ONE OPTION CORRECT TYPE

1. $\lim_{x \to 1} \dfrac{sin^2(x^3 + x^2 + x - 3)}{1 - cos(x^2 - 4x + 3)}$ has the value equal to

   (a) 18

   (b) 9/2

   (c) 9

   (d) none of these

2. Let $f(x) = \displaystyle\int_3^x \dfrac{dt}{\sqrt{t^4 + 3t^2 + 13}}$ If $g'(x)$ is the inverse of f(x) then $g'(0)$ has the value equal to

   (a) 1/11

   (b) 11

   (c) $\sqrt{13}$

   (d) $1/\sqrt{13}$

3. The function f(x) has the property that for each real number x in its domain, 1/x is laso in its domain and $f(x) + f(1/x) = x$ The largest set of real numbers that can be in the domain of f(x) is

   (a) $\{x | x \neq 0)$

   (b) $\{x | x > 0)$

   (c) $\{x | x \neq -1 \text{ and } x \neq 0 \text{ and } x \neq 1)$

   (d) $(-1, 1)$

4. Let $w = \dfrac{z^2 - 3z + 6}{z + 1}$ and $z = 1 + i$ then $|w|$ and amp w respectively are

   (a) $2, -\pi/4$

   (b) $\sqrt{2}, -\pi/4$

   (c) $2, 3\pi/4$

   (d) $\sqrt{2}, 3\pi/4$

5. If $\dfrac{1 - cosa - tan^2(a/2)}{sin^2(a/2)} = \dfrac{kcosa}{w + pcosa}$ where k, w and p have no common factor other than 1, then the value of $k^2 + w^2 + p^2$ is equal to

   (a) 3

   (b) 4

   (c) 5

   (d) 6

6. In a birthday party, each man shook hands with everyone except his spouse, and no handshakes took place between women. If 13 married couples attended, how many handshakes were thre among these 26 people.

   (a) 185

   (b) 234

   (c) 312

(d) 325

7. If x and y are real numbers such that $x^2 + y^2 = 8$ the maximum possible value of x-y , is

   (a) 2
   (b) $\sqrt{2}$
   (c) $\sqrt{2}/2$
   (d) 4

8. Let u(x) and v(x) are differentiable functions such that $\dfrac{u(x)}{v(x)} = 7$ If $\dfrac{u'(x)}{v'(x)} = p$ and $(\dfrac{u(x)}{v(x)})'q$ then $\dfrac{p+q}{p-q}$ has the value equal to

   (a) 1
   (b) 0
   (c) 7
   (d) -7

9. The coefficient of x^9 when $(x + (2/\sqrt{x}))^{30}$ is expanded and simplified is

   (a) $^{30}C_{14}2^9$
   (b) $^{30}C_{16}2^{14}$
   (c) $^{30}C_{9}2^{21}$
   (d) $^{10}C_9$

10. Let C be the circle described by $(x-a)^2 + y^2 = r^2$ where $0 < r < a$ Let m be the slope of the line through the origin that is tangent to C at a point in the first quadrant . Then

   (a) $m = \dfrac{r}{\sqrt{a^2 - r^2}}$
   (b) $m = \dfrac{\sqrt{a^2 - r^2}}{r}$
   (c) $m = \dfrac{r}{a}$
   (d) $m = \dfrac{a}{r}$

11. What can one say about the local extrema of the function f(x) $=x + (1/x)$

   (a) the local maximum of f(x) is greater than the local minimum of f(x)
   (b) the local minimum of f(x) greater than the local maximum of f(x)
   (c) the function f(x) does not have any local extrema
   (d) f(x) has one asymptote

12. $tan(arctan(\dfrac{-2}{3}) + arctan(5))$ equals

   (a) $-\sqrt{3}$
   (b) -1
   (c) 1
   (d) $\sqrt{3}$

13. A line passes through (2,2) and cuts a triangle of area 9 square units from the first quadrant . The sum of all possible values for the slope of such a line, is

