage over a given period.

A) growing
B) reducing
C) constant
D) linear

17. A quantity decays _____ when it decreases by a constant percentage over a given period.

A) linearly
B) exponentially
C) logarithmically
D) evenly

18. Typically, exponential decay is rapid at first but eventually slows.

A) True
B) False

19. The half life of a radioactive substance is the time it takes for half of the substance to decay.
A) doubling time
B) half-life
C) shelf-life
D) halving time

20. Suppose Mark's salary grows by $2500 each year and Sarah's salary grows by 2.5% each year. Which one has a salary that grows exponentially?
A) Mark
B) Sarah
C) Both
D) Neither

21. Water is pumped into a tank at a rate of 12 gallons per minute. What type of function describes the amount of water in the tank?
A) Linear
B) Exponential
C) Logarithmic
D) Constant

22. An investment grows according to the rule: *Next month's balance = 1.003 × Current balance.* Find the percentage increase each month.
A) 1.3%
B) 0.3%
C) 3.0%
D) 1.003%

$1.003 \times \text{Current}$

$= (1 + 0{,}003) \times \text{Current}$

$(1 + r) \times \text{Current} \Rightarrow r = 0{,}003 = 0{,}3\%$

23. Suppose the number of internet domain hosts grew according to the rule: *Next year's number = 1.47 × Current number*. If the number of domain hosts initially was 8.4 million, find an exponential function that gives the number of hosts, H, in terms of time, t.

$H = 8.4 \times (1.47)^t$

Answer Key

1. B
2. A
3. The trend line is not an appropriate way to analyze the data because the data does not represent a linear relationship. The scatterplot indicates an inconsistent growth rate, so a linear trend line does not represent the data accurately.
4. 2008, 2009, 2011
5. 4.28 ppm
6. A
7. C
8. D
9. B
10. D
11. 16.5%
12. C
13. B
14. D
15. B
16. C
17. B
18. A
19. B
20. B
21. A
22. B
23. $H = 8.4 \times (1.47)^t$