

# **Math 242 Lab 12**

# **Polar Coordinates**

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# Lab Assignment

- Complete ALL Lab Assignment Questions (with codes, computation results for questions from page 3~4)
- Submit “lastnameLab12.nb” and “lastnameLab12.pdf” (**File->Save As → pdf**) on Canvas
- Deadline: **Tomorrow 11:59pm**
- Correct computation results (without codes) are available on Canvas  
→ Files → Lab → Lab\_12\_Polar Coordinates → lab12\_examples\_hints

# PolarPlot

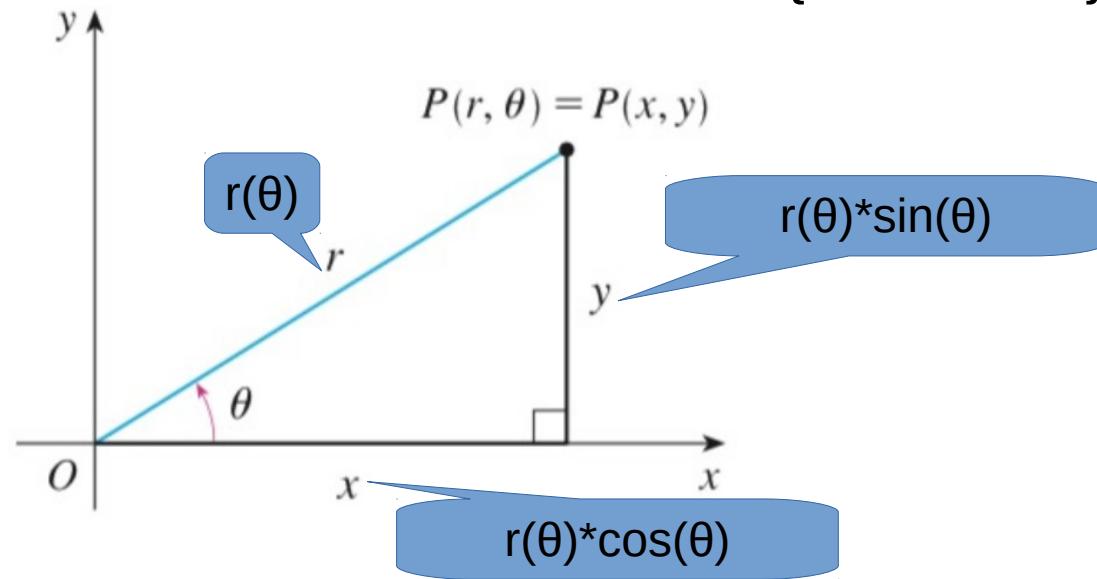
- **Syntax:** `PolarPlot[r[theta], {theta, thetamin, thetamax}]`
- `r[theta] = Sin[5*theta]`
- `PolarPlot[r[theta], {theta, 0, Pi}]`  
OR
- `PolarPlot[Sin[5*theta], {theta, 0, Pi}]`  
OR
- `PolarPlot[Sin[5*t], {t, 0, Pi}]`

# Polar Coordinates (r,theta)

# Cartesian coordinates (x,y)

- $r[\text{theta}_\perp] = \text{Log}[\text{theta} + 1]$
- $\text{PolarPlot}[r[\text{theta}], \{\text{theta}, 0, 7\pi\}]$

- $x[\text{theta}_\perp] = r[\text{theta}] * \text{Cos}[\text{theta}]$
- $y[\text{theta}_\perp] = r[\text{theta}] * \text{Sin}[\text{theta}]$
- $\text{ParametricPlot}[\{x[\text{theta}], y[\text{theta}]\}, \{\text{theta}, 0, 7\pi\}]$



# Manipulate(from Lab 11)

Optional

- **Syntax:** Manipulate[ **(expression)**, {**parameter**, min, max, **increment**} ]
- Manipulate[ParametricPlot[{r\*Cos[t], Sin[t]}, {t, 0, 2\*Pi}], {r, 0, 10, .01}]
- In this example,  
for “**ParametricPlot**”, the parameter (variable) is “**t**”;  
for “**Manipulate**”, the parameter is “**r**”.

# Manipulate

- Manipulate[

```
ParametricPlot[
```

```
{x[theta], y[theta]}, {theta, 0, tstop}, PlotRange -> {-3.2, 3.2}],
```

```
{tstop, 0.1, 7*Pi}
```

```
]
```

- In this example,

Start from 0.1 to avoid  
ParametricPlot[..., {t, 0, 0}]

- for “**ParametricPlot**”, the parameter (variable) is “**theta**”;
- for “**Manipulate**”, the parameter is “**tstop**”.

# Arc Length and Area

- Example:

$$r = \frac{4}{1 - \sin(\theta)}, \text{ for } 0 \leq \theta \leq \pi/4$$

- $r[\theta] = 4/(1 - \sin[\theta]);$
- **Arc Length:**  $L = \int_a^b \sqrt{r(\theta)^2 + r'(\theta)^2} d\theta.$
- `Integrate[Sqrt[r[theta]^2 + r'[theta]^2], {theta, 0, Pi/4}] // N`
- **Area:**  $A = \frac{1}{2} \int_a^b r^2 d\theta.$
- `(1/2)*Integrate[r[theta]^2, {theta, 0, Pi/4}] // N`

# Wrong

- `2pi`
- `cos(t)`
- `sin(theta)`
- `Polarplot[...]`
- `Parametricplot[...]`

# Correct

- `2Pi`
- `Cos[t]`
- `Sin[theta]`
- `PolarPlot[...]`
- `ParametricPlot[...]`