1. **Problem (15pts).**

Determine if the lines
\[
\begin{align*}
\frac{x - 1}{2} &= \frac{y - 2}{3} = \frac{z - 3}{4} \\
\frac{x + 1}{6} &= \frac{y - 3}{-1} = \frac{z + 5}{2}
\end{align*}
\]
are parallel, intersect, or are skew.

2. **Problem (15pts).**

Compute the length of the curve,
\[
x = t^2/2, \quad y = t^3/3,
\]
for \(0 \leq t \leq \sqrt{8}\).

3. **Problem (15pts).**

A constant force \(\vec{F} = 3\vec{i} + 5\vec{j} + 10\vec{k}\) moves an object along the line segment from \((1,0,2)\) to \((5,3,8)\). Find the work done if the distance is measured in feet and the force in lbs.

4. **Problem (20pts).**

Let \(\vec{a} = 2\vec{i} + 3\vec{j} - \vec{k}, \quad \vec{b} = -2\vec{i} + 3\vec{j} - \vec{k}\). Compute, \(\vec{a} \cdot \vec{b}, \quad \text{proj}_\vec{a}(\vec{b}), \quad \text{and} \quad \vec{a} \times \vec{b}\). Is the angle between the vectors \(\vec{a}\) and \(\vec{b}\) greater than or less than \(\pi/2\)? Explain.

5. **Problem (15pts).**

Find the equation of the plane that contains the point \((0,0,0)\) and the line \(x = 1 + t, \quad y = 2 + t, \quad z = 3 - t\).

6. **Problem (20pts).**

Let \(\vec{r}(t) = <t, t^2, t^3/3>\). Find the unit tangent vector, curvature and the tangent and normal components of the acceleration vector all at time \(t = 1\). (You are not required to find the normal vector.)
7. **Bonus Problem (10pts).**

Because of a stress fracture to her shin, Lindsay Vonn finds that when going at 40 \(ft/sec\) the smallest radius circle that she can travel in has a radius of 60 ft. Otherwise the centrifugal force is too great and her leg would break. At the fastest part of the ski run, she will be going 80 \(ft/sec\). What is the smallest radius circle that her leg can withstand while going \(80ft/sec\)? Explain.