1. (a) Find the STANDARD FORM equation of the conic that has its vertex at \((-1, 2)\) and its focus at \((-1, 0)\). (b) Graph this conic. (c) Find the equation of the directrix. (d) Label the vertex, focus, and directrix on your graph. (Be careful with your notation, and show your steps clearly.)

\(\underline{\text{a) Standard Form of conic:}}\)

\(\underline{\text{c) equation of directrix:}}\)
2.  (a) Find the *STANDARD FORM* equation of the conic that the following equation:
\[ y^2 + 6y + 8x + 25 = 0. \] (b) Graph this conic. (c) Find the vertex, focus, and directrix. (d) **Label** the vertex, focus, and directrix on your graph. (*Be careful with your notation, and show your steps clearly.*)

(a) Standard Form of conic: ____________________________________________

(c) vertex : ________________ focus : ________________

(c) equation of directrix : ________________________________
3. (a) Rewrite the equation of the conic \(9x^2 + 4y^2 + 36x - 24y + 36 = 0\) in STANDARD FORM. (b) Sketch a graph of this conic. (c) Find the center, foci, and vertices. (d) Label the center, foci, and vertices on your graph. (Be careful with your notation, and show your steps clearly.)

(a) Standard Form of conic:

(c) center : ___________________________  foci : ___________________________

   vertices : ___________________________
4. (a) Rewrite the equation of the conic $3x^2 - 2y^2 - 6x - 12y - 27 = 0$ in STANDARD FORM. (b) Sketch a graph of this conic. (c) Find the center, foci, vertices, and the equations of the asymptotes. (d) Label the center, foci, vertices, and the asymptotes on your graph. (Be careful with your notation, and show your steps clearly.)

(a) Standard Form of conic: 

(c) center: __________________________ foci: __________________________ 

vertices: __________________________ asymptotes: __________________________
5.  (a) Use a graphing utility to graph the curve represented by the following parametric equations: \[
\begin{align*}
  x &= t^3 \\
  y &= \frac{1}{2} t^2
\end{align*}
\]  
(b) Eliminate the parameter and write the corresponding rectangular equation. (Be careful with your notation, show orientation arrows on your curve, and show your steps clearly.)
6. (a) Use a graphing utility to graph the curve represented by the following parametric equations: 
\[
\begin{align*}
\begin{cases}
x = 4 + 2\cos(\theta) \\
y = -1 + 4\sin(\theta)
\end{cases}
\end{align*}
\]  
(b) Eliminate the parameter and write the corresponding rectangular equation in \textit{STANDARD FORM}. (c) State the center and vertices. (d) Label the center and vertices on your graph. (Be careful with your notation, show orientation arrows on your curve, and show your steps clearly.)

(b) Standard Form of conic:

(c) center : 
vertices :
7. (a) Use a graphing utility to graph the curve represented by the following parametric equations: 
\[
\begin{align*}
  x &= 4 \sec(\theta) \\
  y &= 3 \tan(\theta)
\end{align*}
\]
(b) Eliminate the parameter and write the corresponding rectangular equation in STANDARD FORM. (c) State the center and vertices. (d) Label the center and vertices on your graph. (Be careful with your notation, show orientation arrows on your curve, and show your steps clearly.)

(b) Standard Form of conic: __________________________

(c) center: __________ vertices: __________
8.  (a) Use a graphing utility to graph the curve represented by the following parametric equations: 
\[
\begin{align*}
x &= t + 1 \\
y &= t^2 + 3t
\end{align*}
\]
(b) Find \( \frac{dy}{dx} \).  (c) Find \( \frac{d^2y}{dx^2} \).  (d) Use \( \frac{dy}{dx} \) to find slope of the tangent line when \( t = -1 \).  (e) Use \( \frac{d^2y}{dx^2} \) to find the concavity of the curve when \( t = -1 \). (Be careful with your notation, show orientation arrows on your curve, use calculus to demonstrate your results, and show your steps clearly.)

(b) \( \frac{dy}{dx} = \)

(c) \( \frac{d^2y}{dx^2} = \)

(d) slope of the tangent line when \( t = -1 \):

(e) concavity of the curve when \( t = -1 \):
9.  (a) Use a graphing utility to graph the curve represented by the following parametric equations: \[ \begin{align*}
  x &= 2 \cos(\theta) \\
  y &= 2 \sin(\theta)
\end{align*} \]. (b) Find \( \frac{dy}{dx} \). (c) Find \( \frac{d^2y}{dx^2} \). (d) Use \( \frac{dy}{dx} \) to find slope of the tangent line when \( t = \frac{\pi}{4} \). (e) Use \( \frac{d^2y}{dx^2} \) to find the concavity of the curve when \( t = \frac{\pi}{4} \). (Be careful with your notation, show orientation arrows on your curve, use calculus to demonstrate your results, and show your steps clearly.)

(b) \( \frac{dy}{dx} = \)

(c) \( \frac{d^2y}{dx^2} = \)

(d) slope of the tangent line when \( t = \frac{\pi}{4} \):

(e) concavity of the curve when \( t = \frac{\pi}{4} \):
10. (a) Use a graphing utility to graph the curve represented by the following parametric equations:
\[
\begin{align*}
{x} &= t^2 - t - 2 \\
{y} &= t^3 - 3t
\end{align*}
\]
(b) Find \( \frac{dy}{dx} \). (c) Find all point(s) of horizontal tangency. (d) Find all point(s) of vertical tangency. (e) Label the point(s) of horizontal tangency and the point(s) vertical tangency on the curve. (Be careful with your notation, show orientation arrows on your curve, use calculus to demonstrate your results, and show your steps clearly.)

