1. Given the region bounded by the curve \( y = -x^2 + 8x - 9 \) and the line \( y = x - 3 \). Set up the integral which when evaluated will be equal to the volume of the solid generated when this region is revolved about the line \( y = -5 \). Set up the integral which when evaluated will be equal to the volume of the solid generated when this region is revolved about the line \( x = 10 \).

\[
\Delta V = \pi \left[ \left( \frac{y_{\text{line}}}{y_{\text{para}}} + 5 \right)^2 - \left( \frac{y_{\text{line}}}{y_{\text{line}}} + 5 \right)^2 \right] \Delta x
\]

\[
\text{Vol} = \pi \int_{1}^{6} \left[ (-x^2 + 8x - 9)^2 - (x+2)^2 \right] dx
\]

Vol about \( x = 10 \)

\[
\text{Vol} = 2 \pi \int_{1}^{6} (10-x) \left[ (-x^2 + 8x - 9) - (x-3) \right] dx
\]

2. Evaluate the following limit

\[
\lim_{x \to 0} \frac{1 - \cos(5x)}{e^{4x} - 1 - 4x} = \lim_{x \to 0} \frac{5 \sin(5x)}{4 e^{4x} - 4} = \frac{5}{16}
\]

3. A chain weighs 3 pounds per foot. 150 feet of the chain hangs from the top of a tall building. There is a bucket on the end of the chain containing oil. As the bucket is raised the oil leaks from the bucket at the rate of \( \frac{5}{2} \) lbs per foot. The oil and bucket together weigh 500 lbs at the start. Find the work required to raise the bucket and chain from where 120 feet of the chain hangs from the top of the building to where 40 feet hangs from the top of the building.

\[
\Delta W = \text{Work to Raise the Bucket and Chain a distance of } \Delta y \text{ feet.}
\]

\[
\Delta W = \left[ 3(150-y) + (500 - \frac{5}{2} y) \right] \Delta y
\]

\[
\text{Work} = \int_{30}^{110} \left( 950 - \frac{11}{2} y \right) dy = 45,200 \text{ ft-lbs}
\]