



- For  $f(x) = \frac{x-1}{3}$ , for what value of  $x$  is  $f(x) = 30$  ?  
A.  $\frac{29}{3}$       B.  $\frac{31}{3}$       C. 89      D. 91      E. NOTA
- For  $g(x) = \sqrt{x+1} - 1$  find  $g(g(3))$ .  
A. 2      B.  $\sqrt{2} - 1$       C. 1      D. 0      E. NOTA
- $f(x) = \begin{cases} x-2 & \text{for } x > 1 \\ 4-x & \text{for } x \leq 1 \end{cases}$ . If for  $a \neq b$ ,  $f(a) = f(b) = 3$  then give the value of  $|a-b|$ .  
A. 0      B. 1      C. 4      D. 6      E. NOTA
- The function  $A(x)$  gives the area of a triangle with vertices on the coordinate axes at  $(0,0)$ ,  $(0,x)$  and  $(x,0)$ , for  $x > 0$ . For what value of  $x$  is  $A$  equal to 20 ?  
A.  $\sqrt{10}$       B.  $2\sqrt{10}$       C. 20      D. 40      E. NOTA
- For  $f(x) = x^2 - 2x + 3$  which is true for all values of  $x$  ?  
A.  $f(-x) = -f(x)$       B.  $f(x) = f(-x)$       C.  $f(1+x) = f(1-x)$       D.  $f(x) \geq 3$       E. NOTA
- For  $f(x) = 3^{x+1}$ , give the value of  $\frac{3f(3)}{f(2)}$ .  
A. 9      B. 6      C. 3      D. 1      E. NOTA
- The domain of  $f(g(x))$  contains all reals except for  $x$ -values  $a$  and  $b$ .  
For  $f(x) = \frac{1}{x-3}$  and  $g(x) = \frac{x+3}{2x+2}$  give the value of  $ab$ .  
A. 0.5      B. 0.6      C. -0.6      D. -1.8      E. NOTA
- Relations  $g, h$ , and  $k$  have the properties below. Which cannot be a function?  
 $g(2) = g(-2)$        $h(x) = \pm\sqrt{x}$        $k(-3) = -k(-3)$   
A.  $g$  only      B.  $h$  only      C.  $k$  only      D.  $h$  and  $k$  only      E. NOTA



9.  $f(x) = \log x$  and  $f(k) = \log 1 + \log 2 + \log 3 + \dots + \log n$ . If  $k = 120$  then give the value of  $n$ .

- A. 4                      B. 5                      C. 59                      D. 119                      E. NOTA

10.  $A(x)$  is given by the surface area of a sphere of radius  $x$ , divided by the radius of the sphere, for domain  $x > 0$ . For what value of  $x$  is  $A(x)$  equal to the area of the great circle of the sphere?

- A.  $\sqrt{2}\pi$                       B. 1                      C. 2                      D. 4                      E. NOTA

11.  $f(x) = 1 - x^2$  and  $g(x) = f(x) + 2x$ . Find the value of  $x$  such that  $f(x) = g(x) - 2$ .

- A. 1                      B. 2                      C. 3                      D. 4                      E. NOTA

12.

$x$	1	2	3	4
$f$	4	6	1	5
$g$	a	b	c	d

In the table above, relations  $f$  and  $g$  have the property that  $f(g(x)) = g(f(x)) = x$ , for all  $x$ . Give the value of  $a + d$ .

- A. 10                      B. 5                      C. 4                      D. 3                      E. NOTA

13. For  $f(x) = x \cdot 16^x$  find  $f\left(f\left(\frac{1}{4}\right)\right)$ .

- A.  $\sqrt[4]{2}$                       B.  $\sqrt{2}$                       C. 2                      D. 4                      E. NOTA

14.  $f$  is a linear function with domain all reals, and  $f(1) = 2$ . If  $f(-x) = -f(x)$  for all numbers in its domain, find the value of  $k$  where  $f(k) = 12$ .

- A. 6                      B. 11                      C. 12                      D. 24                      E. NOTA

15. The function  $f$  is defined as the value of  $C(x, 3)$ , the number of different combinations of  $x$  objects taken 3 at a time,  $x > 3$ . Find the greatest value of  $k$  such that  $f(k) < 10$ .

