Parametric equations and a parameter interval for the motion of a particle in the xy-plane are given. Identify the particle's path by finding a Cartesian equation for it. Graph the Cartesian equation. Indicate the portion of the graph traced by the particle and the direction of motion.

1) \( x = 4 \cos t, \ y = 4 \sin t, \ \pi \leq t \leq 2\pi \)

2) \( x = 2 \sin t, \ y = 3 \cos t, \ 0 \leq t \leq 2\pi \)
3) \( x = 25t^2, \ y = 5t, \ -\infty \leq t \leq \infty \)

Obtain the Cartesian equation of the curve by eliminating the parameter.
4) \( x = \sqrt{t}, \ y = 2t + 8 \)

5) \( x = 3\sqrt{t} - 7, \ y = 9\sqrt{8} - t \)

6) \( x = t^3 - 5t, \ y = t^2 - 5 \)
7) \(x = 9 \sin^2 t, \ y = 9 \cos^2 t; \ 0 \leq t \leq 2\pi\)

Find \(dy/dx\) without eliminating the parameter.

8) \(x = 5t^2, \ y = \sqrt{11} t^3; \ t \neq 0\)

9) \(x = 6 \tan t - 2, \ y = 4 \sec t + 3, \ t \neq \frac{(2n+1)\pi}{2}\)

10) \(x = \ln(2t), \ y = e^{2t}\)

11) \(x = 1/t^6, \ y = -3 + \ln t\)

Find \(d^2y/dx^2\) without eliminating the parameter.

12) \(x = 5t^2, \ y = \sqrt{10} t^3; \ t \neq 0\)
13) \( x = 1 - 2 \sin t, \quad y = 1 + 7 \cos t, \quad t \neq n\pi \)

14) \( x = \ln(2t), \quad y = \ln(8t)^3, \quad t > 0 \)

15) \( x = \frac{t^2}{2} + 8t, \quad y = \frac{t^2}{2} - 2t, \quad t \neq -8 \)

Find an equation for the line tangent to the curve at the point defined by the given value of \( t \).

16) \( x = \sin t, \quad y = 6 \sin t, \quad t = \frac{\pi}{3} \)

Find the length of the parametric curve defined over the given interval.

17) \( x = 6t - 6, \quad y = 12t + 1, \quad 0 \leq t \leq 1 \)
Find the area of the surface generated by revolving the curves about the indicated axis.

18) \( x = \sin t, \ y = 3 + \cos t, \ 0 \leq t \leq 2\pi; \ x\text{-axis} \)

19) \( x = t + \sqrt{6}, \ y = \frac{t^2}{2} + \sqrt{6}t, \ -\sqrt{6} \leq t \leq \sqrt{6}; \ y\text{-axis} \)

Change the given polar coordinates \((r, \theta)\) to rectangular coordinates \((x, y)\).

20) \((\sqrt{3}, \pi/6)\)

21) \((-4, -\pi/3)\)

Find a set of polar coordinates for the point for which the rectangular coordinates are given.

22) \((-5\sqrt{3}, 5)\)

A) \(\left(10, \frac{2\pi}{3}\right)\)  
B) \(\left(10, \frac{5\pi}{6}\right)\)  
C) \(\left(5, \frac{5\pi}{6}\right)\)  
D) \(\left(5, \frac{2\pi}{3}\right)\)
For the given rectangular equation, write an equivalent polar equation.
23) $x^2 + y^2 = 64$

24) $x^2 + y^2 - 10x = 0$

For the given polar equation, write an equivalent rectangular equation.
25) $r \cos \theta = 11$

26) $r = -9 \csc \theta$

27) $r = \frac{1}{7 \cos \theta - 3 \sin \theta}$

28) $r^2 \sin 2\theta = 24$
Find the area of the specified region.
29) Inside one leaf of the four-leaved rose $r = 3 \sin 2\theta$

Find the length of the curve.
30) The spiral $r = 5\theta^2$, $0 \leq \theta \leq 2\sqrt{3}$

Graph the polar equation.
31) $r = \frac{1}{1 - \sin \theta}$

Find an equation for the line tangent to the curve at the point defined by the given value of $t$.
32) $x = 6t^2 - 3$, $y = t^5$, $t = 1$
Obtain the Cartesian equation of the curve by eliminating the parameter.
33) \( x = \cos \theta, \ y = -4 \sin^2 \theta \)

34) \( x = 9 \sec t, \ y = 7 \tan t \)

Find the length of the curve.
35) The spiral \( r = e^{4\theta}, \ 0 \leq \theta \leq \pi \)

