Dr. Katiraie MA115A Quiz 2 Form B (Sections 3.1 and 3.2) Name: Solution

1. The following table shows the average life expectancy, in years, of a child born in the given year:

Year	2003	2004	2005	2006	2007
Life expectancy	77.1	77.5	77.4	77.7	77.9

If t denotes the time in years since 2003 and E is the life expectancy in years, then the trend line for this data is given by $E = 0.18t + 77.16$. If this trend line persisted through 2012, what would be the average life expectancy of a child born in 2012?

$2012 - 2003 = 9$

$E = 0.18(9) + 77.16 = 78.78 \approx 78.8$ years

2. 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.

$(0, 47.5 \text{ mph})$ slope $= -0.647 \dfrac{\text{mph}}{\text{Degrees}}$ $\boxed{S = -0.647C + 47.5}$

Avg speed $= -0.647X + 47.5 = \boxed{-0.647C + 47.5}$

Avg speed at 15° degrees $= \boxed{-0.647(15) + 47.5 = 37.795 \text{ mph}}$

3. Suppose that inflation is 3% per year. This means that the cost of an item increases by 3% each year. Suppose a jacket cost \$150 in 2011. Find a formula that gives the cost C in dollars of the jacket after t years.

Cost $=$ initial $(1+r)^t = 150\,(1+0.03)^t = 150(1.03)^t$

$\boxed{\text{Cost} = 150\,(1.03)^t}$

4. Radium-226 is subject to radioactive decay, and each year the amount present is reduced by 4.2%. The amount of radium-226 is an exponential function of time in years. What is the base of this exponential function?

Base $= 1 - 4.2\% = 1 - 0.042 = \boxed{0.958}$

5. The half-life of carbon-14 is 5770 years. How many half-lives is 15,000 years?

$$\text{half life} = 15000 \text{ years} * \frac{1h}{5770 \text{ years}} \cong \frac{15000}{5770} \cong \boxed{2.6 \text{ half lives}}$$

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. What would the speed of sound be after a 67 degree Fahrenheit rise in temperature?

$(0, 1052.3)$

$\text{slope} = 1.1 \frac{\text{ft/sec}}{\text{degrees F}}$

$\text{speed at } 67°F = 1.1(67) + 1052.3$

$= \boxed{1126 \text{ ft/sec}}$

7. Suppose you make an investment of $2000 that you are not allowed to cash in for 5 years. Unfortunately, the value of the investment decreases by 10% per year. How much money will be left after the end of the 5-year term?

$\text{Amount} = \text{initial}\,(1-r)^t$

$\text{Amount} = 2000(1 - 0.10)^5 = 2000(0.90)^5$

$= \boxed{\$1180.98}$

8. The half-life of cesium-137 is 30 years. Find a formula that gives the amount C of cesium-137 remaining after h half-lives if we initially have 30 grams of cesium-137.

$\text{Amount} = \text{initial}\left(\frac{1}{2}\right)^h$

$\boxed{\text{Amount} = 30\left(\frac{1}{2}\right)^h}$

9. The table below shows the total number of patients diagnosed with the flu in terms of days since an outbreak started:

Time in days	0	5	10	15	20	25
Number of flu patients	21	28	35	42	49	56

a) Find the formula for the linear function giving the number of diagnosed flu cases in terms of time if F is the number of flu patients diagnosed and d is time in days.

$(0,21)$

$(5,28)$

$$m = \frac{28-21}{5-0} = \frac{7}{4} = 1.4$$

$$\boxed{F = 1.4d + 21}$$

b) What would you expect to be the number of diagnosed cases after 18 days?

$$F = 1.4(18) + 21 = 46.2 \approx \boxed{47 \text{ Patient}}$$

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. What is the average speed if the curvature is 15 degrees?

$$S = -0.647(C) + 47.5$$

$(0, 47.5)$

$$\text{Slope} = -0.647 \frac{\text{mph}}{\text{degrees}}$$

Avg Speed at 15 degrees $F = -0.647(15) + 47.5$

$$= \boxed{37.795 \text{ mph}}$$