1. Simplify: \( \frac{15}{1 - \frac{5}{2}} \).
A. 2/3  B. 2  C. 3/2  D. 6  E. None of the above.

2. Factor: \( 16x^2 - 4y^8 \)
A. \((4x - y^2)(4x + y^2)\)  B. \((4x - 2y^4)^2\)  C. \(4(2x - y^4)(2x + y^4)\)  D. \(4(2x - y^2)\)  E. None of the above.

3. Simplify: \( \left( \frac{4a^4b^8}{c^2} \right)^{-1/2} \). (All letters denote positive real numbers.)
A. \( \frac{1}{2a^2b^4c} \)  B. \( \frac{2a^2b^4}{c} \)  C. \( \frac{a^4b^3}{16c^2} \)  D. \( \frac{c}{2a^2b^4} \)  E. None of the above.

4. Subtract and simplify: \( \frac{2x^2 - 1}{x} \) for \( x \neq 0 \).
A. \( \frac{3x + 1}{3x + 1}(x - 2) \)  B. \( \frac{2x^2 - 1}{x} \)  C. \( \frac{-7x}{3x + 1}(x - 2) \)  D. \( \frac{2x}{3x + 1}(x - 2) \)  E. None of the above.

5. Divide and simplify: \( \frac{x - 2}{x^2 - 2x - 9} \).
A. \( \frac{(x - 2)^2}{(x - 3)^2(x + 3)} \)  B. \( \frac{x + 3}{(x + 1)^2} \)  C. \( \frac{x + 3}{x + 1} \)  D. \( \frac{1}{x + 3} \)  E. None of the above.

6. A job takes 4 hours for two people working together. If one person works alone he can do the job in 6 hours. How long will it take the other person working alone to complete the job?
A. 4 hrs.  B. 6 hrs.  C. 8 hrs.  D. 10 hrs.  E. None of the above.

7. Write without negative exponents: \( \frac{xy^{-1}}{(x + y)^{-1}} \).
A. \( \frac{x(x + y)}{y} \)  B. \( \frac{x^2}{x + y} \)  C. \( \frac{x + y}{xy} \)  D. \( \frac{xy}{x + y} \)  E. None of the above.

8. Simplify by rationalizing the denominator: \( \frac{\sqrt{3}}{2 + \sqrt{3}} \).
A. \( \frac{1}{2} \)  B. 2  C. \( 2\sqrt{3} - 3 \)  D. \( \sqrt{3} + 2 \)  E. \( \frac{2\sqrt{3} - 3}{7} \)

9. Let \( x \) and \( y \) be two consecutive positive integers such that \( x \) is less than \( y \) and the difference of their squares is 145. Find \( x \).
A. 73  B. 72  C. 12  D. 8  E. None of the above.

10. If \( A = P(1 + rt) \), then \( t = \)
A. \( \frac{A - P}{r} \)  B. \( A - P \)  C. \( \frac{A - P}{P} \)  D. \( \frac{A}{P} \)  E. None of the above.

11. A truck enters a freeway traveling 40 mph. One hour later a car enters the same freeway traveling 55 mph. After how many miles will the car overtake the truck?
A. 146 \( \frac{2}{3} \) miles  B. 201 \( \frac{2}{3} \) miles  C. 120 miles  D. 106 \( \frac{2}{3} \) miles  E. None of the above.
12. A square of side $x$ is inscribed in a circle. Express the area, $A$, of the circle as a function of $x$.
   A. $A = \frac{x^2}{2}$  B. $A = x^2$  C. $A = \pi x^2$  D. $A = \frac{\pi}{4} x^2$  E. None of the above.

13. Solve for $p$:
   \[ \frac{4}{2p-3} + \frac{10}{4p^2 - 9} = \frac{1}{2p + 3} \]
   A. $p = -\frac{3}{2}$  B. $p = \frac{5}{6}$  C. There is no solution  D. $p = -\frac{25}{3}$  E. None of the above.

14. How many ml of a 50% acid solution should be added to 40 ml of a 20% acid solution to obtain a solution that is 25% acid?
   A. 10 ml  B. 8 ml  C. 6 ml  D. 4 ml  E. None of the above.

15. Solve for $x$:
   \[ x = \sqrt{14 + 5x} \]
   A. $x = 3, x = 14$  B. $x = -2, x = 7$  C. $x = -2$  D. $x = \frac{14}{3}$  E. None of the above.

