

# 1-4 Parametric Equations

## Learning Objectives:

I can graph a relation given by parametric equations

I can convert between parametric and Cartesian equations

I can find the inverse of a relation given in parametric equations

I can find the domain and range of a relation given in parametric equations

A parametric equation is a set of equations of the form:

$$x = f(t)$$

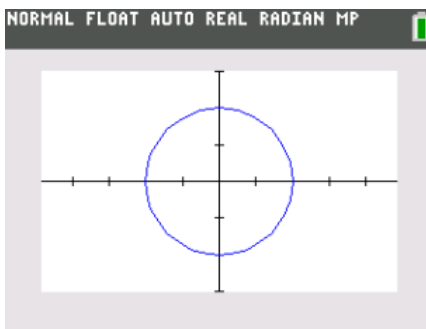
$$y = g(t)$$

over a set of  $t$ -values.  $t$  is the parameter.

### Ex1. Graph

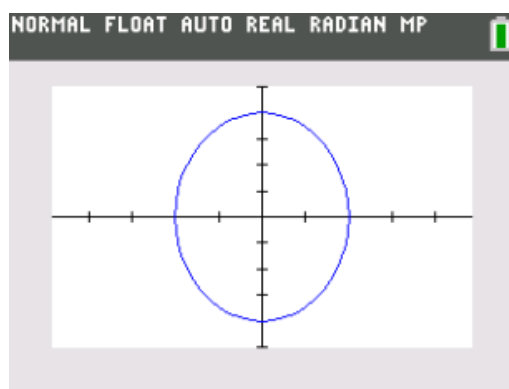
1.)  $x=2\cos(t)$        $y = 2 \sin(t)$

```
NORMAL FLOAT AUTO REAL RADIAN MP
Plot1 Plot2 Plot3
X1T 2cos(T)
Y1T 2sin(T)
X2T =
Y2T =
X3T =
Y3T =
X4T =
Y4T =
X5T =
```



2.)  $x = 2\cos(t)$        $y = 4 \sin(t)$

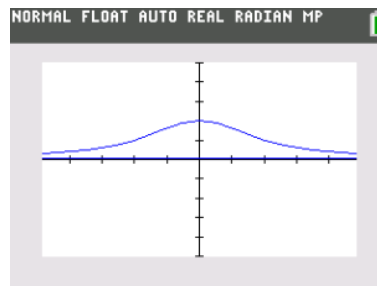
```
NORMAL FLOAT AUTO REAL RADIAN MP
Plot1 Plot2 Plot3
X1T 2cos(T)
Y1T 4sin(T)
X2T =
Y2T =
X3T =
Y3T =
X4T =
Y4T =
X5T =
```



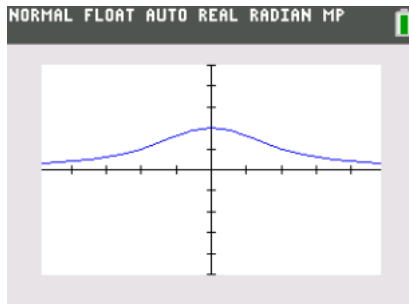
# do exploration #3 (in groups) on pg 33

```
NORMAL FLOAT AUTO REAL RADIAN MP
Plot1 Plot2 Plot3
0X1T 2(1/tan(T))
Y1T 2(sin(T))^2
X2T =
Y2T =
X3T =
Y3T =
X4T =
Y4T =
```

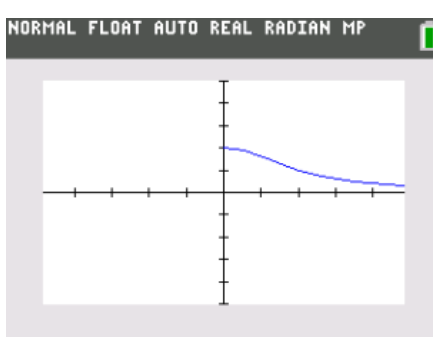
```
NORMAL FLOAT AUTO REAL RADIAN MP
WINDOW
Tmin=0
Tmax=3.141592654
Tstep=.13089969389958
Xmin=-4.829268293
Xmax=4.829268293
Xscl=1
Ymin=-5
Ymax=5
Yscl=1
```



