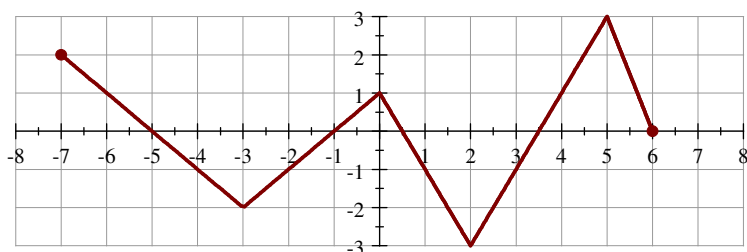


**TMATYC - Precalculus Test - 2015**

Use the graph of the function  $g(x)$  shown below to answer #'s 1 & 2



1. The sum of all the values of  $x$  for which  $g(x) = 0$  is  
 A.  $-2$       B.  $0$       C.  $1$       D.  $2$       E.  $4$
2. The domain of the function  $g$  is  
 A.  $(-\infty, \infty)$       B.  $[-3, 3]$       C.  $[-7, 6]$       D.  $[0, \infty)$       E.  $[0, 2]$
3. The slope of line 1 is the reciprocal of the  $y$ -intercept for line 2 and the  $y$ -intercept of line 1 is the reciprocal of the slope of line 2. If these two lines intersect at the point  $(2, 0)$  then the product of the two lines' slopes is  
 A.  $-2$       B.  $-\frac{1}{2}$       C.  $\frac{1}{2}$       D.  $1$       E.  $2$
4. The graph of  $-f(x) + 3$  can be obtained from the graph of  $f(x)$  by  
 A. shifting  $f$  to the right 3 units and then reflecting about the  $x$ -axis  
 B. shifting  $f$  up 3 units and then reflecting about the  $x$ -axis  
 C. shifting  $f$  up 3 units and then reflecting about the  $y$ -axis  
 D. reflecting  $f$  about the  $x$ -axis and then shifting up 3 units  
 E. reflecting  $f$  about the  $x$ -axis and then shifting right 3 units
5. Find the diameter of the circle whose equation is  $x^2 - 6x + y^2 + 4y - 3 = 0$   
 A. 2      B. 4      C. 8      D. 16      E. 32
6. At noon, a blue car is 100 miles due east of a red car. The red car is traveling south at 25 miles per hour, while the blue car is traveling west at 40 miles per hour. Express the distance in miles,  $d$ , between the cars  $t$  hours after noon.  
 A.  $d = \sqrt{(25t)^2 + (100 - 40t)^2}$       B.  $d = \sqrt{(25t)^2 + (40t)^2}$       C.  $d = \sqrt{(40t)^2 - (25t)^2}$   
 D.  $d = \sqrt{15}t^2$       E.  $d = 100 - \sqrt{(25t)^2 + (40t)^2}$
7. An equilateral triangle has side length  $x$ . What is the altitude of the triangle in terms of  $x$ ?  
 A.  $\frac{\sqrt{3}}{2}x$       B.  $\frac{\sqrt{2}}{2}x$       C.  $\frac{1}{2}x$       D.  $x$       E.  $\frac{1}{2}x^2$
8. Let  $h(x) = ax^2 + bx + c$  with  $a$ ,  $b$ , and  $c$  all integers. If  $h(-1) = h(3) = 14$  and  $ac = 15$ , then  $a + b + c =$   
 A. 1      B. 2      C. 7      D. 12      E. 29

9. Which of the following statements is/are true for all real numbers  $x$ ?

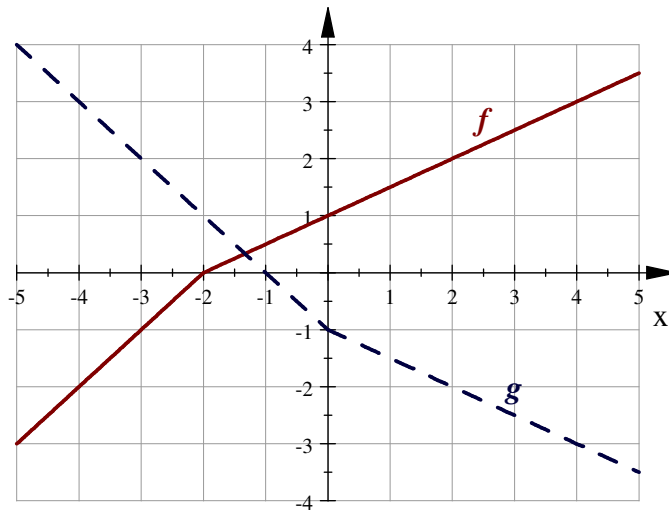
A.  $\sqrt{x^2} = x$       B.  $|-x| = x$       C.  $\tan^2 x + 1 = \sec^2 x$

D. A, B, and C are all true      E. None of these statements are true for all real numbers  $x$

10. The first term in a geometric sequence is 2 and the second term is 6. Find the 100th term of the sequence.

A.  $3^{100} \times 2$       B.  $3^{99} \times 2$       C.  $2^{99} + 6$       D.  $2 + 99 \times 3$       E.  $2 + 100 \times 3$

Use the graphs of the functions  $f$  (solid line) and  $g$  (dashed line) shown below to answer #'s 11 & 12



11. If  $h(x) = f(x + g(x))$ , find  $h(4)$

A. -5      B. -1      C. 0      D. 1.5      E. 3

12.  $g^{-1}(-2) =$

A. 2      B. 1      C. 0      D. -4      E. undefined

13. If  $c$  is a complex number and  $x - c$  is a factor of the polynomial function  $p(x)$ , which of the following **may be false**?

