Section 11.4 Discussion Questions

1. What is the magnitude of the cross product of two parallel vectors?
2. What are two ways to find the magnitude of $\mathbf{u} \times \mathbf{v}$?

Section 11.5 Discussion Questions

1. Why is $\mathbf{r}(t) = \langle f(t), g(t), h(t) \rangle$ called a vector-valued function?
2. How do you determine whether $\mathbf{r}(t) = f(t)\mathbf{i} + g(t)\mathbf{j} + h(t)\mathbf{k}$ is continuous at $t = a$?
3. True or False? The line $\mathbf{r}(t) = \langle 3, -1, 4 \rangle + t\langle 6, -2, 8 \rangle$ passes through the origin.
4. True or False? Any two nonparallel lines in $\mathbb{R}^3$ intersect.

Section 11.6 Discussion Questions

1. Explain the geometric meaning of $\mathbf{r}'(t)$.
2. Consider the curve $\mathbf{r}(t) = \langle \sqrt{t}, 1, t \rangle$ for $t > 0$. Find all points on the curve at which $\mathbf{r}$ and $\mathbf{r}'$ are orthogonal.

Section 11.7 Discussion Questions

1. What is the relationship between the position and velocity vectors for motion on a circle?
2. True or False? If the speed of an object is constant, then its velocity components are constant.
3. True or False? If you double the initial speed of a projectile, its range also doubles (assume only gravity acts on the object).

Section 11.8 Discussion Questions

1. Suppose an object moves according to $\mathbf{r} = \langle f(t), g(t), h(t) \rangle$. Write the equation that allows you to find the distance the object travels between the times $t = a$ and $t = b$.

Section 11.9 Discussion Questions

1. Explain what it means for a curve to be parameterized by its arc length.
2. True or False? The vectors $\mathbf{T}$ and $\mathbf{N}$ at a point depend on the orientation of a curve.

3. True or False? If the speedometer of a car reads a constant 60 mi/hr, the car is not accelerating.

Proof Questions

1. (11.3) Show that $(\mathbf{u}+\mathbf{v}) \bullet (\mathbf{u}+\mathbf{v}) = |\mathbf{u}|^2 + 2\mathbf{u} \bullet \mathbf{v} + |\mathbf{v}|^2$

2. (11.4) Consider $\mathbf{u} \times \mathbf{u} = \mathbf{0}$. Prove the equation is true by using the determinant formulation of the cross product.

3. (11.6) If $\mathbf{r} = \langle at, bt, ct \rangle$, where $\langle a, b, c \rangle \neq \langle 0, 0, 0 \rangle$, show that the angle between $\mathbf{r}$ and $\mathbf{r}'$ is constant for all t.

4. (11.8) Consider the single variable equation $y = f(x)$. We can parameterize this equation using t to get: $x = t, y = f(t)$. Use the arc length equation for vector curves to derive the arc length formula for single variable equations.