MA205 – LSN 17
Parametric Equations

“6 is afraid of 7, cause 7 8 9.."

- Barenaked Ladies

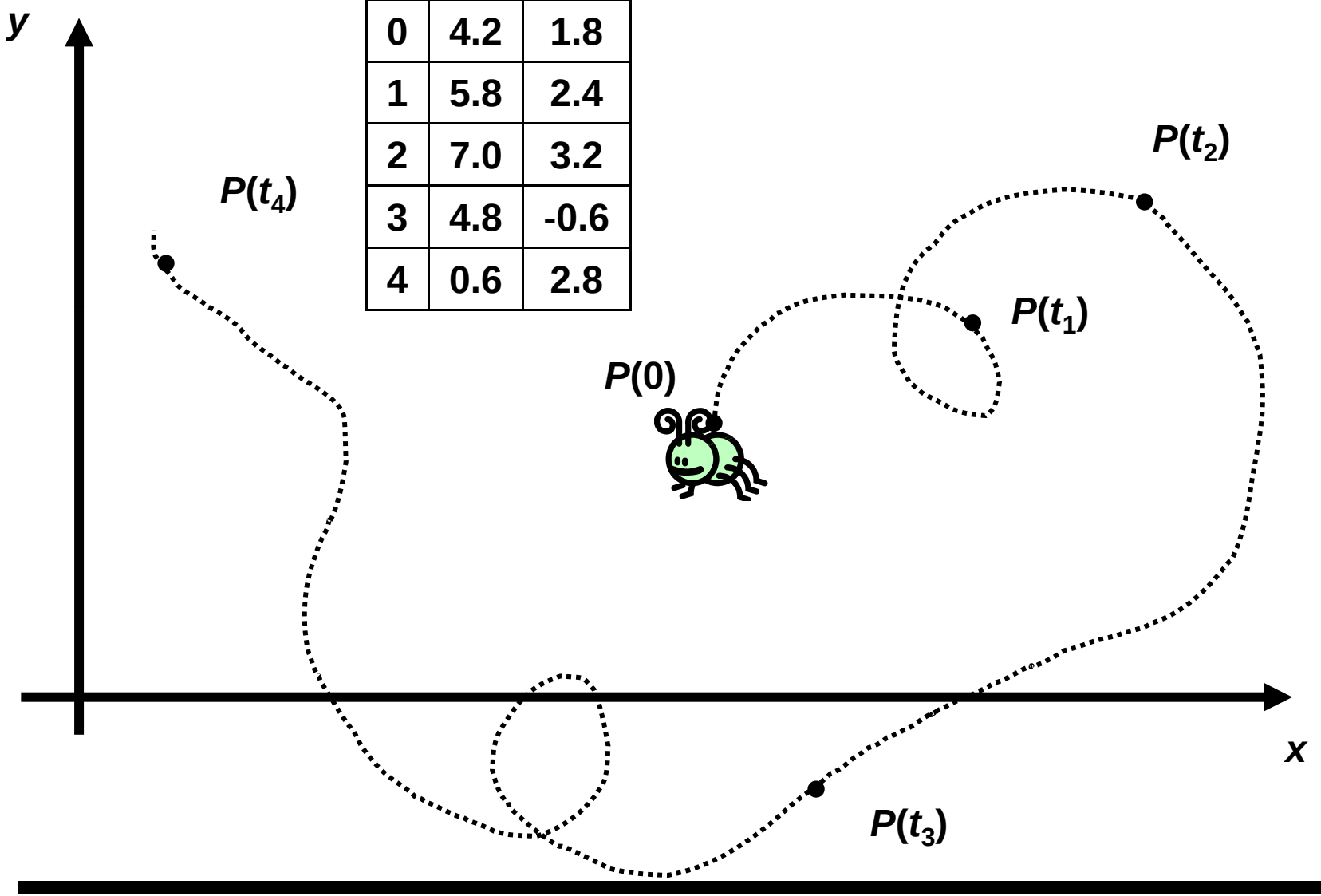
Objectives

- **Understand what a parametric equation represents.**
- **Convert cartesian equations to parametric equations.**
- **Convert parametric equations to cartesian equations.**
- **Represent parametric functions in vector form.**

Parametric Equations

- **The representation of a curve by its x-coord, y-coord and z-coord in terms of another parameter.**

t	x	y
0	4.2	1.8
1	5.8	2.4
2	7.0	3.2
3	4.8	-0.6
4	0.6	2.8



When would we need parametric equations?

