1. The following table shows the percentage of children in the United States between the ages of 3 and 5 who are enrolled in public and nonpublic nursery school and kindergarten programs:

$m = \frac{59.4 - 54.6}{1990 - 1985}$

Date	1970	1975	1980	1985	1990	1995	2000
Percentage	37.5	48.6	52.5	54.6	59.4	61.8	64.0

$m = 0.96$

Use interpolation to estimate the percentage of children enrolled in 1987.

$54.6 + 0.96(2) = 56.52$ percent

2. The population of the United States in 1890 was 62.98 million. If the population rose to 76.21 million by 1900, calculate the average growth rate and explain what it means.

(1890, 62.98)
(1900, 76.21)

rate $= \frac{76.21 - 62.98}{1900 - 1890} = 1.323 \frac{\text{million people}}{\text{year}}$; please see the back of this packet for more detail.

3. A study at ABC College found that 54.8% of its students owned a laptop computer in 2005. Another study found that 65.3% of its students owned a laptop computer in 2008. Use these figures to estimate the percentage in 2007.
A) 65.3%
B) 61.8%
C) 60.1%
D) 68.8%

(2005, 54.8 percent)
(2008, 65.3 percent)

$m = \frac{65.3 - 54.8}{2008 - 2005} = 3.5 \frac{\text{percent}}{\text{year}}$

$\boxed{54.8 + 2(3.5) = 61.8\%}$

4. In 1949, the inflation rate in the United States was negative, and the value was –2%. If a car cost $1500 at the beginning of the year, what did it cost at the end of the year?
A) $1200
B) $1470
C) $1497
D) $1350

$1500(1 - 0.02)^1 = \boxed{\$1470}$

5. The following table shows the world population (in billions) on the given date:

Date	1950	1960	1970	1980	1990	2000
Population	2.56	3.04	3.71	4.45	5.26	6.08

Use interpolation to estimate the world population in 1987.
A) 5.18 billion
B) 4.94 billion
C) 5.10 billion
D) 5.02 billion

$\frac{5.26 - 4.45}{1990 - 1980} = \boxed{0.081}$

$4.45 + 7(0.081) = 5.02$ Billion

6. The following table shows the world population (in billions) on the given date:

Date	1950	1960	1970	1980	1990	2000
Population	2.56	3.04	3.71	4.45	5.26	6.08

What is the percent change from 1960 to 1970?
A) 6.7%
B) 19%
C) 22%
D) 25%

$$\boxed{\frac{3.71 - 3.04}{3.04} \times 100\% = 22\%}$$

7. The following table from the World Health Organization shows the cumulative number of Severe Acute Respiratory Syndrome (SARS) cases reported on certain dates in March and April 2003:

Date	March 26	March 31	April 5	April 10	April 15
Number of cases	1323	1622	2416	2781	3235

Use interpolation to estimate the number of cases reported on April 2.
A) 2218
B) 1887
C) 1940
D) 2095

$$\frac{2416 - 1622}{5 - 0} = 158.8$$

$$\boxed{1622 + 2(158.8) = 1939.6 \approx 1940}$$

8. The following table shows the percentage of children in the United States between the ages of 3 and 5 who are enrolled in public and nonpublic nursery school and kindergarten programs:

Date	1970	1975	1980	1985	1990	1995	2000
Percentage	37.5	48.6	52.5	54.6	59.4	61.8	64.0

2003
?