16. Find all solutions: $m^4 - m^2 - 6 = 0$.
   A. $m = 2, 3$  B. $m = -2, \pm \sqrt{3}$  C. $m = \pm \sqrt{3}, \pm 2i$  D. $m = \pm \sqrt{3}, \pm \sqrt{2}i$  E. None of the above.

17. Solve the inequality and express the solution in terms of intervals: $3x - 2 > 6x + 1$
   A. $(-\infty, -1)$  B. $(-1, 1)$  C. $(-\infty, -1]$  D. $(-1, \infty)$  E. None of the above.

18. Solve the inequality: $|6 - 2x| \leq 3$.
   A. $x \geq \frac{3}{2}$  B. $x \leq \frac{3}{2}$  C. $\frac{3}{2} \leq x \leq \frac{9}{2}$  D. $-\frac{9}{2} \leq x \leq \frac{3}{2}$  E. None of the above.

19. Find all values of $k$ so that the solutions of the following equation are real numbers: $2x^2 - 4x + k = 0$.
   A. $k = 2$  B. $k > 2$  C. $k \geq 2$  D. $k \leq 2$  E. None of the above.

20. The base of a triangle is three inches more than its height. If each is increased by 3 inches the area is 14 square inches. Find the original base ($b$) and original height ($h$) in inches.
   A. $b = 4, h = 1$  B. $b = 9, h = 6$  C. $b = 8, h = 5$  D. $b = 7/2, h = 1/2$  E. None of the above.

21. Solve for $x$:
   \[
   \begin{align*}
   2x^2 + y^2 &= 1 \\
   x - y &= 1
   \end{align*}
   \]
   A. $x = 2/3$  B. $x = 0, 2/3$  C. $x = -2/3$  D. $x = 0, 3/2$  E. None of the above.

22. If the point $(2, 3)$ is midway between $A$ and $B$ and the point $A$ has coordinates $(1, -2)$, find the coordinates of the point $B$.
   A. $(1, 5)$  B. $(3, 1)$  C. $(3, 8)$  D. $(3/2, 1/2)$  E. None of the above.

23. The slope of a line perpendicular to the line drawn is:

   \[
   \text{A. } \frac{1}{3} \text{   B. } -\frac{1}{3} \text{   C. } -3 \text{   D. } 3 \text{   E. None of these.}
   \]

24. If $m$ varies directly as the product of $x$ and $y$ and inversely as $z$, find the constant of proportionality $k$ if $m = 3$ when $x = 4, y = 2$ and $z = 6$.
   A. $k = 1/6$  B. $k = 9/4$  C. $k = 3$  D. $k = 1/4$  E. None of the above.
25. Give the equation of the line in slope-intercept form which is parallel to the line $2x - 3y = 7$ and contains the point $(4, -1)$.
   A. $y = \frac{2}{3}x - 7$  B. $y = -\frac{2}{3}x + \frac{5}{2}$  C. $y = \frac{2}{3}x - \frac{11}{3}$  D. $y = \frac{2}{3}x + \frac{14}{3}$  E. None of the above.

26. The equation for the circle shown is:
   
   A. $x^2 + y^2 = 4$  B. $x^2 + y^2 - 4y = 0$  C. $x^2(y - 2) = 4$  D. $x^2 + y^2 + 4y = 0$  E. $x^2 + y^2 + 4x + 4y - 8 = 0$

27. Determine $(g \circ f)(x)$ for the following functions: $f(x) = 1 - \sqrt{x}$ and $g(x) = \frac{1}{x}$.
   A. $-\sqrt{x}$  B. $1 - \sqrt{1/x}$  C. $1 - \sqrt{x}$  D. $\frac{1}{1 - \sqrt{x}}$  E. $1/\sqrt{x}$

28. If $f(x) = \frac{x}{x^2 + 1}$, find $\frac{1}{f(3)}$.
   A. $3/10$  B. $3/16$  C. $16/3$  D. $10/3$  E. None of these.

29. The graph below could best be described by which equation?

   A. $y = 2x^2 + 2$  B. $y = -2x^2 + 2$  C. $y = -2x^2 - 2$  D. $y = 2x^2 - 2$  E. $y = -(x - 2)^2$

30. The figure below most closely resembles the graph of which function?

   A. $y = (1/2)^x$  B. $y = 2^x$  C. $y = -2^x$  D. $y = -(1/2)^x$  E. $y = 1 - 2^x$

31. Express as one logarithm: $\log_b y^3 + \log_b y^2 - \log_b y^4$.
   A. $\log_b y^2$  B. $\log_b y$  C. $\log_b(y^3 + y^2 - y^4)$  D. $\log_b \frac{y^3 + y^2}{y^4}$  E. None of the above.

