**Colorado Technical University**

 **Course:** MATH207 – Integral Calculus

#### Unit 9 Part 18 Readings: Polar Calculus

**Polar Derivatives**

Find the slope of a polar curve

Remember, a slope will be: $\frac{dy}{dx}$

x = r cos(θ)

Use: r = ƒ(θ)

Then: x = ƒ(θ) cos(θ)

So: $\frac{dx}{dθ}$ = ƒ ’(θ) cos(θ) - ƒ(θ) sin(θ)

 = $\frac{dr}{dθ}$ cos(θ) - r sin(θ)

And: y = r sin(θ)

Then: y = ƒ(θ) sin(θ)

So: $\frac{dy}{dθ}$ = ƒ ’(θ) sin(θ) + ƒ(θ) cos(θ)

 = $\frac{dr}{dθ}$ sin(θ) + r cos(θ)

So: $\frac{dy}{dx}$ = $\frac{dy/dθ}{dx/dθ}$ = $\frac{\frac{dr}{dθ} sin(θ) + r cos(θ) }{\frac{dr}{dθ} cos(θ) - r sin(θ) }$

**Polar Integrals**

Can we find areas enclosed by polar curves?

Note that I said “enclosed by” instead of “under”

These problems work a little differently for

polar coordinates

You need to know which part of the graph you want to find

the area of – the inner loop? The outer loop?

https://www.geogebra.org/m/jhKUc6Hm

will let you see where the graph starts and which

way it goes

 this will be necessary for the limits of the integral

The formula for finding this area is: A = *∫*αβ 1/2 r2 dθ

Notice that we use r in the integral instead of ƒ(θ)



**Area Between Two Polar Curves**

The formula for finding this area is: A = ∫αβ 1/2 (router2 - rinner2) dθ

It’s hugely critical to get the “inner” and “outer” right!

The limits will be where you need this