Use extrapolation to estimate the percentage of children enrolled in 2003.
A) 64.5%
B) 64.9%
C) 65.3%
D) 65.7%

$$\frac{64.0 - 61.8}{2000 - 1995} = 0.44$$

$$\boxed{64.0 + 3(0.44) = 65.32\%}$$

9. Suppose the inflation rate of a country in 2009 was 20%. If a dress costs $150 at the beginning of the year, how much would it cost at the end of the year?
   A) $130
   B) $170
   C) $180
   D) $200

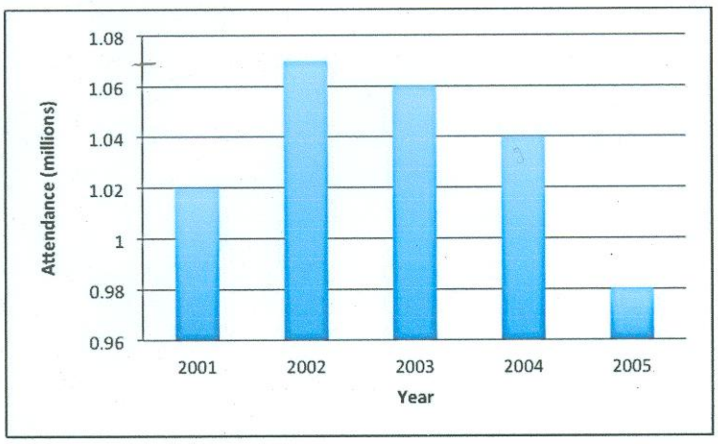
$150(1+0.20) = \boxed{\$180}$

10. The following table shows the average weight of newborn boys from birth to six months:

Age (in months)	0	1	2	3	4	5	6
Weight	7.16	9.15	10.91	12.56	14.00	15.43	16.53

Represent these data with a bar graph. please see the back of this packet,

11. The bar graph below shows the annual attendance (in millions) at a state fair:



The chart seems to show a sharp increase in attendance from 2001 to 2002. Calculate the percent change from 2001 to 2002.
   A) 25%
   B) 15%
   C) 10%
   D) 5%

$\frac{1.07-1.02}{1.02} \times 100\% = 0.049 \times 100\%$

$= \boxed{4.9\%}$

$\boxed{\approx 5\%}$

12. Suppose that the cost of purchasing CDs from a music club is a flat membership fee of \$25 plus \$10 for each CD purchased. If C is the cost in dollars and n is the number of CDs bought, then the amount of money you pay is a linear function of the number of CDs you buy and the linear formula for this relationship would be:
   A) $C = 25n + 10$
   B) $C = 10n + 25$
   C) $C = 25n - 10$
   D) $C = 10 - 25n$

$\boxed{C = 10n + 25}$

13. A salesman earns a base salary of \$1500 a month, plus 4% of his monthly sales. Then his monthly income is a linear function of his monthly sales.
   A) True
   B) False

$= 1500 + \boxed{0.04X}$

14. A new laptop computer selling for \$899 in January had fallen in price to \$719 by June. Assuming the relationship of price to time is linear, determine the decrease in price over each month.
   A) \$45 per month
   B) \$40 per month
   C) \$35 per month
   D) \$30 per month

(0, 899)
(6, 719)

$\frac{719 - 899}{6 - 0} = \boxed{-30 \frac{\$}{\text{Month}}}$

15. 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)
(1, 1052.3 + 1.1)

$1.1 * 20 = 22$

16. 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
   C) - 1.546 mph
   D) 1.546 mph

(0, 47.5)

slope $= 0.647 \frac{\text{mph}}{\text{Degree}}$

17. 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) $S = -0.647C + 47.5$

(0, 47.50)
slope = −0.647
$S = -0.647C + 47.50$

18. 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

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.

A) $F = 21d + 0.7$
B) $F = 0.7d + 21$
C) $F = 1.4d + 21$
D) $F = 2.1d + 0.7$

(0, 21)
(5, 28)

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

19. 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	18 20	25
Number of flu patients	21	28	35	42	49	56

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

A) 45 patients
B) 46 patients
C) 47 patients
D) 48 patients

$\frac{49-42}{20-15} = 1.4$

$42 + 3 * 1.4 = 46.2$

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

Year	2003	2004	2005	2006	2007	2012
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?