32. Which are true of the function $f(x) = \log_a x$ if $a > 1$?
   I. $f$ is an increasing function.  II. $f$ has $a$ as an $x$ intercept.  III. $f$ has 1 as a $y$ intercept.
   IV. The domain of $f$ is $(0, \infty)$. List all correct answers.
   A. I, II and III  B. I and II  C. II and IV  D. I and IV  E. I and III

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33. Which of the following is equivalent to \( \log \left( \frac{432}{\sqrt{0.95 \sqrt{72.1}}} \right) \)?
   A. \( \log 432 - \frac{1}{2} \log 0.95 - 3 \log 72.1 \)  
   B. \( \log 432 - \frac{1}{3} \log 0.95 - \frac{1}{3} \log 72.1 \)  
   C. \( \log 432 - 2 \log 0.95 + 3 \log 72.1 \)  
   D. \( \log 432 - \frac{1}{2} \log 0.95 + \frac{1}{3} \log 72.1 \)  
   E. \( \log 432 - 2 \log 0.95 - 3 \log 72.1 \)

34. Solve for \( x \): \( 3^x = 5 \).
   A. \( x = \log 4 + 5 \log 3 \)  
   B. \( x = 5 + \log(4/3) \)  
   C. \( x = 5 + \frac{\log 4}{\log 3} \)  
   D. \( x = 5 + \log 4 \)  
   E. \( x = \frac{5 + \log 4}{\log 3} \)

35. Solve for \( x \): \( \log_3 \sqrt{2x + 3} = 2 \).
   A. \( x = 5/2 \)  
   B. \( x = 3/2 \)  
   C. \( x = 39 \)  
   D. \( x = 17 \)  
   E. \( x = 3 \)

36. Given that \( \log_3 m = 8 \), \( \log_3 n = 10 \) and \( \log_3 p = 6 \). Calculate \( \log_3 \left( \frac{\sqrt{mn}}{p^3} \right) \).
   A. \(-9\)  
   B. \(\frac{2\sqrt{5}}{27}\)  
   C. \(22\)  
   D. \(-56\)  
   E. \(-4\)

37. The graph of \( y = 2 + 2^x \) crosses the y-axis at
   A. 0  
   B. 1  
   C. 2  
   D. 3  
   E. 4

38. Which of the following looks most like the graph of \( y = x^2(x - 1)(x + 1)^2 \)?

39. Which set of equations below has no solution?
   A. \(2x + 3y = 8\)  
   B. \(3x + 4y = 5\)  
   C. \(2x - 3y = 4\)  
   D. \(x - 4y = 6\)  
   E. \(3x - 2y = 4\)

40. Determine where the two lines \( x + 4y = 3 \) and \( 2x - 6y = 8 \) intersect.
   A. \( x = \frac{-12}{5}, y = \frac{6}{5}\)  
   B. \( x = \frac{3}{5}, y = \frac{3}{5}\)  
   C. \( x = \frac{2}{7}, y = \frac{5}{7}\)  
   D. \( x = \frac{3}{5}, y = \frac{2}{5}\)  
   E. None of the above.

41. The value of a rare book is increasing linearly. It was worth $54 in 1981 and $62 in 1983. What is the formula for the value \( v \) of the book \( t \) years after 1980?
   A. \( v = 50 + 4t \)  
   B. \( v = 48 + 3t \)  
   C. \( v = 50 + 3t \)  
   D. \( v = 51 + 4t \)  
   E. None of the above.

42. If \( f(x) = x^2 - 2x + 4 \) then \( \frac{f(x+h) - f(x)}{h} = \)
   A. \( 2x + h - 2 \)  
   B. \( x + 2h - 2 \)  
   C. \( x + 2h + 2 \)  
   D. \( 2x - h - 2 \)  
   E. \( 2x - h + 2 \).

43. An aquarium in the shape of a rectangular box is to have a height of 1.5 feet and a volume of 6 cubic feet. Let \( x \) denote the length of the base and \( y \) the width of the base. Express \( y \) as a function of \( x \).
   A. \( y = 1.5x \)  
   B. \( y = \frac{4}{x} \)  
   C. \( y = x^2 \)  
   D. \( y = \frac{6}{x} \)  
   E. \( y = 9x \)
44. If \( \log_x 2 = 5 \), solve for \( x \). Give your answer correct to four decimal places. (Hint: Change to exponential notation.)

A. 2.2361  B. 1.4142  C. 0.6990  D. 1.1487  E. 0.3010

SOLUTION