Faculty: Dr. Chandhini G **Problem Sheet 3 - Programs (Deadline 12.04.2018)**

1. The particle starts at a rest on a smooth inclined plane whose angle θ is changing at a constant rate $\frac{d\theta}{dt} = \omega < 0$. At the end of t seconds position of the object is given by $x(t) = \frac{g}{2\omega^2}\left(\frac{e^{\omega t} - e^{-\omega t}}{2} - \sin \omega t\right)$. Suppose the particle has moved 1.7 ft in 1 second. Find, to 10^{-5} accuracy, the rate ω at which θ changes. Assume $g = -32.17\ ft/s^2$.

2. The sum of two numbers is 20. If each number is added to its square root, the product of the sums is 155.55. Determine the two numbers to within 10^{-4}.

3. Determine, to within 10^{-6} accuracy, the length of the graph of ellipse with equation $4x^2 + 9y^2 = 36$ using (a) Trapezoidal rule, (b) Simpson's $1/3^{rd}$ rule. (Choose n appropriately in advance! How?)

4. The forces on the bridge truss is assumed to satisfy the following equations:
$-F_1 + \frac{\sqrt{2}}{2} f_1 + f_2 = 0; \quad \frac{\sqrt{2}}{2} f_1 - F_2 = 0; \quad -\frac{\sqrt{2}}{2} f_1 + \frac{\sqrt{3}}{2} f_4 = 0; \quad -\frac{\sqrt{2}}{2} f_1 - f_3 - \frac{1}{2} f_4 = 0;$
$-f_2 + f_5 = 0; \quad f_3 - 10,000 = 0; \quad -\frac{\sqrt{3}}{2} f_4 - f_5 = 0; \quad \frac{1}{2} f_4 - F_3 = 0$
Solve above 8 equations using 1) Jacobi, 2) Gauss-Siedel and 3) SOR methods ($\omega = 1.25$). Take error tolerance as 10^{-3} with $\|.\|_\infty$ norm on the two consecutive iterate values of the vector $[F_1, F_2, F_3, f_1, f_2, f_3, f_4, f_5]^T$.