BLUE MATH LESSON 8A: FUNCTIONS – TRANSFORMATIONS AND COMPOSITIONS

Race to the Finish

Directions: Answer each question below.

HOMEWORK SET (NO CALCULATOR)

1. The graph of $f(x) = x^3$ crosses the y-axis at the point $(0, 0)$. At which point will the graph $y = 2(x - 1)^3 - 1$ cross the y-axis?
   A) $(0, 1)$
   B) $(1, 0)$
   C) $(0, -3)$
   D) $(-1, 0)$

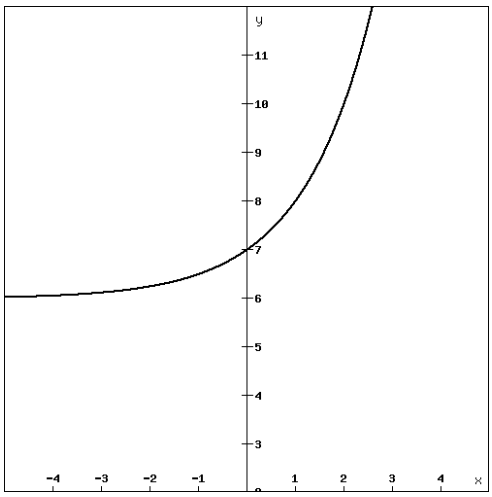
2. The definition of $f^{-1}(x)$ is that $f^{-1}(f(x)) = x$. If $f(x) = \frac{x-5}{3}$, then which of the following is equal to $f^{-1}(x)$?
   A) $5x + 3$
   B) $5x - 3$
   C) $3x + 5$
   D) $3x - 5$

3. The graph of a circle has a radius of 2, and a center at $(-4, -6)$. Which of the following is the equation of that circle?
   A) $(x + 4)^2 + (y - 6)^2 = 2$
   B) $(x - 4)^2 + (y + 6)^2 = 2$
   C) $(x - 4)^2 + (y - 6)^2 = 4$
   D) $(x + 4)^2 + (y + 6)^2 = 4$

4. The graph of $f(x) = \frac{1}{x}$ has a vertical asymptote at $x = 0$ and a horizontal asymptote at $y = 0$. What would be the equation of the function with a vertical asymptote at $x = -3$ and a horizontal asymptote at $y = 2$?
   A) $\frac{1}{x-3} + 2$
   B) $\frac{1}{x+3} + 2$
   C) $\frac{1}{x-3} - 2$
   D) $\frac{1}{x+3} - 2$

5. What is the resulting function when you vertically stretch the graph of $f(x) = x^3$ by a factor of $\frac{1}{4}$, shift it left 3 units, up 2 units, and reflect it over the y-axis?
   A) $\frac{1}{4}(-x - 3)^3 + 2$
   B) $\frac{1}{4}(-x + 3)^3 + 2$
   C) $\frac{1}{4}(x - 3)^3 + 2$
   D) $-\frac{1}{4}(x + 3)^3 + 2$

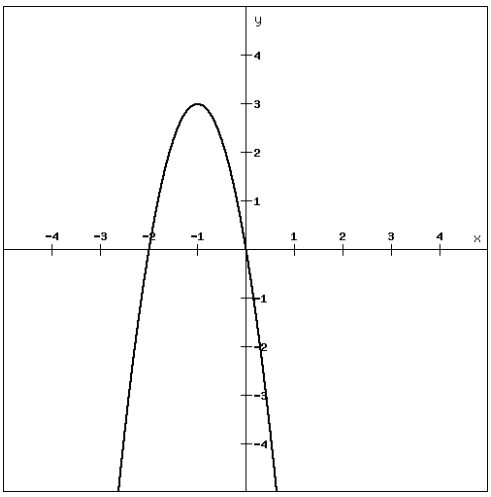
6. You have a circle centered on the origin with a radius of 6. You wish to move the circle so that the edge of the circle is tangent to both the x- and y-axis. What is a possible equation of your new circle?
   A) $(x + 3)^2 + (y - 3)^2 = 6$
   B) $(x + 6)^2 + (y - 6)^2 = 6$
   C) $(x + 6)^2 + (y + 6)^2 = 36$
   D) $(x - 3)^2 + (y - 3)^2 = 36$



7. Which parent function best describes the graph of the function above?
   A) $y = a^x$
   B) $y = \ln x$
   C) $y = \sqrt[3]{x}$
   D) $y = a^{\frac{1}{x}}$

