Office Hrs Matt Tanzer: MW 1-2pm 739 Evans

## 10.1 Curves Defined By Parametric Equations

- parametric equations operate by a function of <u>time</u>.
  - make parametric curve.

**EXAMPLE 1**

$x = t^2 - 2t \qquad y = t + 1$

$t = y - 1$

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

$= y^2 - 2y + 1 - 2y + 2$

$x = y^2 - 4y + 3$

☆ there are also parametrics w/ limits.

**EXAMPLE 2/3**

$x = \cos(t) \qquad y = \sin(t) \qquad 0 \le t \le 2\pi$

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

→ same as

$x = \cos(2t) \qquad y = \sin(2t) \qquad 0 \le t \le 2\pi$

**EXAMPLE 4**

A circkle with center $(h,k)$ & radius $r$

$x = r\cos(t) + h \qquad y = r\sin(t) + k \qquad 0 \le t \le 2\pi$

EXAMPLE 5

$x = \sin(t)$ $\quad y = \sin^2 t$

$y = x^2$ ← parabola!!

EXAMPLE 6

$x = y^4 - 3y^2$

$y = t$ $\quad x = t^4 - 3t^2$ $\quad y = t$

cheat!

if $x = g(y)$

just graph $y = t$, $x = g(t)$

if $y = f(x)$

just graph $x = t$, $y = f(t)$

EXAMPLE 8

$x = a + \cos(t)$ $\quad y = a\tan(t) + \sin(t)$

→ conchoids of Nicomedes

10.1 Lecture (08/25/15)
- Div, Grid, Curl (rec. book)
- Dec 14 - Final 8am - 11am

It is important to note how a curve is traced out.

ex. $x = \sin(t)$ $y = \cos(t)$

vs.

$x = \cos(t)$ $y = \sin(t)$

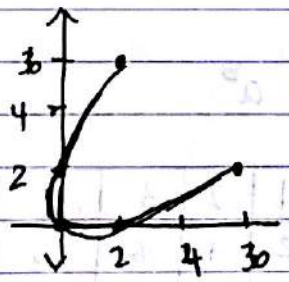
↳ these start @ diff points, but make same curve.

with a parameter restriction ($t \in [a, b]$), you get an initial & terminal point.

★ $\forall t$ = "for all t"

exercise!

$x = t^2 + t$ , $y = t^2 - t$ $t \in [-2, 2]$




★ it dips below!

| t | x | y |
|---|---|---|
| -2 | 2 | 6 |
| -1 | 0 | 2 |
| 0 | 0 | 0 |
| 1 | 2 | 0 |
| 2 | 6 | 2 |

$x - y = 2t$ , $x + y = 2t^2$

$(x-y)^2 - 2(x+y) = 0$

⬇

$x^2 - 2xy + y^2 - 2x - 2y = 0$

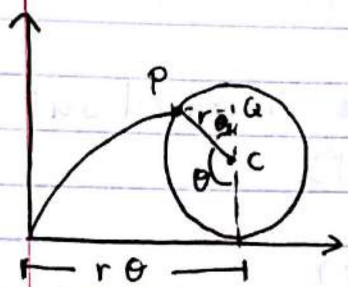
parabola

$B^2 - 4AC = (-2)^2 - 4 \cdot 1 \cdot 1 = 0$

$\cot(2\theta) = \frac{C - A}{B} = 0 = \frac{\pi}{4}$

(45°) rotation

exercise 39




$\theta_2 = \pi - \theta$

$C = (r\theta, r)$

$P = (r\theta - PQ)$

$Q = ( \quad , r - r\cos\theta)$ ← y

Yah! Geometry!

$PQ = r\theta + r\sin(\pi - \theta)$

$= r(\theta - \sin\theta)$ ← x

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what's bigger?

$e^{\pi}$ or $\pi^{e}$ ?

$(2.7)^{3.14}$ $(3.14)^{2.7}$

↳ $a^b$

| a \ b | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 2 | 2 | 4 | 8 | 16 |
| 3 | 3 | 9 | 27 | 81 |
| 4 | | | | |

13
128
× 4
512

256
× 4
512

$1^{10} = 1$ $2^{10} = 1048$ $3^{10} =$ $4^{10}$

$10^1 = 10$ $10^2 = 100$ $10^3 = 1000$ $10^4 = 10{,}000$

$1^9 = 1$ $2^5 = 32$ $3^5 = 243$ $4^5$ 1048

$5^1 = 5$ $5^2 = 25$ $5^3 = 125$ $5^4 = 625$

as result of this trend, $e^{\pi}$ is larger.