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 $f(x) = x(\ell n\, x - 2)$ 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, $c \in R$ (D) none of these

9. If $f(x) = \int_x^{x^2} (t-1)\,dt$, $1 \le x \le 2$, 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 $f(x) = \frac{\ell nx}{\sqrt{x}}$ is

(A) $(-\infty, e)$ (B) $(-\infty, e^2)$ (C) $\left(-\infty, \frac{2}{e}\right]$ (D) $\left(-\infty, \frac{1}{e}\right)$

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 [.] 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 $y = \frac{\ell n x}{x^2}$. 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 asecx + bcosecx, 0 <a < b, 0 < x < π/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 sinx cos2x 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) πS (B) $2\pi S$ (C) $\sqrt{2}\pi S$ (D) $4\pi S$