A) 78.8 years
B) 79.0 years
C) 78.6 years
D) 79.2 years

$2012 - 2003 = 9$

$0.18(9) + 77.16 \cong \boxed{78.8}$ years

21. 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

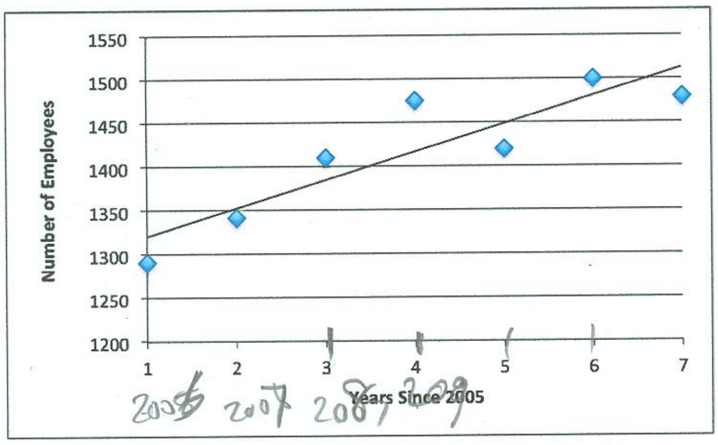
If t denotes the time in years since 2003 and E is the life expectancy in years, then the trend line for this data is given by $E = 0.18t + 77.16$. If this trend line persisted through 2500, what would be the average life expectancy of a child born in 2500?

A) 166.4 years
B) 166.6 years
C) 166.8 years
D) 167.0 years

$2500 - 2003 = 497$

$0.18(497) + 77.16 = \boxed{166.6 \text{ years}}$

22. 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 & 2011

23. The formula for an exponential function y of t is:
A) y = Initial value × Base
B) y = Initial value × Base^t
C) y = Base × (Initial value)^t
D) y = Initial value + Base^t

= Initial Value * Base^t

24. 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

25. 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.
A) $H = 1.47 \times (8.4)^t$
B) $H = 1.47 + (8.4)^t$
C) $H = 8.4 + (1.47)^t$
D) $H = 8.4 \times (1.47)^t$

$\boxed{H = 8.4 * 1.47^t}$

26. The probability P (as a decimal) that no tsunami with waves over 15 feet or higher will strike a beach community over a period of t years is given by the formula $P = 0.93^t$. What is the percentage decrease of the probability for each one-year increase in the time interval?

A) 3%
B) 5%
C) 7%
D) 9%

$(0, 1)$
$(1, 0.93)$

$\frac{0.93-1}{1-0} = \frac{-0.07}{1} = -7\%$

27. Actinium-225 has a half-life of 10 days. Suppose we have an initial amount of 100 grams of actinium-225. How much would be present after 30 days?

A) 50 grams
B) 33.3 grams
C) 25 grams
D) 12.5 grams

$100\left(\frac{1}{2}\right)^h = 100\left(\frac{1}{2}\right)^{\frac{30}{10}} =$
$= 100(1/2)^3 = \boxed{12.5 \text{ grams}}$

28. The rate of inflation measures the percentage increase in the price of consumer goods. The rate of inflation in the year 2000 was 3%. Suppose that this rate persisted through 2010. What would be the cost in 2010 of an item that costs \$100 in 2000?

A) \$130.00
B) \$130.48
C) \$134.39
D) \$138.42

$100(1+0.03)^{10} = \$134.39$

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

A) 3.8
B) 3.2
C) 2.6
D) 2.4

$\frac{15000}{5770} = \boxed{2.6}$

$\left(\frac{1}{2}\right)^h \Rightarrow$

30. 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.

