1)   Which equation of a line is **perpendicular** to the line $y = \frac{5}{3}x - 4$ and passing

through the point $(-15, 2)$.

A $y = \frac{5}{3}x + 27$

B $y = -\frac{3}{5}x + 11$

C $y = -\frac{5}{3}x - 23$

D $y = -\frac{3}{5}x - 7$

E   None of the above.

2)   The frequency (in cycles per second) of a vibrating string **varies inversely** as its
length. Suppose a piano string 2 feet long vibrates 240 cycles per second. What
would be the frequency of a string 5 feet long?

A   64 cycles per second
B   80 cycles per second
C   24 cycles per second
D   600 cycles per second
E   96 cycles per second

3)   If $f(x) = x^2 + 1$ and $g(x) = 2x - 3$, find and simplify $(f \circ g)(x)$.

A $(f \circ g)(x) = 4x^2 - 12x + 10$

B $(f \circ g)(x) = 2x^3 - 3x^2 + 2x - 3$

C $(f \circ g)(x) = 4x^2 + 10$

D $(f \circ g)(x) = 2x^2 - 3$

E $(f \circ g)(x) = 4x^2 - 8x + 4$

4) Which pairs of functions, $f(x)$ and $g(x)$, are inverses?

I $f(x) = \dfrac{2}{x-4}$ and $g(x) = \dfrac{4x+2}{x}$

II $f(x) = \dfrac{x+2}{5}$ and $g(x) = 5x-2$

III $f(x) = \dfrac{3x-4}{x}$ and $g(x) = \dfrac{x}{3x-4}$

A   III only

B   I only

C   I and II only

D   I and III only

E   II only

5) Graph the function $g(x) = 2^x$ in the coordinate system provided. Which statement about the graph is **false**?

A   The y-intercept is 1.

B   The domain of the function is $[0, \infty)$.

C   The graph is never in quadrant III.

D   The graph is always increasing.

E   The graph contains the point (3, 8).
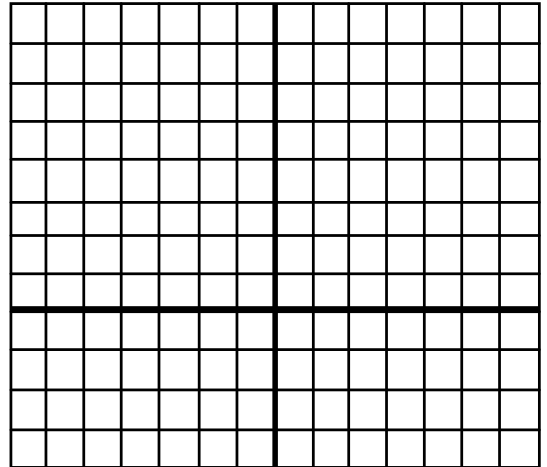
6) Convert $\log_m(a+3) = 12r$ to equivalent exponential form.

A $m^{(a+3)} = 12r$

B $(a+3)^m = 12r$

C $(a+3)^{12r} = m$

D $(12r)^m = a+3$

E $m^{12r} = a+3$

7)   Evaluate this logarithmic expression: $\log_4\left(\log_2 16\right)$

        A   0

        B   2

        C $\dfrac{1}{2}$

        D   1

        E   None of the above.

8)   The percentage of first year college women who agreed with the statement, 'The activities of married women are best confined to the home and family', can be modeled by the function below, where $f(x)$ is the percentage and x is the number of years after 1969. Approximate the percentage that agreed with the statement in 2010?   Which choice describes this percentage?

$$f(x) = -4.86\ln x + 32.5$$

        A   Between 0% and 5%.

        B   Between 5% and 8%.

        C   Between 12% and 16%.

        D   Between 8% and 12%.

        E   Between 16% and 21%.

9)   Condense the following logarithmic expression so it is a single logarithm whose coefficient is 1.

$$2\log 5 + 3\log x - \frac{1}{2}\log(x+2)$$

        A $\dfrac{\log 25 + \log\left(x^3\right)}{\log\left(\sqrt{x+2}\right)}$

        B $\log\left(\dfrac{25x^3}{\sqrt{x+2}}\right)$

        C $\dfrac{\log\left(25x^3\right)}{\log\left(\sqrt{x+2}\right)}$

        D $\dfrac{\log\left(25x^3\right)}{\sqrt{\log(x+2)}}$

        E $\log\left(\dfrac{25x^3}{\sqrt{x}+\sqrt{2}}\right)$

10) A certain city currently has a population of 250,000 people. It is growing at a rate of 2% per year ($k = 0.02$). What will the population be in 8 years? Assume the growth rate remains constant. Round to the nearest whole number.

$$P = P_0 e^{kt}, \text{ where } P \text{ is the population after } t \text{ years with an initial}$$
$$\text{population of } P_0 \text{ and a growth rate of } k$$

A   361,360

B   293,378

C   1,238,258

D   995,268

E   302,899

11) Solve the equation. $\log_6 x + \log_6 (x+1) = 1$

A $x = -3, \ x = 2$

B $x = -2, \ x = 3$

C $x = 3$ only

D $x = 2$ only

E   No solution

12) Solve this system of linear equations. What is the value of the x?

$$\begin{cases} y = 6 - 2x \\ 4x + 3y = 22 \end{cases}$$

A $x = 10$

B $x = 2$

C $x = -20$

D $x = -8$

E $x = -2$

13)   A hotel has 400 rooms. Those with kitchen facilities rent for $120 a night and those without kitchen facilities rent for $90 per night. On a night when the hotel was completely occupied, revenues from all rooms were $38,400. How many rooms with kitchen facilities are in this hotel? Which statement describes this number?

       A   There are less than 90 rooms with kitchen facilities.

       B   There are between 90 and 150 rooms with kitchen facilities.

       C   There are between 150 and 210 rooms with kitchen facilities.

       D   There are between 210 and 300 rooms with kitchen facilities.

       E   There are between 300 and 400 rooms with kitchen facilities.

14)   A circle has the equation below. What is the exact length of the radius of this circle?

$$x^2 + y^2 - 8x - 2y - 23 = 0$$

       A $r = 40$

       B $r = \sqrt{23}$

       C $r = 2\sqrt{10}$

       D $r = 23$

       E $r = 2\sqrt{5}$

15)   Pure sulfuric acid is to be added to some 20% sulfuric acid solution to make 120 Liters of 35% sulfuric acid. If x represents the amount of pure sulfuric acid and y represents the amount of 20% sulfuric acid used in the mix, which system of equations could be used to find x and y?

       A $\begin{cases} x + y = 120 \\ x + 0.2y = 42 \end{cases}$

       B $\begin{cases} x + y = 120 \\ x + 0.2y = 35 \end{cases}$

       C $\begin{cases} x + y = 35 \\ x + 0.2y = 120 \end{cases}$

       D $\begin{cases} y = x + 120 \\ x + 20y = 4200 \end{cases}$

       E $\begin{cases} x + y = 120 \\ 100x + 20y = 42 \end{cases}$