8. If $f(x) = 2x^2 + 2$, and $g(x) = x - 1$, then which of the following is equal to $f(g(x))$?
   A) $2x^2 + 4$
   B) $2x^2 - 2x + 4$
   C) $2x^2 - 4x + 3$
   D) $2x^2 - 4x + 4$

9. A function $f(x)$ has the form $x^2 + bx + c$. Reflecting $f(x)$ across the y-axis yields the same translation as shifting $f(x)$ to the right 8 units. What value must c hold if $f(x) = 0$ has only one solution?
   A) 2
   B) 4
   C) 8
   D) 16



10. Which of the following functions best describes the graph above?
    A) $f(x) = \left(-\frac{1}{3}x + 1\right)^2 + 3$
    B) $f(x) = -3(x+1)^2 + 3$
    C) $f(x) = 3(-x-1)^2 + 3$
    D) $f(x) = -3(x-1)^2 - 3$

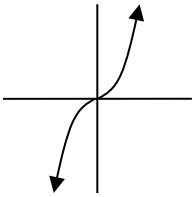
11. Let $f(x) = x + 3$ and $g(x) = 2x - 2$. First, $g(x)$ is halved. Then, $f(x)$ is shifted up 2 units and left 3 units. What is the product of the roots of the transformations of both functions?
    A) -8
    B) $-\frac{9}{2}$
    C) $\frac{9}{2}$
    D) 8

12. Let $h(x+3) = 3x - 15$ and $g(x) = 4x^2$. If $h(x)g(x-2) = 0$ what one possible value of x?
    A) -3
    B) -2
    C) 0
    D) 8

13. The function $f(x) = -2(x + 1)^2 - 2$ is translated from it parent function $f(x) = x^2$ by which of the following transformations?
    A) Shift 1 unit to the right, 2 units down, and reflect it over the x-axis
    B) Shift 1 unit to the left, 2 units down and reflect it over the x-axis
    C) Stretch it vertically by a factor of 2, shift 1 unit to the right, 2 units down, and reflect it over the x-axis
    D) Stretch it vertically by a factor of 2, shift 1 unit to the left, 2 units down, and reflect it over the x-axis

14. The graph of the parent function $y = x^3$ is transformed by a reflection across the x-axis, then a reflection across the y-axis. Which of the graphs best shows those transformations?

A)



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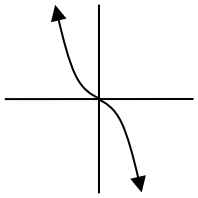

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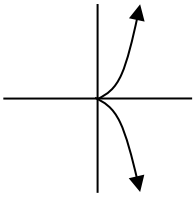
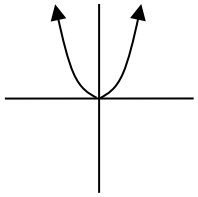


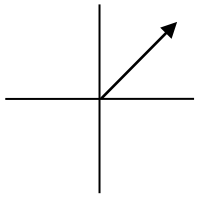
D)



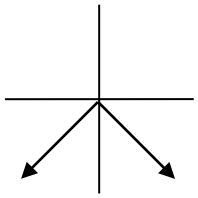
15. Let $f(x) = x^2$. First, $f(x)$ is translated 2 units to the left and 1 unit downward. Then, $f(x)$ is reflected across the x-axis. If c and d are both distinct roots of $f(x)$ after the transformations, what is $(c + d)^2$?
    A) –4
    B) –3
    C) –1
    D) 16

16. If $f(x) = x^2$ and $g(x) = \sqrt{x}$, which of the following could be the graph of $g(f(x))$?

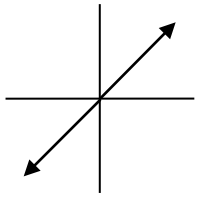
A)



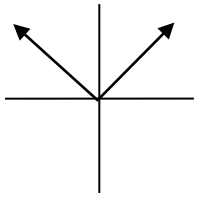
C)



B)



D)



17. The vertex of $f(x) = |x|$ is located at the point $(0, 0)$. What is the x-coordinate of the vertex of $f(x) = 2|x - 3| + 2$?

18. Let $f(x) = x - 2, g(x) = x^2$. What is a possible value of x for which $f(x) = g(f(x))$?

19. If the graph of $f(x) = -(x - 3)^2 + 6$ is shifted 3 units to the right and 2 units up to form $g(x)$, what is the y-coordinate of the vertex of $g(x)$?

20. What is the y-intercept of the graph of $f(x) = 3(2^{x-2})$?