

Homework 4

Problem 1. Calculate the arc length of the curve given parametrically by

$$x(t) = 2t^2, \quad y = \sqrt{3}t^4, \quad z = t^6$$

for $0 \leq t \leq 2$

Problem 2. Find the maximum curvature of the curve $\mathbf{r}(t) = \langle t, t, t^2 \rangle$.

Problem 3. Assume the acceleration of gravity is $10m/sec^2$ downwards. A cannon ball is fired at ground level. If the cannon ball rises to a height of 80 meters and travels a distance 240 meters before it hits the ground, what is the magnitude of the initial velocity in meter per second?

Problem 4. Let $\mathbf{r}(t) = \sqrt{2} \cos t \mathbf{i} + \sqrt{2} \sin t \mathbf{j} + t \mathbf{k}$. Using the parametric equations for the line tangent to the function at $t = \frac{\pi}{4}$ find the coordinates of the point where the tangent line intersects the xy -plane:

Problem 5. Find the unit tangent vector to the curve

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

at the point where $t = \pi/2$.