1. For $f(x) = \dfrac{x-1}{3}$, for what value of x is $f(x) = 30$?

   A. $\dfrac{29}{3}$ B. $\dfrac{31}{3}$ C. 89   D. 91   E. NOTA

2. For $g(x) = \sqrt{x+1} - 1$ find $g(g(3))$.

   A. 2   B. $\sqrt{2} - 1$ C. 1   D. 0   E. NOTA

3. $f(x) = \begin{cases} x-2 & for \ \ x > 1 \\ 4-x & for \ \ x \le 1 \end{cases}$. If for $a \ne b$, $f(a) = f(b) = 3$ then give the value of $|a-b|$.

   A. 0   B. 1   C. 4   D. 6   E. NOTA

4. 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

5. 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. $f(x) \ge 3$ E. NOTA

6. For $f(x) = 3^{x+1}$, give the value of $\dfrac{3f(3)}{f(2)}$.

   A. 9   B. 6   C. 3   D. 1   E. NOTA

7. The domain of $f(g(x))$ contains all reals except for x-values a and b.
   For $f(x) = \dfrac{1}{x-3}$ and $g(x) = \dfrac{x+3}{2x+2}$ give the value of ab .

   A. 0.5   B. 0.6   C. -0.6 D. -1.8 E. NOTA

8. 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 $f(k) = \log 1 + \log 2 + \log 3 + ... + \log n$. 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 $f(f(\frac{1}{4}))$.

    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. $\dfrac{20\sqrt{2}}{3}$ 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. $y = \dfrac{1}{x}$ B. $y = \dfrac{1}{2}x - 1$ 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. $f(x) = \sum\limits_{n=0}^{x} \left(\dfrac{1}{3}\right)^n$. 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 $\left| \dfrac{f(2)}{f(0)} \right|$.

    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 $x > 0$, $f(x) = \sqrt{x - \sqrt{x - \sqrt{x - \sqrt{\ldots}}}}$ 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. $\dfrac{1}{9}$ B. $\sqrt{3}$ C. 3   D. 9   E. NOTA

30. If $f(x+1) = \dfrac{1}{x} + \dfrac{1}{x+1}$ 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. $\dfrac{19}{90}$ B. $\dfrac{17}{72}$ C. $\dfrac{7}{12}$ D. $\dfrac{13}{30}$ E. NOTA