Name _Solution Key_

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

Solve the problem.

1) A restaurant offers pizzas with 2 types of crust, 4 different toppings, and in 3 different sizes. How many different pizzas could be ordered?   1) _A_

   A) 24   B) 18   C) 9   D) 16

Total # of different Pizzas = $2 \times 4 \times 3 = 24$

Find the indicated probability. Round your answer to 6 decimal places when necessary.

2) Three fair coins are tossed. Find the probability of getting the same thing on all three coins.   2) _D_

   A) $\frac{1}{2}$ B) $\frac{3}{8}$ C) $\frac{1}{8}$ D) $\frac{1}{4}$

$P(3 \text{ Heads or } 3 \text{ tails}) = \frac{1}{8} + \frac{1}{8} = \frac{2}{8} = \frac{1}{4}$

Solve the problem.

3) In a certain town, 10% of people commute to work by bicycle. If a person is selected randomly from the town, what are the odds against selecting someone who commutes by bicycle?   3) _B_

   A) $1:10$ B) $9:1$ C) $9:10$ D) $1:9$

$P(\text{Commuting}) = 10\% = \frac{1}{10}$ odds Against selecting those who Commutes are $9:1$

Provide an appropriate response.

4) ___A___ growth occurs when a quantity grows by the same absolute amount in each unit of time.   4) _A_

   A) Linear   B) Quadratic
   C) Exponential   D) None of the above

Solve.

5) Using the chessboard parable, find the total number of grains when all squares up to and including 15 are filled.   5) _B_

   A) 16,384 grains   B) 32,767 grains   C) 28 grains   D) 8192 grains

Total No. of grains up to & including square 15 $= 2^{15} - 1 = 32,767$

6) Use the bacteria parable to determine how many bacteria are in the bottle at 11:24.   6) _C_

   A) 26 bacteria   B) 48 bacteria   C) 2^{24} bacteria   D) 2^{23} bacteria

$t = 11:24 - 11:00 AM = 24 \text{ minutes}$

$B(t) = 2^t = 2^{24} = 2^{24}$

7) Use the bacteria parable to determine what fraction of the bottle is full at 11:25.   7) _B_

   A) $\frac{1}{2^{34}}$ full   B) $\frac{1}{2^{35}}$ full   C) $\frac{9}{20}$ full   D) $\frac{1}{2^{36}}$ full

@ 11:25 $\left(\frac{1}{2}\right)^{35} = \frac{1}{2^{35}}$ full

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Provide an appropriate response.

8) The doubling time of a city's population is 9 years. How long does it take for the population to quadruple.

8) $\underline{B}$

    A) 9^4 years   B) 18 years   C) 4 years   D) 2^9 years

$$P_{(t)} = P_0 \cdot 2^{t/9} \quad , \quad \frac{P_{(t)}}{P_0} = 4 = 2^{t/9} \quad = \boxed{t = 18\ years}$$

9) Oil consumption is increasing at a rate of 1.4% per year. By what factor will oil consumption increase in 4 years? Use the approximate doubling time formula (rule of 70).

9) $\underline{D}$

    A) 11.2   B) 1.03   C) 1.46   D) 1.06

$$T_{double} = \frac{70}{1.4} = 50\ years \quad , \quad C(t) = C_0 \cdot 2^{t/50}$$
$$\frac{C(4)}{C_0} = 2^{4/50} = 1.06$$

10) Urban encroachment is causing the area of a forest to decline at a rate of 6% per year. Use the approximate half-life formula to determine the half-life of the forest.

10) $\underline{D}$

    A) 10.00 years   B) 23.33 years   C) 1.06 years   D) 11.67 years

$$T_{half} \approx \frac{70}{6} = 11.67\ years.$$

11) Inflation is causing prices to rise at a rate of 6% per year. Use the approximate double time formula to determine what the price will be in 8 years if the item costs $100 today.

11) $\underline{C}$

    A) $321.70   B) $106.12   C) $160.85   D) $174.11

$$C(t) = 100 \times 2^{t/T_{double}} \quad , \quad T_{double} = 11.67\ years \quad , \quad C(8) = 100 \times 2^{8/11.67} = \$160.85$$

12) Real populations sometimes increase beyond their environment's carrying capacity in a relatively short period of time. What is the name of this phenomenon?

12) $\underline{C}$

    A) Annual growth rate   B) Collapse
    C) Overshoot   D) Logistic growth

13) The following table gives the birth and death rates for four countries in three different years:

13) $\underline{A}$

Town	Birth rate (per 100)			Death rate (per 100)		
	1980	1990	2000	1980	1990	2000
Simpleton	1.9	1.5	0.9	1.2	1.2	0.8
Normalton	2.8	2.4	2.1	0.7	0.6	0.5
Ruralton	1.3	1.2	1.2	1.1	1.0	0.9
Littleton	1.4	1.6	1.5	0.9	0.8	0.7

$$G.R. = 2.4 - .6 = 1.8\ per\ 100$$

Find Normalton's net growth rate due to births and deaths in 1990.

    A) 1.8 per 100   B) 0.9 per 100   C) 0.6 per 100   D) 0.4 per 100

14) Consider a population that begins growing exponentially at a base rate of 2% per year and then follows a logistic growth pattern. If the carrying capacity is 90 million, find the actual growth rate when the population is 74 million.

14) $\underline{B}$

    A) 0.38%   B) 0.36%   C) 0.40%   D) 0.32%

$$G.R. = 2\left(1 - \frac{74}{90}\right)$$
$$= .36\%$$

2

Use the earthquake magnitude scale to answer the question.

15) How many times as much energy is released by an earthquake of magnitude 8 as by one of magnitude 2?

15) _B_

    A) 10^4 times as much energy

    B) 10^9 times as much energy

    C) 10^6 times as much energy

    D) 10^2 times as much energy

$$\frac{E_{M8}}{E_{M2}} = \frac{2.5 \times 10^4 \times 10^{1.5 \times 8}}{2.5 \times 10^4 \times 10^{1.5 \times 2}} = \left(10^{1.5 \times 6}\right) = 10^9$$

Use the decibel scale to answer the question.

16) How many times as loud as the softest audible sound is the sound of busy street traffic (80 decibels)?

16) _D_

    A) 10^{80} B) 10^3 C) 10^{16} D) 10^8

$$\frac{I_s}{I_{SAS}} = 10^{\frac{80}{10}} = 10^8$$

Use the pH scale to answer the question.

17) What is the pH of a solution with a hydrogen ion concentration of 0.1 mole per liter? Is this solution an acid or a base?

17) _A_

    A) pH = 1; acid   B) pH = 2; acid   C) pH = 7; neutral   D) pH = 8; base

$$pH = -\lg(0.1) =$$
$$= 1 \quad \text{Acid very much so}$$

18) Solve for x: $5^x = 10$

a) x=.69   b) x=1/2   c)x= -1   d) x=3.71   e)x = 1.43

18) _e_

$$5^x = 10$$
$$\ln 5^x = \ln 10$$
$$x \ln 5 = \ln 10$$
$$x = \frac{\ln 10}{\ln 5} = 1.43$$