## TOPIC: WRITING PARAMETRIC EQUATIONS

### Parameterize Equations

◆ Often you'll be given an eq'n with only $x$ & $y$ and be asked to write $x(t)$ & $y(t)$ → **"parameterize"**.

- ***Choose*** a $t$ (avoid domain restrictions), solve for $x(t)$, then _____ into original eq'n to find $y(t)$.

**Recall — Eliminate the Parameter**

$$\left.\begin{aligned} x(t) &= t - 1 \\ y(t) &= 4t \end{aligned}\right\} \; y = 4(x+1)$$

**New — Parameterize Equations**

$$y = 4(x+1) \;\Leftrightarrow\; \begin{cases} t = \\ x(t) = \\ y(t) = \end{cases} \quad \text{OR} \quad \begin{cases} t = \\ x(t) = \\ y(t) = \end{cases}$$

**TRY**
$t = x$
$t = \# \cdot x,$
$t = x \pm \#$

**AVOID**
$t = \# \cdot x^2$
$t = \sqrt{x}$

**EXAMPLE** Without choosing $x(t) = t$, find parametric equations for the rectangular equation.

$(\boldsymbol{A})$

$$y = 2x + 5$$

$t = x + 1$

$(\boldsymbol{B})$

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

**HOW TO: Parameterize Equations**

**1)** Define $t$, unless given
*Try $t = x$, or $t =$ (___) if () in eq'n*

**2)** Solve for $x(t)$

**3)** Plug $x(t)$ into original eq'n for $x$

**4)** Solve for $y(t)$

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**EXAMPLE** Write two sets of parametric equations for the rectangular eq'n below.

$$y = 2x^3$$

**HOW TO: Parameterize Equations**

**1)** Define $t$, unless given

*Try $t = x$, or $t =$ (___) if () in eq'n*

**2)** Solve for $x(t)$

**3)** Plug $x(t)$ into original eq'n for $x$

**4)** Solve for $y(t)$

## TOPIC: WRITING PARAMETRIC EQUATIONS

### Equations of Circles and Ellipses

◆ To parameterize an eq'n containing $x^2 + y^2$, write the eq'n in the form (_____)$^2$ + (_____)$^2 = 1$.

- Set $f(x)^2 =$ _____$(t)$, and $g(y)^2 =$ _____$(t)$, then solve for $x$ & $y$.

**Recall — Eliminate the Parameter**

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

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

$$\left(\frac{x}{2}\right)^2 + y^2 = 1$$

**New — Parameterize Equations**

$$\left(\frac{x}{2}\right)^2 + y^2 = 1$$

$x(t) =$

$y(t) =$

**EXAMPLE** Write parametric equations for the equation below.

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

**HOW TO: Parameterize Equations**

**1)** Write eq'n as $f(x)^2 + g(y)^2 = 1$

**2)** Set $f(x)^2 = \cos^2(t)$, solve for $x(t)$

**3)** Set $g(y)^2 = \sin^2(t)$, solve for $y(t)$

## TOPIC: WRITING PARAMETRIC EQUATIONS

**PRACTICE** Write parametric equations for the rectangular equation below.

$$x^2 + y^2 = 25$$

**HOW TO: Parameterize Equations**

**1)** Write eq'n as $f(x)^2 + g(y)^2 = 1$

**2)** Set $f(x)^2 = \cos^2(t)$, solve for $x(t)$

**3)** Set $g(y)^2 = \sin^2(t)$, solve for $y(t)$