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1. Find the general solutions to differential equations

a) $y'' - 2y = x^2 - e^x$

b) $y'' - 4y' + 4y = e^{2x}$

2. Determine the unit tangent vector $\mathbf{T}(t)$ for the curve

$$\mathbf{r} = \cos t \sin t \mathbf{i} + \sin^2 t \mathbf{j} + \cos t \mathbf{k}.$$

3. Determine the length of the conical helix

$$\mathbf{r} = t \cos t \mathbf{i} + t \sin t \mathbf{j} + t \mathbf{k}$$

in the interval $0 \leq t \leq 2\pi$.

4. Determine the unit tangent vector, principal normal and the radius of curvature for the curve

$$x = 2 + \sqrt{2} \cos t, \quad y = 1 - \sin t, \quad z = 3 + \sin t$$

for all values of t .