(b) \( \frac{dy}{dx} = \)

(c) point(s) of horizontal tangency:

(d) point(s) of vertical tangency:
11. (a) Use a graphing utility to graph the curve represented by the following parametric equations: 
\[ \begin{align*}
    x &= 4 + 2\cos(\theta) \\
    y &= -1 + \sin(\theta)
\end{align*} \]
(b) Find \( \frac{dy}{dx} \). (c) Find all point(s) of horizontal tangency. (d) Find all point(s) of vertical tangency. (e) Label the point(s) of horizontal tangency and the point(s) vertical tangency on the curve. (Be careful with your notation, show orientation arrows on your curve, use calculus to demonstrate your results, and show your steps clearly.)
12. (a) Use a graphing utility to graph the curve represented by the following parametric equations: 
\[ \begin{align*} 
  x &= 2t - t^2 \\
  y &= 2t^3 
\end{align*} \]
over the interval \(1 \leq t \leq 2\). (b) Write an integral that represents the arc length of this curve over the interval \(1 \leq t \leq 2\). (Do not attempt to evaluate this integral algebraically.) (c) Use the numerical integration capability of a graphing utility to approximate the value of this integral. Round your result to the nearest tenth. (Be careful with your notation, show orientation arrows on your curve, and show your steps clearly.)

(b) arc length integral = 

(c) arc length approximation \(\approx\)
13. (a) Use a graphing utility to graph the curve represented by the following parametric equations:
\[
\begin{align*}
  x &= t^2 \\
  y &= 2t
\end{align*}
\]
over the interval \(0 \leq t \leq 2\). (b) Write an integral that represents the arc length of this curve over the interval \(0 \leq t \leq 2\). (c) Use a table of integrals to complete the computation of this arc length integral, and the numerical integration capability of a graphing utility to approximate the value of this integral. Round your result to the nearest tenth. (Be careful with your notation, show orientation arrows on your curve, and show your steps clearly.)

(b) arc length integral =

(c) arc length approximation \(\approx\)
14. (a) Use a graphing utility to graph the curve represented by the following polar equation: 

\[ r(\theta) = 2\cos(\theta) \] 

over the interval \( 0 \leq \theta < \pi \). (b) Find \( \frac{dy}{dx} \). (c) Find all points of horizontal tangency. (d) Find all points of vertical tangency. (e) Label these points of horizontal tangency and the points of vertical tangency on the curve. (Be careful with your notation, show orientation arrows on your curve, use calculus to demonstrate your results, and show your steps clearly.)

(b) \( \frac{dy}{dx} = \) 

(c) point(s) of horizontal tangency:

(d) point(s) of vertical tangency:
15. (a) Use a graphing utility to graph the curve represented by the following polar equation:
\[ r(\theta) = 1 - \sin(\theta) \] over the interval \(0 \leq \theta < 2\pi\). (b) Find \( \frac{dy}{dx} \). (c) Find all points of horizontal tangency. (d) Find all points of vertical tangency. (e) Label these points of horizontal tangency and the points of vertical tangency on the curve. (Be careful with your notation, show orientation arrows on your curve, use calculus to demonstrate your results, and show your steps clearly.)

(b) \( \frac{dy}{dx} = \)

(c) point(s) of horizontal tangency:

(d) point(s) of vertical tangency:
16.  (a) Use a graphing utility to graph the curve represented by the following polar equation:
\[ r(\theta) = 6\sin(2\theta) \] over the interval \( 0 \leq \theta \leq 2\pi \). (b) Find the area of one petal of this curve.
(c) Shade the interior of the petal whose area you are computing. (Be careful with your notation, show orientation arrows on your curve, and show your steps clearly.)

(b) area of one petal of this curve = \________
17. (a) Use a graphing utility to graph the curve represented by the following polar equation:
\[ r(\theta) = 3\cos(3\theta) \] over the interval \( 0 \leq \theta \leq \pi \). (b) Find the area of one petal of this curve. (c) Shade the interior of the petal whose area you are computing. (Be careful with your notation, show orientation arrows on your curve, and show your steps clearly.)

(b) area of one petal of this curve = 

18. (a) Use a graphing utility to graph the curve represented by the following polar equation:
\[ r(\theta) = 1 + \sin(\theta) \] over the interval \( 0 \leq \theta \leq 2\pi \). (b) Find the arc length of this curve over the interval \( 0 \leq \theta \leq 2\pi \). (Be careful with your notation, show orientation arrows on your curve, and show your steps clearly.)

(b) arc length of this curve over the interval \( 0 \leq \theta \leq 2\pi = \)
19. (a) Use a graphing utility to graph the curve represented by the following polar equation: 
\[ r(\theta) = 2 - 2\cos(\theta) \] over the interval \( 0 \leq \theta \leq 2\pi \). (b) Find the arc length of this curve over the interval \( 0 \leq \theta \leq 2\pi \). (Be careful with your notation, show orientation arrows on your curve, and show your steps clearly.)

(b) Arc length of this curve over the interval \( 0 \leq \theta \leq 2\pi \) =