

MSLC Math 1172 Exam 3 Review (Parametric through Arc Length)

- Consider the set of parametric equations $x = 5t^3 + 1, y = \ln t, t > 0$.
 - Find its rectangular (Cartesian) equation.
 - Determine $\frac{dy}{dx}$ in terms of t .
 - Determine $\frac{dy}{dx}$ in terms of x .
 - Make a sketch of the curve. Label the direction as t increases. Label any horizontal or vertical tangent lines.
- Consider the curves $r = 1 - \sin \theta, r = 1 + \cos \theta$
 - Graph both curves
 - Find all the intersection points
 - Find the area of the region inside the cardioid $r = 1 + \cos \theta$ and outside the cardioid $r = 1 - \sin \theta$
- Find the Cartesian equation of the given polar equation $r - 3 \cos \theta = 0$
- Consider the two vectors $\mathbf{u} = \langle 2, 3, 1 \rangle$ and $\mathbf{v} = \langle 2, 4, -5 \rangle$
 - Find the angle between the vectors.
 - Find $\text{proj}_{\mathbf{v}} \mathbf{u}$
 - Express \mathbf{u} as the sum $\mathbf{u} = \mathbf{p} + \mathbf{n}$ where \mathbf{p} is parallel to \mathbf{v} and \mathbf{n} is orthogonal (perpendicular) to \mathbf{v} .
- Find the area of the triangle with vertices $A = (0, 1, 2), B = (6, 2, 1), C = (4, 0, 5)$
- Consider the pair of lines $\mathbf{r}(t) = \langle 4t, 1 + 2t, 3t \rangle$ and $\mathbf{R}(s) = \langle -1 + s, -7 + 2s, -12 + 3s \rangle$
 - Find the point of intersection.
 - Determine the equation of the line that is perpendicular to these two lines and passes through the point of intersection.
 - Determine the equation of the line that is parallel to $\mathbf{R}(s)$ and passes through $(0, 0, 0)$
- Re-parameterize the curve with respect to arc length, s , measured from the point where $t = 0$ in the direction of increasing t . $\mathbf{R}(t) = 2t\mathbf{i} + (1 - 3t)\mathbf{j}$
- Let $\mathbf{r}(t) = t\mathbf{i} + \cos t\mathbf{j} + \sin t\mathbf{k}, 0 \leq t \leq 4\pi$. Find the tangent line to $\mathbf{r}(t)$ at the point $(\pi, -1, 0)$.
- If the acceleration of a particle is $\mathbf{a}(t) = -9.8\mathbf{k}$ and the particle starts at the point $(1, 2, 3)$ with the initial velocity $\mathbf{v}(t) = \mathbf{i} + 2\mathbf{k}$, find $\mathbf{r}(t)$ and the speed of the particle for time t .
- What force is required so that a particle of mass m has position function $\mathbf{R}(t) = t^3\mathbf{i} + t^2\mathbf{j}$?