- A. 3                      B. 4                      C. 5                      D. 6                      E. NOTA

16. Given  $f(a, b) = a^2 - 2b + 1$ . If  $f(k, 1) = 12$  then what is the value of  $k^2 - 9$ ?

- A. 3                      B. 3 or -3                      C. 4                      D. 13                      E. NOTA



17. The function  $f(x)$  is defined as the length of side  $\overline{AC}$  of triangle ABC, if  $AB=10$ ,  $BC=10$  and  $m\angle B = x$ , for domain  $0 < x < 180$  degrees. Find  $f(60)$ .
- A. 10                      B. 50                      C.  $\frac{20\sqrt{2}}{3}$                       D.  $25\sqrt{3}$                       E. NOTA
18. What is the maximum value of the function  $f(x) = 9 - 2x - x^2$  ?
- A. 11                      B. 10                      C. 9                      D. 8                      E. NOTA
19. Which function  $y = f(x)$  below has an inverse that is not a function?
- A.  $y = \frac{1}{x}$                       B.  $y = \frac{1}{2}x - 1$                       C.  $y = x^2$                       D.  $xy - 2 = 0$                       E. NOTA
20. For  $f(x) = ax^3 + 4x^2 + bx + c$ , if  $f(1) = 6$  then give the value of  $a + b + c$ .
- A. 8                      B. 6                      C. 4                      D. 2                      E. NOTA
21.  $g(x) = f(x) + 1$  and  $f$  is a linear function with y-intercept 0 and positive slope. If the area bounded by  $f$ , the x-axis, and the line  $x = 2$  is  $k$ , then find the area bounded by the graph of  $g$ , the axes, and the line  $x = 2$ .
- A.  $k + 1$                       B.  $k + 2$                       C.  $k + 3$                       D.  $k + 4$                       E. NOTA
22.  $f(x) = a|x + b| + c$  and has minimum value at the point  $(1, -4)$  and an x-intercept 2, then  $f(3) = ?$
- A. 0                      B. 1                      C. 4                      D. 12                      E. NOTA
23.  $P(x)$  gives the percent of decrease when 400 is decreased to  $x$ , for  $0 < x < 400$ .  $P(300) = ?$ .
- A. 25                      B. 30                      C. 50                      D. 100                      E. NOTA
24.  $f(x) = \sum_{n=0}^x \left(\frac{1}{3}\right)^n$ . Which value is closest to  $f(10^{100})$  ?
- A. 0                      B. 1.5                      C. 3                      D. 6                      E. NOTA



25.  $f(x) = x + (x-1)i$  and  $i = \sqrt{-1}$ . Find  $\left| \frac{f(2)}{f(0)} \right|$ .
- A.  $2+i$       B.  $1+2i$       C.  $\sqrt{5}$       D. 5      E. NOTA
26. The function  $f(x)$  is defined as the length of side  $\overline{AC}$  of triangle ABC, if  $AB=12$ ,  $BC=10$  and  $m\angle B = x$ , for domain  $0 < x < 180$  degrees. Give the range of the function  $f$ , in interval notation.
- A. (2, 22)      B. (0, 12)      C. (0, 22)      D. (2, 12)      E. NOTA
27. A parabolic arch (vertex at maximum height) has vertex 200 feet off of the ground. Let  $H(x)$  be the height in feet of the arch above ground at  $x$  feet from the center (axis) of the arch. If  $H(200) = 0$  then find the value of  $H(10)$
- A. 200      B. 199.5      C. 195      D. 105      E. NOTA
28. For  $x > 0$ ,  $f(x) = \sqrt{x - \sqrt{x - \sqrt{x - \sqrt{\dots}}}}$  If  $f(k) = 2$  then  $k =$
- A. 1      B.  $\sqrt{2}$       C. 3      D. 6      E. NOTA
29.  $f(x, y) = 27^{\frac{x}{y}}$  and  $g(x, y) = 3^{\frac{y}{x}}$ . If  $f(k, 3) = g(2, k) \cdot \sqrt{3}$ , then  $g(k, 2) =$
- A.  $\frac{1}{9}$       B.  $\sqrt{3}$       C. 3      D. 9      E. NOTA
30. If  $f(x+1) = \frac{1}{x} + \frac{1}{x+1}$  and the domain of  $f(x)$  is positive integers where  $f$  is defined, which could NOT be a value of the range of  $f(x)$ ?
- A.  $\frac{19}{90}$       B.  $\frac{17}{72}$       C.  $\frac{7}{12}$       D.  $\frac{13}{30}$       E. NOTA