1. a. \( < 4, -1, -5 > \cdot < 0, 11, -22 > = 99 \)
   b. \( < -\frac{2}{7}, \frac{3}{7}, -\frac{6}{7} > \)
   c. \( < 0, -22, -11 > \)
   d. \( \cos^{-1}\left(\frac{\sqrt{3}}{2}\right) = \frac{\pi}{6} \)
   e. \( V = |\mathbf{u} \cdot (\mathbf{v} \times \mathbf{w})| = 77 \)

2. \( x = 3 + 2t \)
   \( y = -3 - t \) (there are many possible "initial" points)
   \( z = 0 + t \)

3. \(-4x + 3y + 5z = 8\)

4. \( \mathbf{i} + \left(1 - \frac{\pi}{2}\right)\mathbf{j} + \frac{1}{4}\mathbf{k} \)

5. a. \( e^4 - \frac{1}{e^4} = \frac{e^8 - 1}{e^4} \)
   b. \( \kappa = \frac{|\mathbf{r}'(t) \times \mathbf{r}''(t)|}{|\mathbf{r}'(t)|^3} = \frac{|\mathbf{T}'(t)|}{|\mathbf{r}'(t)|} = \frac{\sqrt{2}}{(e^t + e^{-t})^2} \)

6. a. \( \frac{5}{5x+y^3} - 3x^2 \sec^2(x^3 + y) \)
   b. \( \frac{-15y^2}{(5x+y^3)^2} - 6x^2 \sec^2(x^3 + y) \tan(x^3 + y) \)
   c. \( \frac{30xy-3y^4}{(5x+y^3)^2} - 2 \sec^2(x^3 + y) \tan(x^3 + y) \)

7. a. \( f(3, 2) = 30 \)
   b. \( 4x + 63y - z = 108 \)