Task 2

1. Solve the differential equation:

$$\frac{dy}{dx} + y - x + xy\cot x = 0, \quad x \neq 0$$

2. Solve the differential equation:

$$(x^2 + 3xy + y^2)\,dx - x^2\,dy = 0$$

   Given that $y = 0$ when $x = 1$.

3. Find the angle between the vectors

$$(\vec{a} + \vec{b}) \text{ and } (\vec{a} - \vec{b})$$

   if

$$\vec{a} = 2\hat{i} - \hat{j} + 3\hat{k}, \quad \vec{b} = 3\hat{i} + \hat{j} - 2\hat{k}.$$

   Also find a vector perpendicular to both.

4. Show that the lines

$$\frac{x-1}{3} = \frac{y-1}{-1} = \frac{z+1}{0}$$

   and

$$\frac{x-4}{2} = \frac{y}{0} = \frac{z}{-3}$$

   intersect. Find their point of intersection.

5. A committee of 4 students is selected from a group of 7 boys and 4 girls. Find the probability that the committee contains exactly 2 girls, given that at least one girl must be selected.