   (a) -2.5

2

(b) -2

(c) -1.5

(d) -1

14. Which of the following statement is / are true concering the general cubic $f(x) = ax^3 + bx^2 + cx + d (a \neq 0 \text{ \& a,b,c,d} \in R)$

(a) The cubic always has at least one real root

(b) the cubic always has exactly one pont of inflection

(a) only I

(b) only II

(c) both I and II

(d) neither I nor II is true

15. If S $= 1^2 + 3^2 + 5^2 + \cdots + (99)^2$ then the value of the sum $2^2 + 4^2 + 6^2 + \cdots + (100)^2$ is

(a) $S + 2550$

(b) 25

(c) 45

(d) $S + 5050$

16. Through the focus of the parabola $y^2 = 2px (p > 0)$ a line is drawn which intersects the curve at A(x_1, y_1) and B(x_2, y_2) The ratio $\dfrac{y_1 y_2}{x_1 x_2}$ equals

(a) 2

(b) -1

(c) -4

(d) some function of p

17. $\lim\limits_{n \to \infty} \dfrac{n.3^n}{n(x-2)^n + n.3^{n+1} - 3^n} = \dfrac{1}{3}$ then the range of x is $(n \in N)$

(a) $[2, 5)$

(b) $(1, 5)$

(c) $(-1, 5)$

(d) $\mathbb{R}$

18. The area of the region(s) enclosed by the curves $y = x^2$ and $y = \sqrt{|x|}$ is

(a) 1/3

(b) 2/3

(c) 1/6

(d) 1

19. Suppose that domain of the function f(x) is set D and the range is the set R, where D and R are the subsets of real numbers. Consider the function f(2x), f(x+2),2f(x), f(x/2), f(x)/2-2. If m is the number of functions listed above that must have the same domain as f and n is the number of functions that must have the same range as f(x) then the ordered pair (m,n) is

(a) (1,5)

(b) (2,3)

(c) (3,2)

3

(d) (3,3)

20. $f : \mathbb{R} \to \mathbb{R}$ is defined as f(x) $=x^2 + 2mx + 1$ for x < 0 ; =mx-1 for $x > 0$ If f(x) is one one then m must lies in the interval

(a) $(-\infty, 0)$
(b) $(-\infty, 0]$
(c) $(0, \infty)$
(d) $[0, \infty)$

21. Let A=$\{x | x^2 + (m-1)x - 2(m+1) = 0, x \in \mathbb{R}\}$ B =$\{x | (m-1)x^2 + mx + 1 = 0, x \in \mathbb{R}\}$ Number of values of m such that $A \cup B$ has exactly 3 distinct elements, is

(a) 4
(b) 5
(c) 6
(d) 7

22. If the function $f(x) = 4x^2 - 4x - tan^2\alpha$ has the minimum value equal to -4 then the most general values of α is given by

(a) $2n\pi + \pi/3$
(b) $2n\pi - \pi/3$
(c) $n\pi \pm \pi/3$
(d) $2n\pi/3$

where $n \in I$

LINKED COMPREHENSION TYPE

(PASSAGE)   Consider the function defined on $[0, 1] \to \mathbb{R}, f(x) = \dfrac{sinx - xcosx}{x^2}$ **if** $x \neq 0$ **and** $f(0) = 0$

23. The function f(x)

(a) has a removable discontinuity at x= 0
(b) has a non removable finite discontinuity at x=0
(c) has a non removable infinite discontinuity at x=0
(d) is continuous at x=0

24. $\displaystyle\int_0^1 f(x)dx$ equals

(a) $1 - sin(1)$
(b) $sin(1) - 1$
(c) $sin(1)$
(d) $-sin(1)$

25. $\displaystyle\lim_{t \to 0} \frac{1}{t^2} \int_0^1 f(x)dx$ equals

(a) 1/3
(b) 1/6
(c) 1/12
(d) 1/24

4