12

—

Time (hours)	Number of bacteria
0	200
1	210
2	221
3	232

A scientist is studying the growth of a bacteria culture. The table below shows the exponential relationship between t, the time in hours since the start of the experiment, and c, the number of bacteria in the culture. If no external factors affected the growth, which of the following equations best models the relationship between t and c?

A) $c = 210(1 + 0.05)^t$

B) $c = 200(1 + 0.5)^t$

C) $c = 0.05(1 + 200)^t$

D) $c = 200(1 + 0.05)^t$

13

$$2x = 5y + 11$$
$$6x + 5 = y - 8$$

When the given equations are graphed in the xy-plane, the graphs intersect at how many points?

A) 0

B) 1

C) 2

D) More than 2

14

The population of marine organisms in an Atlantic region affected by an oil spill decreases by 0.53% per day relative to the previous day's population. Which of the following functions best represents this change in the population of marine organisms?

A) Decreasing exponential

B) Decreasing linear

C) Increasing exponential

D) Increasing linear

15

$$(x + 5)^2 + (y - 11)^2 = 169$$

A circle in the xy-plane is represented by the graph of the equation given above. The point (m, n) lies on the circle. Which of the following is a possible of n?

A) −9

B) 23

C) 27

D) 36

16

$$|x - 6| + 54 = 68$$

What is the product of the solutions to the given equation?

−160

$|x-6| + 54 - 54 = 68 - 54$

$|x-6| = 14$

① $x - 6 = 14$

$x = 20$

② $x - 6 = -14$

$x = 6 - 14 = -8$

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17

In the xy-plane, line l passes through the point $(4, 2)$ and is perpendicular to the line represented by the equation $y = 2x + 1$. If line l also passes through the point $(-1, k)$, what is the value of k?

A) $-\frac{1}{2}$

B) $-\frac{7}{2}$

C) $\frac{9}{2}$

D) 12

18

The side length of equilateral triangle R is 178 times the side length of equilateral triangle Q. If the area of equilateral triangle R is m times the area of equilateral triangle Q, what is the value of m?

19

$$5x + 2y = 32$$
$$6x + 6y = 42$$

The ordered pair (x, y) is the solution to the given system of equations. What is the value of y?

A) 1

B) 3

C) 4

D) 6

20

The function g is defined by the equation $g(x) = x^2 - 2x - 15$. If $g(x)$ reaches its minimum at the point (h, k), what is the value of k?

21

A function g is given by $g(x) = m|x - n|$, where m and n are constants. The graph of $y = g(x)$ includes the point $(26, 0)$ in the xy-plane, and $g(-26) < 0$. Which of the following statements must be true?

A) $g(0) = -26$

B) $n = -26$

C) $m > n$

D) $n > m$

22

$$\sqrt{x + 6} = -x$$

The given equation has which of the following solutions?

I. 3

II. -2

III. -3

A) I only

B) II only

C) III only

D) II and III

8

$$-8(6z + 9) = 24(-3 - 2z)$$

How many solutions satisfy the given equation?

A) Zero

B) Exactly one

C) Exactly two

D) Infinitely many

9

What is the surface area, in square centimeters, of a cube that has a volume of 704,969 cubic centimeters?

10

A scientist used function $g(x)$ to model the population of bacterial colony in a controlled environment. For each increase in the value of x by n, where n is a positive constant, the value of $g(x)$, increases by a factor of 64. Which of the following equivalent forms of the function g displays $\frac{1}{n}$ as a coefficient of x?

A) $g(x) = 72(16)^{\frac{1}{6}x}$

B) $g(x) = 72(64^{\frac{1}{4}x})^{\frac{1}{2}}$

C) $g(x) = 72(4)^{\frac{1}{2}x}$

D) $g(x) = 72(4^3)^{\frac{1}{8}x}$

$g(x) = 72(64)^{\frac{x}{n}}$

$g(x) = 72(4^3)^{\frac{1}{8}x}$

$= 72(64)^{\frac{1}{8}x}$

x increases by 8, g ↑ 1.

64 times of the original one.

11

$$3x^2 = 549 + y$$

$$6x + y = -45$$

When graphed in the xy-plane, the graphs of the given system of equations intersect at point (a, b). What is a possible value of a?

A) −18

B) −16

C) 12

D) 6

12

The expression $4x^2 + 20x - 56$ has which of the following factor(s)?

I. $4x - 8$

II. $3x + 2$

A) I only

B) II only

C) I and II

D) Neither I nor II

13

$$8|15 - x| + 9|15 - x| = 51$$

Which of the following is a solution that satisfies the given equation?