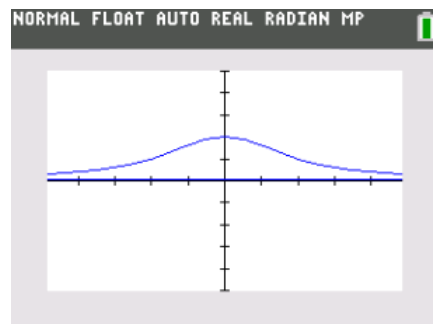
```
NORMAL FLOAT AUTO REAL RADIAN MP
WINDOW
Tmin=-1.570796327
Tmax=1.570796327
Tstep=.13089969389958
Xmin=-4.829268293
Xmax=4.829268293
Xscl=1
Ymin=-5
Ymax=5
Yscl=1
```



```
NORMAL FLOAT AUTO REAL RADIAN MP
WINDOW
Tmin=0
Tmax=1.570796327
Tstep=.13089969389958
Xmin=-4.829268293
Xmax=4.829268293
Xscl=1
Ymin=-5
Ymax=5
Yscl=1
```



```
NORMAL FLOAT AUTO REAL RADIAN MP
Plot1 Plot2 Plot3
0X1T -2(1/tan(T))
Y1T 2(sin(T))^2
X2T =
Y2T =
X3T =
Y3T =
X4T =
Y4T =
```



## Inverses

$$f(x) = \sin(x)$$

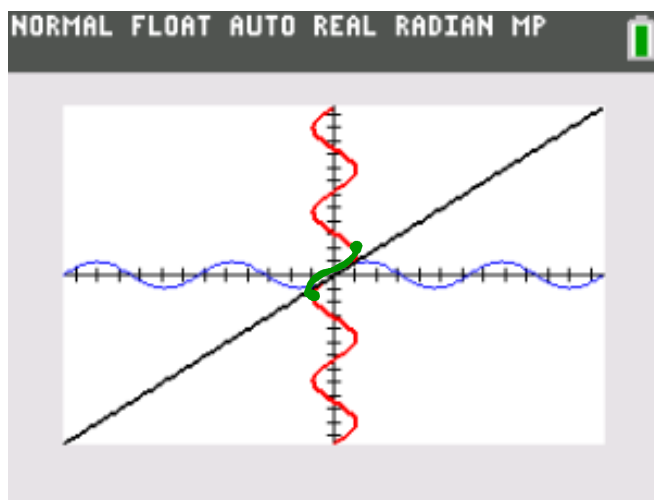
$$f^{-1}(x) = \sin^{-1}(x)$$

$$x = t$$

$$x = \sin t$$

$$y = \sin(t)$$

$$y = t$$



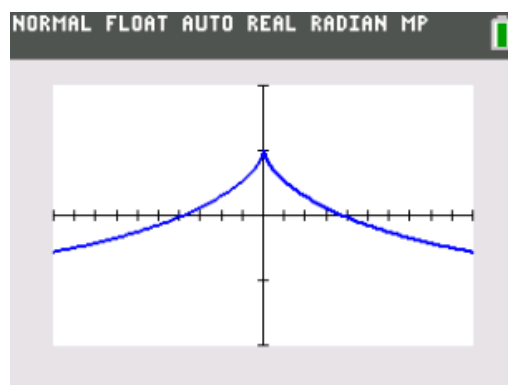
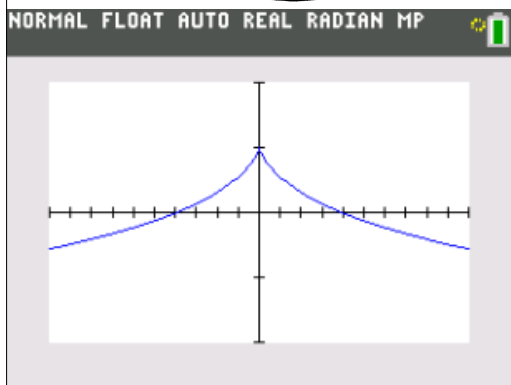
Ex2. Find the Cartesian equation for the parametric curve.

