Cluster Innovation Centre, University of Delhi, Delhi-110007

Examination : **End Semester Examination – March 2021**
Name of the Course : **B.Tech (Information Technology & Mathematical Innovations)**
Name of the Paper : **Seeing the world through Calculus: First steps through symbolic Mathematics**
Paper Code : **32861101**
Semester : **I**
Duration : **3 Hours**
Maximum Marks : **75**
Instructions:
This question paper contains six questions, out of which any four are to be attempted. Each question carries equal marks.

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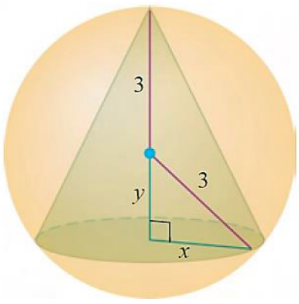
1. Find the length of curve $y = \frac{x^3}{24} + \frac{2}{x}$ from $x = 2$ to $x = 3$. Find a general formula for the length of the curve $y = Cx^n + Dx^{2-n}$ from $x = a$ to $x = b$ for $n(n-2) = \frac{1}{4CD}$.

2. A gun is fired with muzzle speed $v_0 = 700 ft/s$ at an angle of $\alpha = 25^0$. It overshoots the target by 60 ft. The target moves away from the gun at a constant speed of 10 ft/s. If the gunner takes 30 seconds to reload, at what angle should a second shot be fired with the same muzzle speed to hit the target?

3. According to the Poiseuille's law, the resistance to the flow of blood offered by a cylindrical blood vessel of radius 'r' and length 'x' is $R(r, x) = \frac{cx}{r^4}$, for a constant $c > 0$. A certain blood vessel in the body is 8 cm long and has a radius of 2 mm. Estimate the percentage change in R when 'x' is increased by 3% and 'r' is decreased by 2%.

4. Find the volume of the largest right circular cone that can be inscribed in a sphere of radius 3.



5. Find constant A,B,C, and D that guarantee that the graph of $f(x) = 3x^4 + Ax^3 + Bx^2 + Cx + D$ will have horizontal tangents at (2, -3) and (0, 7). There is a third point that has a horizontal tangent. Find this point. Then, for all three points, determine whether each corresponds to a relative maximum, a relative minimum, or neither.

6. Find the volume of the solid formed by revolving the region bounded by $y = x, y = 2x$, and $y = 1$ about the y-axis.