$(1/2)^{\frac{15000}{5770}} = \boxed{16.5\%}$

31. The _______________ of an earthquake is a measure of ground movement.

A) magnitude
B) relative intensity
C) Richter value
D) degree

32. The Magnitude of an earthquake is the logarithm of relative intensity.
A) magnitude
B) scale
C) Richter value
D) degree

33. An increase of 1 unit on the Richter scale corresponds to increasing the relative intensity by a factor of 10.
A) True
B) False

34. Suppose that in January there is a magnitude 4.5 earthquake hitting the east coast of the United States. Six months later, a magnitude 6.5 earthquake hits the west coast. How many times more intense was the west coast quake compared to the east coast quake?
A) 2
B) 10
C) 100
D) 1000

4.5 = log (Relative Intensity)

$\frac{10 \wedge 6.5}{10 \wedge 4.5} = \boxed{100 \text{ times}}$

35. How many times more intense is a 6.0 magnitude earthquake compared to a 3.0 magnitude earthquake?
A) 3
B) 10
C) 100
D) 1000

6 = log (Relative Intensity)
Relative Intensity = 10^6
3 = log (Rel Int)   Relat Inten = 10^3

$= 10^3 = \boxed{1000}$

36. Which is the solution to $2.4 = 1.07^t$?
A) $t = \log(2.4) + \log(1.07)$
B) $t = \log(2.4) - \log(1.07)$
C) $t = \log(2.4) \times \log(1.07)$
D) $t = \log(2.4) \div \log(1.07)$

Correction

37. 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?
A) 4.2
(*) B) 0.968
C) 9.68
D) 2.26

(1 − 4.2%) = 0.958

38. 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?
   A) $1000.00
   B) $1062.88
   C) $1180.98
   D) $1901.98

$2000(1-0.10)^5 = \boxed{\$1180.98}$

39. 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 15% per year. How long will it be before your investment decreases to half its original value?
   A) 2.5 years
   B) 3.6 years
   C) ~~4.1 years~~
   D) 4.3 years

$1000 = 2000(1-0.15)^t$

$1000 = 2000(0.85)^t$

$\frac{\log(1/2)}{\log 0.85} = t$

$t = 4.27$

≈ 3 years

40. The half-life of cesium-137 is 30 years. Suppose you start with 50 grams of cesium-137 in a storage pool. How many half-lives will it take for there to be 5 grams of cesium-137 in the storage pool?

41. You have $500 and wish to buy a computer. You find an investment that increases by 6% each month, and you put your $500 into the account. When will the amount enable you to purchase a computer costing $1000?

#40)

$\frac{5}{50} = \frac{50}{50}\left(\frac{1}{2}\right)^h$

$0.1 = \frac{1}{2}^h$

$\frac{\log 0.1}{\log(0.5)} = h$

$h = 3.32$ half lives

$30 * 3.32 = 99.66$ years

#41)

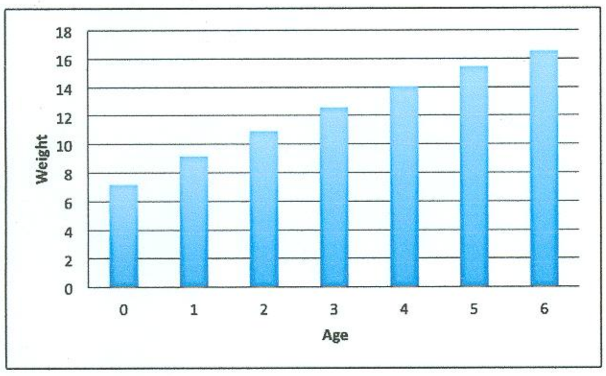
$1000 = 500(1+0.06)^t$

$2 = (1.06)^t$

$t = \frac{\log 2}{\log 1.06} = \boxed{11.9 \text{ months}}$

Answer Key

1. 56.5%
2. The average growth rate was 1.32 million people per year, meaning that from 1890 to 1990 the U.S. population grew, on average, by 1.32 million people per year.
3. B
4. B
5. D
6. C
7. C
8. C
9. C
10.



11. D
12. B
13. A
14. D
15. C
16. B
17. D
18. C
19. B
20. A
21. B
22. 2008, 2009, 2011
23. B
24. B
25. D
26. C
27. D
28. C
29. C
30. 16.5%
31. B
32. A
33. A
34. C
35. D
36. D
37. B CORRECTION 0.958
38. C
39. D
40. 3.32 half-lives or 99.6 years
41. 11.9 months