- **Model Behavior**
- **Curves that do not pass the “Vertical Line Test”**

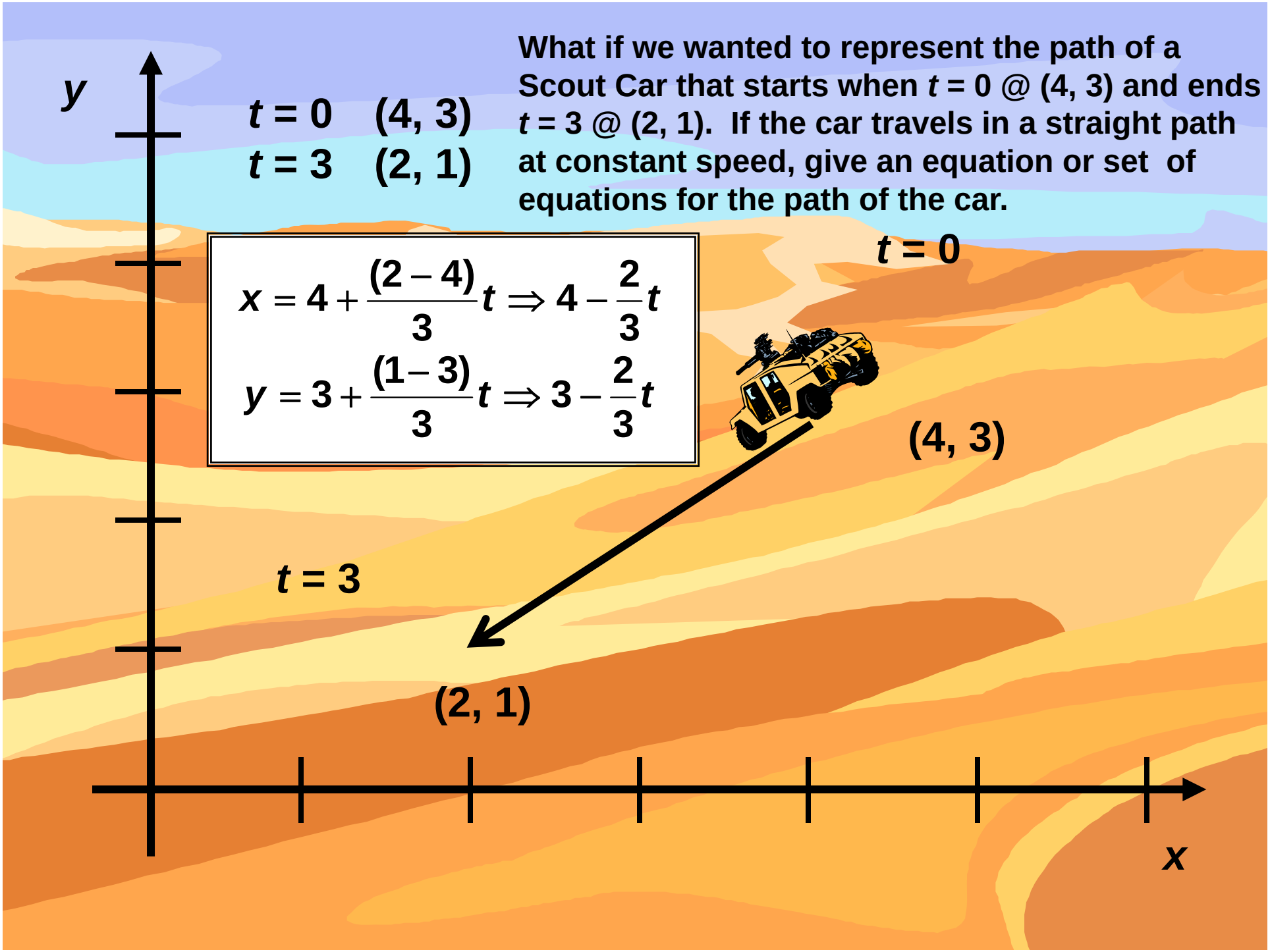
What if we wanted to represent the path of a Scout Car that starts when $t = 0$ @ (4, 3) and ends $t = 3$ @ (2, 1). If the car travels in a straight path at constant speed, give an equation or set of equations for the path of the car.

$t = 0 \quad (4, 3)$

$t = 3 \quad (2, 1)$

$$x = 4 + \frac{(2-4)}{3}t \Rightarrow 4 - \frac{2}{3}t$$

$$y = 3 + \frac{(1-3)}{3}t \Rightarrow 3 - \frac{2}{3}t$$



How would we transform a circle into a parametric equation?

Given $x^2 + y^2 = 36$

Use the Trig Identity: $\sin^2 t + \cos^2 t = 1$

$$\frac{x^2}{36} + \frac{y^2}{36} = \frac{36}{36} \Rightarrow \frac{x^2}{36} + \frac{y^2}{36} = 1 \Rightarrow \left(\frac{x}{6}\right)^2 + \left(\frac{y}{6}\right)^2 = 1$$

$$\frac{x}{6} = \sin t, \frac{y}{6} = \cos t$$

$$x = 6\sin t, y = 6\cos t$$

Parametric → Cartesian

Given: $x = t^2 + 1$

$y = t - 1$

Solve: $t = y + 1$

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

$x = y^2 + 2y + 1 + 1$

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

Summary

- **Use parametric equations for a curve not given by a funtion.**
- **Use parametric equations to describe paths.**
- **Each coordinate requires one function.**
- **The parameter may be time, angle or something else altogether.**