**Colorado Technical University**

 **Course:** MATH207 – Integral Calculus

**Unit 4 Part 07 Readings: Surface Area and Growth Models**

**Surface Area**

**Arc (Curve) Length -** to determine the length of a continuous

function y=ƒ(x) on the interval [a,b]:

1) divide the interval up into equal subintervals each

of width Δx

 2) approximate the curve by a series of straight lines

connecting the points

 3) the length of the curve can be estimated by the sum

of the lengths of the lines

The length of each line is: $\sqrt{\left(x\_{i}-x\_{i-1}\right)2+\left(y\_{i}-y\_{i-1}\right)2} $ =$\sqrt{Δx2+Δy2}$

As Δx→0, the length of the curve “S” becomes: S = *∫* ab $\sqrt{1+(dy/dx)2}$ dx

The **surface area of a solid of revolution** follows a similar pattern, but we rotate the lines around the appropriate axis

These rotated sections are called “**frustums**”



The surface area of a frustum is: A = 2πrL

where r=½(r1+r2)

r1 = radius of right end

r2 = radius of left end

and L is the length of the frustum

The surface area over the interval is: S = *∫*ab 2πy ds

where ds = $\sqrt{1+(dy/dx)^{2}}$ dx

for rotations around the x-axis

And S = *∫*cd 2πx ds

where ds = $\sqrt{1+(dx/dy)^{2}}$ dy

for rotations around the y-axis

**Units:**

What are the units for the area problems? Units squared

What are the units for the volume problems? Units cubed

**Growth Models**

Exponential Models Logarithmic Models



Start slow then speed up Start fast then slow down

Compound Interest: A = P(1+r/n)nt

A = accumulated value

P = the principal amount of money

t = years

r = annual percentage rate (in decimal form)

n = compounded n times per year

Population Growth: A = A0 ekt

 A = amount at time t

 r = growth rate

 A0 = original amount

 if k > 0 then the population is growing

 if k < 0, then the population is shrinking

Logistic Growth (growth within a limit): A = c/ (1+ ae-bt)

 c > 0

 b > 0

as time t increases:

ae-bt approaches 0

A gets closer to the limit c

Min + (Max-Min)/(1+e^(-rate\*(day-inflexion pt)))

