1. The curves \( \mathbf{r}_1(t) = (5t - t^2, 2t + 1, -t - 2) \) and \( \mathbf{r}_2(s) = (s^2 - 45, s + 10, s + 4) \) intersect when:

(a) \( t = ? s = ? \)

**Solution:** Solve the linear equations \( 5t - t^2 = s^2 - 45 \), \( 2t + 1 = s + 10 \), and \( -t - 2 = s + 4 \). It is easy to find the solutions of \( 2t + 1 = s + 10 \), and \( -t - 2 = s + 4 \) are \( t = 1 \) and \( s = -7 \). These are also the solutions of \( 5t - t^2 = s^2 - 45 \).

(b) At the point:

**Solution:** Substitute \( \mathbf{r}_1(t) \) with \( t = 1 \). At the point: \( (4, 3, -3) \).

(c) These curves intersect at angle \( \theta = \)

**Solution:** To find the derivative first. The two vectors are \( \mathbf{r}_1'(1) = <3, 2, -1> \) and \( \mathbf{r}_2'(-7) = <-14, 1, 1> \). The angle is \( \cos^{-1}\left(\frac{<3, 2, -1> \cdot <-14, 1, 1>}{\sqrt{3^2 + 2^2 + (-1)^2} \sqrt{(-14)^2 + 1^2 + 1^2}}\right) = \cos^{-1}\left(\frac{-43}{\sqrt{198}}\right) \).