Linear and exponential growth

1.Laxman recently started a restaurant **32** weeks ago. The table at left shows the number of customers, **C**, during the wth week. Which of the following correctly explains the growth of **C** with respect to w?
The number of customers per week grew linearly because the number of customers per week increased by approximately 30 every week.
The number of customers per week grew linearly because the number of customers per week increased by approximately 100 every week.
The number of customers per week grew exponentially because the number of customers per week increased by approximately 30 every week.
The number of customers per week grew exponentially because the number of customers per week increased by approximately 100 every week.

w	C
1	30
2	60
4	120
8	240
16	480
32	960

2.The equation above relates the urbanization rate r, as a percent, in a particular country to the number of years t since 2000. Which of the following statements best describes the relationship between the year since 2000 and the urbanization rate?

A. It is linear because the urbanization rate increases by 35.7 each year.
B. It is linear because the urbanization rate increases by 1.37 each year.
C. It is exponential because the urbanization rate increases by 35.7% each year.
D. It is exponential because the urbanization rate increases by a factor of 35.7 each year.

3.The cell cycle is the process by which a single cell replicates itself. A microbiologist debates whether cell growth during the cell cycle is linear or exponential. The table at left gives the length, in micrometers, of an S. pombe(yeast) cell at different times after the cell cycle begins. Which of the following best describes the relationship between time and length of this cell?

A. It is linear because the length increases by the same factor every 10 minutes.
B. It is linear because the length increases by the same number every 10 minutes.
C. It is exponential because the length increases by the same factor every 10 minutes.
D. It is exponential because the length increases by the same number every 10 minutes.

Minutes	Length (micrometers)
10	14.5
20	27.9
30	53.8
40	103.7
50	200.1
60	385.8
70	744.0
80	1,434.9

4.A researcher studied the ability of a gelatin sample to retain an electrical charge. The function above approximates the voltage, in volts, of the sample t minutes after it has been charged. Which of the following statements best describes the relationship between the voltage and the number of minutes?

A. It is linear because the voltage increases by 0.41 volts every 2.5 minutes.
B. It is linear because the voltage decreases by 0.8 volts every 0.4 minutes.
C. It is exponential because the voltage decreases by 20% every 2.5 minutes.
D. It is exponential because the voltage increases by 20% every 0.4 minutes.

5.Web developers need to know how long a page will take to load. The table at left gives loading times according to page size when using a particular interface. Which of the following statements best describes the relationship between the page size and loading time?

A. It is linear because the loading time increases by the same factor for each increases by 25 kilobytes in the page size.
B. It is linear because the loading time increases by the same amount for each increases by 25 kilobytes in the page size.
C. It is exponential because the loading time increases by the same factor for each increases by 25 kilobytes in the page size.
D. It is exponential because the loading time increases by the same amount for each increases by 25 kilobytes in the page size.

Page size (in kilobytes)	Loading time (in milliseconds)
25	8
50	12
75	16
100	20
125	24
150	28
175	32
200	36
225	40

6.Oxygen reduction potential (ORP) is a common measurement for water quality. The table at left relates the ORP, in microvolts(μV), to the number of seconds required to purify 99.9% of E. coli bacteria from a liquid. Which of the following best describes the relationship between the ORP and the purification time?

ORP (μV)	Purification time (seconds)
620	61
640	38
660	24
680	15
700	9
720	6
740	4

A. It is approximately linear because for every $20\mu V$ increase in ORP, the purification time decreases by a fixed amount.
B. It is approximately linear because for every $20\mu V$ increase in ORP, the purification time decreases by a common amount.
C. It is approximately exponential because for every $20\mu V$ increase in ORP, the purification time decreases by a fixed amount.
D. It is approximately exponential because for every $20\mu V$ increase in ORP, the purification time decreases by a fcommon amount.

7.The function above relates the elevation **E**, in pulses per second, of a particular neuron above its unstimulated neural response, **t** milliseconds after it reaches its peak response. Which of the following best describes the relationship between the time after the peak response and the elevation of the neural response?

