Ch 9 Review

In exercises 1-3:

a) Sketch the plane curve represented by the parametric equations on the given interval (indicate the orientation).
b) Find $\frac{dy}{dx}$.
c) Write the equation of the tangent line at the given value.
d) Find all points of horizontal and vertical tangency, if any.
e) Find $\frac{d^2y}{dx^2}$.
f) Discuss the concavity at the given value, if possible.
g) Find the arc length of the curve on the given interval.
h) Convert the parametric equation to rectangular form by eliminating the parameter.

1. $\begin{cases} x = \frac{1}{t} \\ y = t^2 \end{cases}$, $t = 1$, $\frac{1}{2} \le t \le 3$

2. $\begin{cases} x = 1 + 4t \\ y = 2 - 3t \end{cases}$, $t = 1$, $0 \le t \le 5$

3. $\begin{cases} x = 6\cos\theta \\ y = 6\sin\theta \end{cases}$, $\theta = \frac{\pi}{6}$, $0 \le \theta \le 2\pi$

In exercises 4-6

a) Find two other representations for the polar coordinates.
b) Convert the coordinates to rectangular coordinates.

4. $\left(2, \frac{\pi}{3}\right)$
5. $\left(-3, \frac{\pi}{2}\right)$
6. $\left(-1, -\frac{\pi}{6}\right)$

In exercises 7-8, convert the rectangular coordinates to polar coordinates.

7. $(-4, -4)$
8. $(-1, 3)$

In exercises 9-10, convert the polar equations to rectangular form.

9. $r = 3\cos\theta$
10. $r^2 = \cos 2\theta$

11. $r = 1 - 2\cos\theta$
    a) Sketch the polar curve.
    b) Write the equation(s) of the tangent line(s) at the pole.

In exercises 12-19,

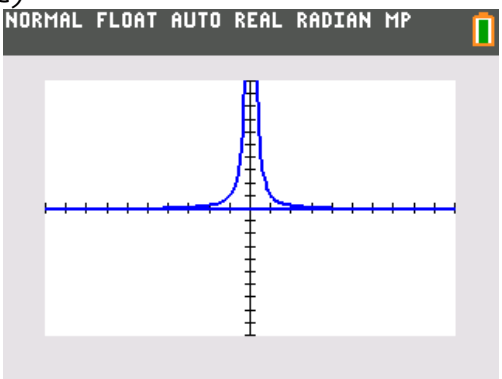
a) Sketch each curve.
b) Find all <u>points</u> of intersection, if applicable.
c) Find the area of the region described.

12. Interior of $r = 2 + \cos\theta$
13. Common interior of $r = 4\cos\theta$ and $r = 2$.
14. Interior of $r = 4\sin 3\theta$
15. Inner loop of $r = 3 - 6\sin\theta$
16. Outer loop of $r = 3 - 6\sin\theta$
17. Inside of $r = 3 + 2\cos\theta$ and outside of $r = 2$.
18. Common interior of $r = 1 + \cos\theta$ and $r = 1$.
19. Common interior of $r = 3 - \cos\theta$ and $r = 3 - \sin\theta$.

ODD ANSWERS

1.

a)



b) $-2t^3$

c) $y-1=-2(x-1)$

d) none

e) $6t^4$

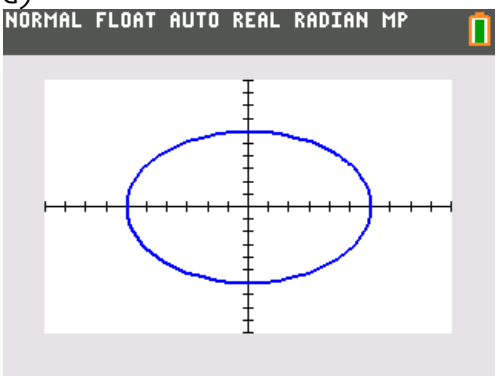
f) The curve is concave up at $t=1$.

g) 9.357

h) $y=\frac{1}{x^2}$

3.

a)



b) $-\cot\theta$

c) $y-3=-\sqrt{3}\left(x-3\sqrt{3}\right)$

d) Horizontal Tangents: (0, 6), (0, -6),
Vertical Tangents: (6, 0), (-6, 0)

e) $-\frac{1}{6}\csc^3\theta$

f) The curve is concave down at $\theta=\frac{\pi}{6}$.

g) 37.699

h) $x^2+y^2=36$

5.

a) (3, $\frac{3\pi}{2}$) or (3, $-\frac{\pi}{2}$)

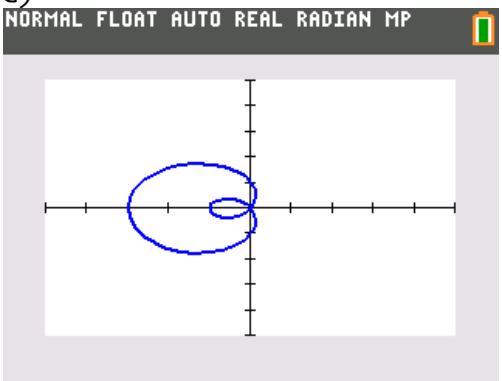
b) (0, -3)

7. $\left(4\sqrt{2},\frac{5\pi}{4}\right)$

9. $x^2+y^2=3x$

11.

a)



b) $y=\pm\frac{3}{\sqrt{3}}x$

13. 4.913

15. 4.892

17. 24.187