36) The circle \( r = 7 \cos \theta \)
Answer Key
Testname: MATH3B_HWCH10

1) \( x^2 + y^2 = 16 \)

Counterclockwise from \((-4, 0)\) to \((4, 0)\)

Objective: (10.1) Graph Parametric Equations and Eliminate the Parameter

2) \( \frac{x^2}{4} + \frac{y^2}{9} = 1 \)

Counterclockwise from \((0, 3)\) to \((0, 3)\), one rotation

Objective: (10.1) Graph Parametric Equations and Eliminate the Parameter
3) \( x = y^2 \)

Entire parabola, bottom to top (from fourth quadrant to origin to first quadrant)

**Objective:** (10.1) Graph Parametric Equations and Eliminate the Parameter

4) \( y = 2x^2 + 8 \)

**Objective:** (10.4) Convert Parametric Equations to Cartesian Equation I

5) \( \frac{x^2}{9} + \frac{y^2}{81} = 1 \)

**Objective:** (10.4) Convert Parametric Equations to Cartesian Equation I

6) \( x^2 = y^3 + 5y^2 \)

**Objective:** (10.4) Convert Parametric Equations to Cartesian Equation I

7) \( x + y = 9 \)

**Objective:** (10.4) Convert Parametric Equations to Cartesian Equation II

8) \( \frac{3\sqrt{11}}{10} t \)

**Objective:** (10.4) Find \( \frac{dy}{dx} \) Given Parametric Equations

9) \( \frac{2}{3} \sin t \)

**Objective:** (10.4) Find \( \frac{dy}{dx} \) Given Parametric Equations

10) \( 2t e^{2t} \)

**Objective:** (10.4) Find \( \frac{dy}{dx} \) Given Parametric Equations

11) \( -\frac{t^6}{6} \)

**Objective:** (10.4) Find \( \frac{dy}{dx} \) Given Parametric Equations

12) \( \frac{3\sqrt{10}}{100t} \)

**Objective:** (10.4) Find \( \frac{d^2y}{dx^2} \) Given Parametric Equations
13) $-\frac{7}{4}\sec^3 t$

Objective: (10.4) Find $d^2 y / dx^2$ Given Parametric Equations

14) 0

Objective: (10.4) Find $d^2 y / dx^2$ Given Parametric Equations

15) $\frac{10}{(t + 8)^3}$

Objective: (10.4) Find $d^2 y / dx^2$ Given Parametric Equations

16) $y = 6x$

Objective: (10.4) Find Equation of Tangent Given Parametric Equations

17) $6\sqrt{5}$

Objective: (10.4) Find Length of Parametric Curve I

18) $12\pi^2$

Objective: (10.4) Find Surface Area of Revolution

19) $\frac{248}{3}\pi$

Objective: (10.4) Find Surface Area of Revolution

20) $\left( \frac{3}{2}, \frac{\sqrt{3}}{2} \right)$

Objective: (10.5) Convert From Polar to Cartesian Coordinates

21) $(-2, 2\sqrt{3})$

Objective: (10.5) Convert From Polar to Cartesian Coordinates

22) B

Objective: (10.5) Convert From Cartesian to Polar Coordinates

23) $r = 8$

Objective: (10.5) Convert Cartesian Equation to Polar Form

24) $r = 10\cos \theta$

Objective: (10.5) Convert Cartesian Equation to Polar Form

25) $x = 11$

Objective: (10.5) Convert Polar Equation to Cartesian Form

26) $y = -9$

Objective: (10.5) Convert Polar Equation to Cartesian Form

27) $7x - 3y = 1$

Objective: (10.5) Convert Polar Equation to Cartesian Form

28) $y = \frac{12}{x}$

Objective: (10.5) Convert Polar Equation to Cartesian Form

29) $\frac{9\pi}{8}$

Objective: (10.5) Find Area of Region Inside Polar Curve
30) \( \frac{280}{3} \)

Objective: (10.5) Find Length of Polar Curve

31) 

Objective: (10.5) Graph Polar Equation II

32) \( y = \frac{5}{12}x - \frac{1}{4} \)

Objective: (10.4) Find Equation of Tangent Given Parametric Equations

33) \( y = -16x^2(1 - x^2) \)

Objective: (10.4) Convert Parametric Equations to Cartesian Equation II

34) \( \frac{x^2}{81} - \frac{y^2}{49} = 1 \)

Objective: (10.4) Convert Parametric Equations to Cartesian Equation II

35) \( \frac{\sqrt{17}}{4}(e^{4\pi} - 1) \)

Objective: (10.5) Find Length of Polar Curve

36) \( 7\pi \)

Objective: (10.5) Find Length of Polar Curve