MATH 146 Location & Motion Activity
Group 1

1. Eliminate the parameter to find a Cartesian equation of the curve, and sketch the curve. (Indicate direction of motion.)

$$x = -3\cos t, \quad y = 4\sin t, \quad 0 \le t \le \pi$$

2. If $\vec{u} = \langle 3, -2 \rangle$ and $\vec{v} = \langle -\frac{1}{2}, 4 \rangle$, find $|\vec{u} - 2\vec{v}|$.

3. Find a polar equation for the curve. What is the shape of the graph?

$$(x^2 + y^2)^2 = 2xy$$

4. Sketch the curve $r = 1 - \cos\theta$ and find the area that it encloses.

5. Find the coordinates of the highest point on the curve $x = \dfrac{1}{t^2 + 1}, \quad y = t^3 - 12t$.

6. Find an equation of the sphere that passes through the point $(5, 2, 0)$ and has center $(3, -1, -4)$.

MATH 146 Location & Motion Activity
Group 2

1. Show that the equation represents a sphere, and find its center and radius.

$$2x^2 + 2y^2 + 2z^2 - 4x + 8y + 12z = 3$$

2. If $\vec{u} = \langle 0, 2 \rangle$ and $\vec{v} = \langle 1, -5 \rangle$, find a unit vector with the same direction as $\vec{u} + \vec{v}$.

3. Find a Cartesian equation for the curve. Sketch the graph.

$$r^2 \sin 2\theta = 2$$

4. Find parametric equations for the path of a particle that moves along the circle $x^2 + y^2 = 4$ once counterclockwise, starting at $(-2, 0)$. $(0 \leq t \leq 2\pi)$

5. Sketch the curve $r = \cos 3\theta$ and find the area that it encloses.

6. Find $\dfrac{d^2y}{dx^2}$. For which values of t is the curve concave upward/downward?

$$x = \cos^3 t, \quad y = \sin^3 t, \quad -\frac{\pi}{2} < t < \frac{\pi}{2}$$

MATH 146 Location & Motion Activity
Group 3

1. Find an equation of the tangent line to the curve at the point $(4, -4)$.

$$x = t^2 + 2t + 5, \quad y = t - 3$$

2. Sketch the curve $r = \sin 4\theta$ and find the area enclosed by one loop.

3. Find a polar equation for the curve. What is the shape of the graph?

$$(x^2 + y^2)^{5/2} = 4xy(x^2 - y^2)$$

4. If $\vec{u} = 2\mathbf{i} - 6\mathbf{j}$ and $\vec{v} = 3\mathbf{i} + \mathbf{j}$, find a unit vector with the same direction as $\vec{u} + \vec{v}$.

5. Find an equation of the largest sphere with center $(4, 2, 6)$ that is contained in the first octant.

6. Eliminate the parameter to find a Cartesian equation of the curve, and sketch the curve. (Indicate direction of motion.)

$$x = t^6, \quad y = t^4, \quad t \leq 0$$

MATH 146 Location & Motion Activity
Group 4

1. Find parametric equations for the path of a particle that moves along the circle $x^2 + y^2 = 1$ three times clockwise, starting at $(1, 0)$. $(0 \leq t \leq 2\pi)$

2. Find the points on the curve where the tangent has slope equal to 1 or -1.

$$x = \cos^3 t, \quad y = \sin^3 t$$

3. Find an equation of the sphere that passes through the point $(-2, 3, 1)$ and has center $(-5, 0, 4)$.

4. Sketch the curves $r = 1 + \sin\theta$ and $r = 1$. Find the area of the region that lies inside the first curve and outside the second curve.

5. If $\vec{u} = \langle 3, -2, 1\rangle$ and $\vec{v} = \langle -2, 4, 0\rangle$, find $|\vec{u} + \frac{1}{2}\vec{v}|$.

6. Find a polar equation for the curve. What is the shape of the graph?

$$(x^2 + y^2)^2 = x^2 - y^2$$

MATH 146 Location & Motion Activity
Group 5

1. Find a polar equation for the curve. What is the shape of the graph?

$$(x^2 + y^2)^2 = 8xy$$

2. Find an equation of a sphere if one of its diameters has endpoints $(-2, 6, 7)$ and $(4, 2, -1)$.

3. If $\vec{u} = \frac{1}{3}\mathbf{i} - \mathbf{k}$ and $\vec{v} = 2\mathbf{i} + 3\mathbf{j} - 8\mathbf{k}$, find $|6\vec{u} - \vec{v}|$.

4. Sketch the curve $r = \cos 5\theta$ and find the area enclosed by one loop.

5. Eliminate the parameter to find a Cartesian equation of the curve, and sketch the curve. (Indicate direction of motion.)

$$x = e^{42t}, \quad y = e^{-42t}, \quad t \geq 0$$

6. Find the length of the curve. Use the fact that $\displaystyle\int_0^1 \sqrt{1 + t^2}\,dt = \frac{\sqrt{2}}{2} + \frac{1}{2}\ln(1 + \sqrt{2})$.

$$x = t\cos t, \quad y = t\sin t, \quad 0 \leq t \leq 1$$