A.  $c$  is a zero of  $p(x)$       B.  $c$  is a solution to  $p(x) = 0$       C.  $p(c) = 0$   
 D.  $(c, 0)$  is an  $x$ -intercept for the graph of  $p(x)$       E. When  $p(x)$  is divided by  $x - c$ , the remainder is zero

14. Find the solution to the inequality  $\sin^2 x + \frac{1}{2} \sin x - \frac{1}{2} \geq 0$  on the interval  $[0, 2\pi]$

A.  $\left[ \frac{7\pi}{6}, \frac{11\pi}{6} \right] \cup \left\{ \frac{\pi}{2} \right\}$       B.  $\left[ \frac{\pi}{6}, \frac{5\pi}{6} \right] \cup \left\{ \frac{3\pi}{2} \right\}$       C.  $\left[ \frac{1}{2}, 2\pi \right]$   
 D.  $\left[ \frac{\pi}{3}, \frac{2\pi}{3} \right]$       E.  $\left[ 0, \frac{5\pi}{6} \right] \cup \left[ \frac{11\pi}{6}, 2\pi \right]$

15. As  $x \rightarrow \infty$ , the expression  $\frac{ae^{-x} + be^{1/x}}{a + b \ln\left(\frac{ax}{ax+1}\right)}$  is approaching

A.  $\frac{b}{a}$       B.  $\frac{a+b}{a}$       C.  $\frac{b-a}{a+b}$       D. 1      E.  $\infty$

16. If  $(x, y)$  is a solution to the system of equations

$$3 \log_4 x + \log_4 y = 2$$

$$\log_2 x - \log_2 y = 4$$

Then the product  $xy =$

- A.  $\frac{1}{4}$       B. 1      C. 4      D.  $\frac{16}{3}$       E. 8

17. If  $a$  and  $b$  are nonzero real numbers, then the vertical asymptote(s) for the function  $f(x) = \frac{x^2 - (a+b)x + ab}{x^2 - a^2}$  is/are

- A.  $x = a, x = b$       B.  $y = a, y = b$       C.  $y = 1$       D.  $x = -a, x = a$       E.  $x = -a$

18.  $y$  varies jointly as  $m$  and the square root of  $n$  and inversely as  $p^2$ .  $y = 8$  when  $m = 2$ ,  $n = 4$ , and  $p = 3$ . What is the value of  $y$  when  $m = 8$ ,  $n = 9$ , and  $p = 4$ ?

- A. 6.5      B. 18      C. 27      D. 64      E. 72

19. A substance grows exponentially with a rate of growth of 2% per year. How many years will it take 1 gram of this substance to grow to 2 grams? Round your answer to the nearest year.

- A. 5      B. 10      C. 25      D. 35      E. 50

20. From the center of a sphere of diameter 20 feet, two lines are drawn to points  $A$  and  $B$  on the sphere. If the distance between these two points along the surface of the sphere is 25 feet, what is the angle between these two lines in radians?

- A. 0.4      B. 1.25      C. 2.5      D. 5      E. 115

21.  $\cos[\tan^{-1} \frac{1}{x}] =$

- A.  $\sin x$       B.  $x$       C.  $\frac{x}{\sqrt{x^2 + 1}}$       D.  $\frac{\sqrt{x^2 + 1}}{x}$       E.  $\frac{1}{\sqrt{x^2 + 1}}$

22. If  $\sin \alpha = \frac{3}{5}$ ,  $\tan \alpha < 0$ ,  $\cos \beta > 0$ , and  $\tan \beta = -\frac{5}{12}$ , find  $\sin(\alpha + \beta)$

- A.  $\frac{11}{60}$       B.  $\frac{14}{65}$       C.  $\frac{16}{65}$       D.  $\frac{56}{65}$       E.  $\frac{64}{65}$

23. If we take the graph of  $y = 2 \sin(4x + \pi)$  and double its amplitude and period and then shift the resulting graph left  $\frac{\pi}{4}$ , then the resulting function could be written as

- A.  $y = 4 \sin(2x + \frac{3\pi}{4})$       B.  $y = 4 \sin(8x + \frac{3\pi}{4})$       C.  $y = 4 \sin(4x + \frac{\pi}{4})$   
D.  $y = 4 \sin(2x - \frac{\pi}{4})$       E.  $y = -4 \sin(8x)$

24. Suppose a certain baseball diamond is a square 80 feet on a side. The pitching mound is located 54 feet from home plate on a line joining home plate and second base. How far is it from the pitching mound to first base? Round to the nearest tenth of a foot.

- A. 56.6      B. 58.9      C. 60.1      D. 69.1      E. 90.7

25. Over the interval  $[0, 2\pi]$ , the equation  $\cos(100x) = \frac{1}{2}$  has how many solutions?

- A. 2      B. 12      C. 50      D. 200      E. infinitely many