

- On the interval  $[0, 1]$ , the function  $X^{25}(1-x)^{75}$  takes its maximum value at the point
  - 0
  - $\frac{1}{4}$
  - $\frac{1}{2}$
  - $\frac{1}{3}$
- The minimum value of the function  $f(x) = x \log x$  is
  - $-\frac{1}{e}$
  - $-e$
  - $\frac{1}{e}$
  - $e$
- Let the function  $f(x)$  be define as follows
 
$$f(x) = \begin{cases} x^3 + x^2 - 10x, & -1 \leq x < 0 \\ \cos x, & 0 \leq x < \frac{\pi}{2} \\ 1 + \sin x, & \frac{\pi}{2} \leq x \leq \pi \end{cases}$$
 then  $f(x)$ 
  - a local minimum at  $x = \frac{\pi}{2}$
  - a local maximum at  $x = \frac{\pi}{2}$
  - absolute minimum at  $x = -1$
  - absolute minimum at  $x = \pi$
- Suppose  $f(x) = \begin{cases} |x-1| + a & \text{if } x \leq 1 \\ 2x+3 & \text{if } x > 1 \end{cases}$ , if  $f(x)$  has a local minimum at  $x = 1$ , then which of the following is most appropriate -
  - $a \leq 5$
  - $a \geq 5$
  - $a \leq 0$
  - $a \geq 0$
- If the function  $f(x) = x^3 + 3(a-7)x^2 + 3(a^2-9)x - 2$  has a positive point of maximum, then the complete set of positive values of  $a$  is
  - $(3, 5]$
  - $(3, \frac{29}{7})$
  - $(2, 3]$
  - $(0, \infty)$
- Let  $f: (1, 3) \rightarrow \mathbb{R}$ , be a function defined by  $f(x) = \frac{x[x]}{1+x^2}$ , where  $[x]$ , denotes the greatest integer  $\leq x$ . Then the range of  $f$ , is
  - $(\frac{2}{5}, \frac{3}{5}] \cup (\frac{3}{4}, \frac{4}{5})$
  - $(\frac{2}{5}, \frac{1}{2}) \cup (\frac{3}{5}, \frac{4}{5}]$
  - $(\frac{2}{5}, \frac{4}{5}]$
  - $(\frac{3}{5}, \frac{4}{5})$
- If  $x = 1$  is a critical point of the function  $f(x) = (3x^2 + ax - 2 - a)e^x$ , then
  - $x = 1$  and  $x = -\frac{2}{3}$  are local minima of  $f$
  - $x = 1$  and  $x = -\frac{2}{3}$  is a local maxima of  $f$
  - $x = 1$  is a local maxima and  $x = -\frac{2}{3}$  is a local minima of  $f$
  - $x = 1$  is a local minima and  $x = -\frac{2}{3}$  are local maxima of  $f$
- The largest term in the sequence  $a_n = \frac{n^2}{n^3+200}$  is given by
  - $\frac{(400)^{2/3}}{600}$
  - $\frac{8}{89}$
  - $\frac{49}{543}$
  - $\frac{4}{89}$
- The set of values of  $b$  for which local extremum values of the function  $f(x) = \frac{2}{3}a^2x^3 - \frac{5a}{2}x^2 + 3x + b$  and maxima occurs at  $x = \frac{1}{3}$  is
  - $(-4, \infty)$
  - $(-\frac{3}{8}, \infty)$
  - $(-10, \frac{3}{8})$
  - None of these
- The volume of the largest possible right circular cylinder that can be inscribed in a sphere of radius  $\sqrt{3}$  is
  - $4\pi$
  - $\frac{4}{3}\sqrt{3}\pi$
  - $\frac{8}{3}\sqrt{3}\pi$
  - $2\pi$