1.)  $x = t^3$

$y = \cos(t)$

$t = \sqrt[3]{x}$

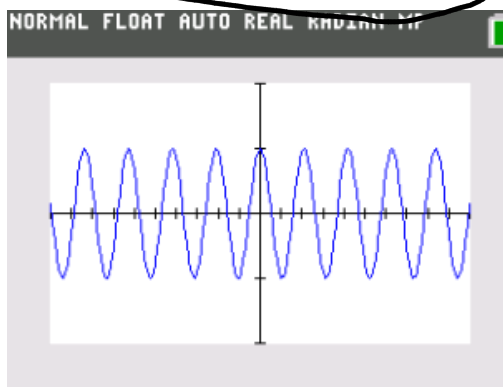
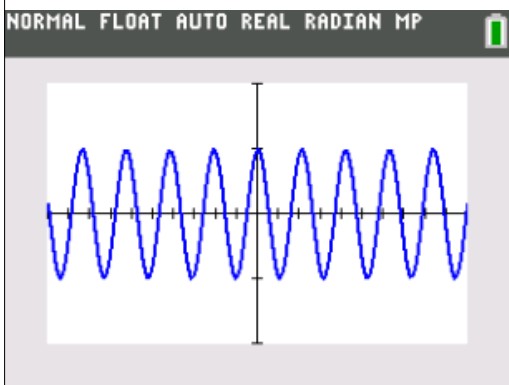
$y = \cos(\sqrt[3]{x})$



Ex3. Find the parametrization of the given Cartesian equations

1.)  $y = \cos(3x)$

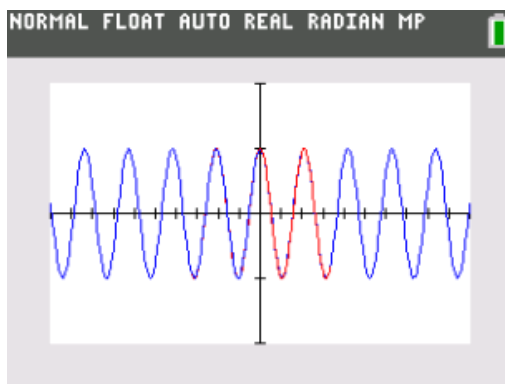
$x = t$   
 $y = \cos(3t)$  *easiest*



$t = 3x$



$x = t/3$   
 $y = \cos t$



2.) A line passing through (2, -1) and (5, 8)

$$\text{slope} = \frac{8 - (-1)}{5 - 2} = \frac{9}{3} = 3$$

$$y - y_1 = m(x - x_1)$$

$$y + 1 = 3(x - 2)$$

$$y = 3(x - 2) - 1$$

$$y = 3x - 7$$

$$\begin{aligned} x &= t \\ y &= 3t - 7 \end{aligned}$$

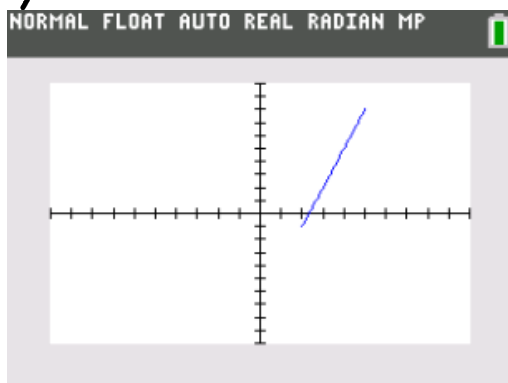


3.) A line segment with endpoints ~~(-1, 2)~~ and ~~(4, 7)~~ <sup>(2, -1)</sup> and <sup>(5, 8)</sup>

$$x = t$$

$$y = 3t - 7$$

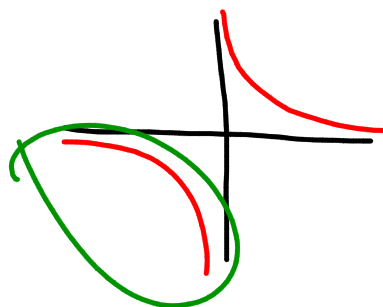
$$2 \leq t \leq 5$$



4.) The portion of the curve  $y = \frac{1}{x}$  that lies in the 3<sup>rd</sup> quadrant.

$$x = t \quad -\infty < t < 0$$

$$y = \frac{1}{t}$$



## Homework

pg 34 # 1-5, 7, 10, 14, 15, 20, 23-28,  
33, 34, 37-42

pg 535 # 1-6