A) −12

B) −17

C) 16

D) 18

14

$$y \leq -25x + 3900$$
$$y \leq 5x$$

In the xy-plane, if a point with coordinates (m, n) lies in the solution set of the system of inequalities above, what is the maximum possible value of n?

15

Energy per Gram of Foodstuff

Foodstuff	Food calories	Kilojoules
Fish	2.0	6.3
Cheese	4.0	15.1
Beef	3.0	10.5

If a total of 720 food calories in a meal is derived entirely from f grams of fish, c grams of cheese, and b grams of beef, which of the following expresses b in terms of c and f?

A) $b = 240 + \frac{2}{3}(f + 2c)$

B) $b = 240 + \frac{2}{3}(2c - f)$

C) $b = 240 - \frac{2}{3}(f + 2c)$

D) $b = 240 - \frac{2}{3}(f - 2c)$

16

$$8x + 10y = 15$$
$$32x + 40y = 60$$

If the equations in the given system are graphed in the xy-plane, which of the following points lies on each of the graphs?

A) $(-\frac{9k}{8} + \frac{5}{4}, \frac{5k}{8} + 60)$

B) $(k, -\frac{5k}{4} + \frac{15}{8})$

C) $(k, \frac{5k}{8} + \frac{15}{16})$

D) $(-\frac{5k}{4} + \frac{15}{8}, k)$

17

North America's population of white-tailed deer has grown at an average rate of 2.6 percent per year since 1980. There were approximately 12 million deer in North America in 1985. Which of the following functions represents North America's white-tailed deer population P, in millions of deer, t years since 1985?

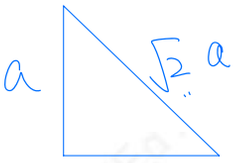
A) $P(t) = 12(2.6)^t$

B) $P(t) = 12(1.026)^t$

C) $P(t) = 1.26t + 12$

D) $P(t) = 1.026t + 12$

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$a^2 + a^2 = 2a^2$

$\sqrt{2} \cdot a$

18

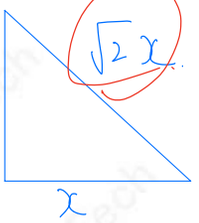
An isosceles right triangle has a perimeter of $108 + 108\sqrt{2}$ centimeters. Which of the following is the length, in centimeters, of one leg of this triangle?

A) 54

B) $54\sqrt{2}$

C) 72

D) $108\sqrt{2}$



$2x + \sqrt{2}x = 108 + 108\sqrt{2}$

19

$$\frac{x^2 - 3c}{x - b}$$

$b, c > 0$, int

In the rational expression above, b and c are strictly positive integers. If the given expression is equivalent to the binomial $x + b$ for all values of x such that $x \neq b$, which of the following could be the value of the constant c?

A) 9

B) 12

C) 18

D) 24

$c = 9 = 3 \cdot 3$

$3c = 3$

3×4

3×2

$\frac{x^2 - 3c}{x - b} = x + b$

$x^2 - 3c = (x+b)(x-b)$

$x^2 - 3c = x^2 - b^2$

$3c = b^2 = b \cdot b$

$c = 3$

$3 \cdot 3 \cdot 2^2 = 3^2 \cdot 2^2 = 6^2 = 6 \cdot 6$

20

An e-commerce site receives customer satisfaction ratings between 0 and 100, inclusive. The average (arithmetic mean) of the first 10 ratings that the site received was 85. What is the least possible value of the 11th rating that would allow the site to have an average rating of at least 92 for its first 20 ratings?

21

The rental cost of an excavator is \$540 for the first day and \$270 for each additional day, for up to 10 days. Which of the following equations represents the total cost y, in dollars, of renting the excavator for n days, where n is a positive integer and $n \leq 10$?

A) $y = 540n - 270$

B) $y = 540n + 270$

C) $y = 270n + 540$

D) $y = 270n + 270$

Vertex Form.

22

An unmanned ground vehicle (UGV) traveling in a straight line has its total distance traveled, d, in meters, modeled by a quadratic function defined in terms of time, t, in seconds. At $t = 8.0$ seconds, the UGV has traveled 32 meters, and at $t = 16.0$ seconds, it has traveled 128 meters. If the UGV starts at 0 meters when $t = 0$, how far will it have traveled, in meters, after 24.0 seconds?

$d(t) = at^2 + bt + c$

288

$t = 0$

$a \cdot (0)^2 + b \cdot (0) + c = 0$

$c = 0$

$d(t) = at^2 + bt$

$(8, 32)$ $(16, 128)$

$\begin{cases} 32 = 64a + 8b \\ 128 = 16^2 a + 16b \end{cases}$

$a = 0.5$

$b = 0$

$d(t) = 0.5t^2$