Practice Test

Chapter 1 Name _____

Instructions. Show your work and/or explain your answers..

1. Find the length of each vector and the angle between them.

$$\mathbf{u} = \left\langle \sqrt{2}, \sqrt{6}, 2\sqrt{2} \right\rangle \qquad \text{and} \qquad \mathbf{v} = \langle 0, 0, 1 \rangle$$

2. Show that if $\mathbf{u}$ is perpendicular to $\mathbf{v}$, then

$$\|\mathbf{u}\|^2 + \|\mathbf{v}\|^2 = \|\mathbf{u} - \mathbf{v}\|^2$$

3. Find a number k for which $\mathbf{u} = \langle 1, 2, 1 \rangle$ is perpendicular to $\mathbf{v} = \langle k, 3, 4 \rangle$.

4. Find the area of the triangle whose vertices are $P_1(0, 0, 0)$, $P_2(1, 1, 0)$, $P_3(1, 1, 4)$.

5. Find the equation of the plane through the points $P_1(0, 0, 0)$, $P_2(2, 1, 5)$, and $P_3(-1, 1, 2)$.

6. Find the xy-equation and sketch the graph of the curve

$$\mathbf{r}(t) = \langle \cos(2t), \sin(t) \rangle, \quad t \text{ in } \left[0, \frac{\pi}{2}\right]$$

7. Find the cartesian equation of the parametric curve

$$\mathbf{r}(t) = \left\langle \sin^2(t), \cos(t) \right\rangle, \ t \ in \ [0, \pi]$$

   Then sketch the curve showing its orientation and its endpoints.

8. Find the velocity, speed, and acceleration of the curve with parametrization

$$\mathbf{r}(t) = \left\langle t, t^2, t^3 \right\rangle$$

9. If a rock is thrown into the air near the earth's surface with initial velocity $\mathbf{v}(0) = \langle 16, 0, 64 \rangle$ feet per second and initial position $\mathbf{r}(0) = \langle 0, 0, 6 \rangle$ feet, then what is the maximum height of the rock if air resistance is ignored?

10. The acceleration due to gravity is 12.2 feet per second per second at the surface of Mars. Find the position function $\mathbf{r}(t)$ of an object with initial velocity $\mathbf{v}_0 = \langle 30, 0, 40 \rangle$ and initial position $\mathbf{r}_0 = \langle 0, 0, 0 \rangle$.

11. Find the arclength and the unit tangent vector of the curve

$$\mathbf{r}(t) = \langle 3\sin(t), 5\cos(t), 4\sin(t) \rangle, \ t \ in \ [0, 2\pi]$$

12. Find the unit normal $\mathbf{N}$ for the curve

$$\mathbf{r}(t) = \left\langle \sin\left(t^3\right), t^3, \cos\left(t^3\right) \right\rangle$$

13. Find the arclength of the curve

$$\mathbf{r}(t) = \left\langle e^{2t}, t, 2e^{t} \right\rangle, \quad t \; in \; [0,1]$$

14. Find the length of the astroid

$$\mathbf{r}(t) = \left\langle \cos^3(t), \sin^3(t) \right\rangle, \quad t \; in \; [0, 2\pi]$$

15. Find the curvature of the curve

$$\mathbf{r}(t) = \langle \sin(t), \cos(t), \ln|\sec(t)| \rangle$$