A. It is linear because every millisecond the elevation declines by a certain factor.
B. It is linear because every millisecond the elevation declines by a certain number of pulses per second.
C. It is exponential because every millisecond the elevation declines by a certain factor.
D. It is exponential because every millisecond the elevation declines by a certain number of pulses per second.

8.A statistician modeled the average private law school tuition in two ways. According to both models, the tuition in 2011 was about $40,000. In one model, the tuition increased by $1750 per year. In the other, the tuition increased by 5% per year. What would be the difference between these models in the year 2013?

9.In one community college, the cost per credit hour for in-state students has been increasing by $3 a year. In another community college, it has been increasing by 9% per year. This year, the cost is $65 at both colleges. To the nearest dollar, what was the positive difference in costs 2 years ago?

10.The table at left shows the percent compression of a coil spring in a mattress, which is measured when different amounts of force are applied. Which of the following best describes the relationship between the percent compression and the force?

Force (kilonewtons)	Percent compression
15	3%
30	6%
45	9%
60	11%
75	13%
90	15%
105	18%
120	20%

A. It is approximately linear because the percent compression nearly doubles for every increase of 15 kilonewtons of force.
B. It is approximately linear because the percent compression grows by about 2.5 for every increase of 15 kilonewtons of force.
C. It is approximately exponential because the percent compression nearly doubles for every increase of 15 kilonewtons of force.
D. It is approximately exponential because the percent compression grows by about 2.5 for every increase of 15 kilonewtons of force.

11.The minimum interior relative humidity, h, at which condensation occurs on a particular window varies with the exterior temperature, T, in degrees Fahrenheit (°F) according to the equation above. Which of the following statements best describes the relationship between the exterior temperature and the minimum interior relative humidity at which condensation occurs for the window?

A. It is linear because the minimum interior relative humidity increases by 1.2 over every 11° F interval.

B. It is linear because the minimum interior relative humidity increases by 1.2 over every 5° F interval.

C. It is exponential because the minimum interior relative humidity increases by 20% over every 11° F interval.

D. It is exponential because the minimum interior relative humidity increases by 20% over every 5° F interval.

12. $d(p) = 5.04p + 19.13$

Abrasive water jets are often used as a safe, precise way of cutting natural stone. The function above relates the percent p of pores (open space) in a rock sample to the cutting depth d of the water jet, in millimeters. Which of the following statements best describes the relationship between the percent of pores and the cutting depth?

A. It is linear because the depth increases by a fixed amount for each increase of 1% in the pores.

B. It is linear because the depth increases by the same percent for each increase of 1% in the pores.

C. It is exponential because the depth increases by a fixed amount for each 1% increase in the pores.

D. It is exponential because the depth increases by the same percent for each 1% increase in the pores.

13.Over a five year interval, the total value of goods, v, in millions of dollars traded between country A and country B increased according to the table at left where Y is the year. Which of the following correctly describes the growth in the value of goods traded over the five year interval?

Y	v
1995	88
1996	132
1997	198
1998	297
1999	446

A. The growth is exponential with the value of goods traded increasing by approximately 44% each year.
B. The growth is exponential with the value of goods traded increasing by approximately 50% each year.
C. The growth is linear with the value of goods traded increasing by approximately 44 million dollars each year.
D. The growth is linear with the value of goods traded increasing by approximately 5050 million dollars each year.

14.The value, V(m), in dollars of a particular house m months after purchase follows the equation given above where m is a positive integer. Which of the following statements best describes the value of the house over time?

A. The value of the house increases linearly.
B. The value of the house decreases linearly.
C. The value of the house increases exponentially.
D. The value of the house decreases exponentially.

15.A mechanical engineer is simulating the rupture of a water tank by puncturing a duplicate water tank and analyzing the water flow. The engineer notices that the rate of water flow, f(t), in liters per second t seconds after puncturing satisfies the equation shown above. Which of the following statements best describes the rate of water flow over time?

A. The rate of water flow increases linearly.
B. The rate of water flow decreases linearly.
C. The rate of water flow increases exponentially.
D. The rate of water flow decreases exponentially.

Thanks

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