

1. If  $f(x) = |x| + |x - 1| + |x - 2|$ , then-  
 (A)  $f(x)$  has minima at  $x = 1$  (B)  $f(x)$  has maxima at  $x = 0$   
 (C)  $f(x)$  has neither maxima nor minima at  $x = 3$  (D) None of these

2. The maximum area of a right angled triangle with hypotenuse  $h$  is :- [JEE-MAIN Online 2013]  
 (A)  $\frac{h^2}{\sqrt{2}}$  (B)  $\frac{h^2}{2}$  (C)  $\frac{h^2}{4}$  (D)  $\frac{h^2}{2\sqrt{2}}$

3. The cost of running a bus from A to B, is Rs.  $\left(av + \frac{b}{v}\right)$ , where  $v$  km/h is the average speed of the bus. When the bus travels at 30 km/h, the cost comes out to be Rs. 75 while at 40 km/h, it is Rs. 65. Then the most economical speed (in km/h) of the bus is : [JEE-MAIN Online 2013]  
 (A) 40 (B) 60 (C) 45 (D) 50

4. The greatest value of  $x^3 - 18x^2 + 96x$  in the interval  $(0, 9)$  is-  
 (A) 128 (B) 60 (C) 160 (D) 120

5. Difference between the greatest and the least values of the function  $f(x) = x(\ln x - 2)$  on  $[1, e^2]$  is  
 (A) 2 (B)  $e$  (C)  $e^2$  (D) 1

6. The sum of lengths of the hypotenuse and another side of a right angled triangle is given. The area of the triangle will be maximum if the angle between them is :  
 (A)  $\pi/6$  (B)  $\pi/4$  (C)  $\pi/3$  (D)  $5\pi/12$

7. Consider the function  $f(x) = x \cos x - \sin x$ , then identify the statement which is correct.  
 (A)  $f$  is neither odd nor even (B)  $f$  is monotonic decreasing at  $x = 0$   
 (C)  $f$  has a maxima at  $x = \pi$  (D)  $f$  has a minima at  $x = -\pi$

8. If  $f(x) = x^3 + ax^2 + bx + c$  is minimum at  $x = 3$  and maximum at  $x = -1$ , then-  
 (A)  $a = -3, b = -9, c = 0$  (B)  $a = 3, b = 9, c = 0$   
 (C)  $a = -3, b = -9, c \in \mathbb{R}$  (D) none of these

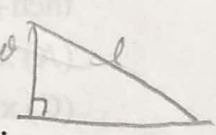
9. If  $f(x) = \int_x^{x^2} (t-1) dt$ ,  $1 \leq x \leq 2$ , then global maximum value of  $f(x)$  is  
 (A) 1 (B) 2 (C) 4 (D) 5

10. Minimum value of the function  $f(x) = \sum_{k=1}^5 (x-k)^2$  is at-  
 (A)  $x = 2$  (B)  $x = 5/2$  (C)  $x = 3$  (D)  $x = 5$

11. Range of the function  $f(x) = \frac{\ln x}{\sqrt{x}}$  is  
 (A)  $(-\infty, e)$  (B)  $(-\infty, e^2)$  (C)  $\left(-\infty, \frac{2}{e}\right]$  (D)  $\left(-\infty, \frac{1}{e}\right)$

**SBG STUDY**

*Handwritten notes for question 9:*  
 $A = \frac{1}{2} \int_1^4 (t-1) dt = \frac{1}{2} \left[ \frac{t^2}{2} - t \right]_1^4 = \frac{1}{2} \left( \frac{16}{2} - 4 - \frac{1}{2} + 1 \right) = \frac{1}{2} \left( 8 - 4 - \frac{1}{2} + 1 \right) = \frac{1}{2} \left( 4 - \frac{1}{2} \right) = \frac{7}{4}$   
 $\frac{dA}{dt} = 0$

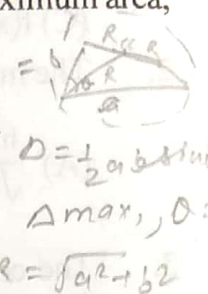


12. If  $ax + \frac{b}{x} \geq c$  for all positive  $x$ , where  $a, b, c > 0$ , then-

- (A)  $ab < \frac{c^2}{4}$  (B)  $ab \geq \frac{c^2}{4}$  (C)  $ab \geq \frac{c}{4}$  (D) None of these

13. Two sides of a triangle are to have lengths 'a' cm & 'b' cm. If the triangle is to have the maximum area, then the length of the median from the vertex containing the sides 'a' and 'b' is

- (A)  $\frac{1}{2}\sqrt{a^2 + b^2}$  (B)  $\frac{2a + b}{3}$  (C)  $\sqrt{\frac{a^2 + b^2}{2}}$  (D)  $\frac{a + 2b}{3}$



14.  $f(x) = 1 + [\cos x]x$ , in  $0 \leq x \leq \frac{\pi}{2}$  (where  $[\cdot]$  denotes greatest integer function)

- (A) has a minimum value 0 (B) has a maximum value 2  
 (C) is continuous in  $\left[0, \frac{\pi}{2}\right]$  (D) is not differentiable at  $x = \frac{\pi}{2}$

15. A rectangle has one side on the positive y-axis and one side on the positive x-axis. The upper right hand vertex of the rectangle lies on the curve  $y = \frac{\ln x}{x^2}$ . The maximum area of the rectangle is

- (A)  $e^{-1}$  (B)  $e^{-1/2}$  (C) 1 (D)  $e^{1/2}$

16. If  $(x - a)^{2m}(x - b)^{2n+1}$ , where  $m$  and  $n$  are positive integers and  $a > b$ , is the derivative of a function  $f$ , then-

- (A)  $x = a$  gives neither a maximum, nor a minimum (B)  $x = a$  gives a maximum  
 (C)  $x = b$  gives neither a maximum nor a minimum (D) None of these

17. The minimum value of  $a \sec x + b \operatorname{cosec} x$ ,  $0 < a < b$ ,  $0 < x < \pi/2$  is-

- (A)  $a + b$  (B)  $a^{2/3} + b^{2/3}$  (C)  $(a^{2/3} + b^{2/3})^{3/2}$  (D) None of these

18. P is a point on positive x-axis, Q is a point on the positive y-axis and 'O' is the origin. If the line passing through P and Q is tangent to the curve  $y = 3 - x^2$  then the minimum area of the triangle OPQ, is

- (A) 2 (B) 4 (C) 8 (D) 9

19. A minimum value of  $\sin x \cos 2x$  is-

- (A) 1 (B) -1 (C)  $-2/3\sqrt{6}$  (D) None of these

20. The rate of change of the function  $f(x) = 3x^5 - 5x^3 + 5x - 7$  is minimum when

- (A)  $x = 0$  (B)  $x = 1/\sqrt{2}$  (C)  $x = -1/\sqrt{2}$  (D)  $x = \pm 1/\sqrt{2}$

21. For the function  $f(x) = \int_0^x \frac{\sin t}{t} dt$ , where  $x > 0$ ,

- (A) maximum occurs at  $x = n\pi$ ,  $n$  is even (B) minimum occurs at  $x = n\pi$ ,  $n$  is odd  
 (C) maximum occurs at  $x = n\pi$ ,  $n$  is odd (D) None of these

22. The least area of a circle circumscribing any right triangle of area  $S$  is :

- (A)  $\pi S$  (B)  $2\pi S$  (C)  $\sqrt{2}\pi S$  (D)  $4\pi S$