Unit 6: Integration and Accumulation of Change (Differentials, Slope Fields, and Euler's)

Verifying Solutions for Differential Equations

Differential Equations are equations where both x & y can be integrated/anti-differentiated. Both x & y may be expressions of their own.

Ex: A bacterial colony on the surface of a piece of chin started to grow exponentially at 2 AM. At the time, there were 233 bacterial on it. At 5 AM, the population had grown to 1,622. At what time will the bacterial colony hit 5,000 strong?

$1622 = 233e^{k3}$

$\frac{1}{3}(\ln\frac{1622}{233}) = k$

$5000 = 233e^{1/3} \ (\ln(\frac{1622}{233})t)$

$\ln(\frac{5000}{233}) = \frac{1}{3}\ln(\frac{1622}{233})\ t$

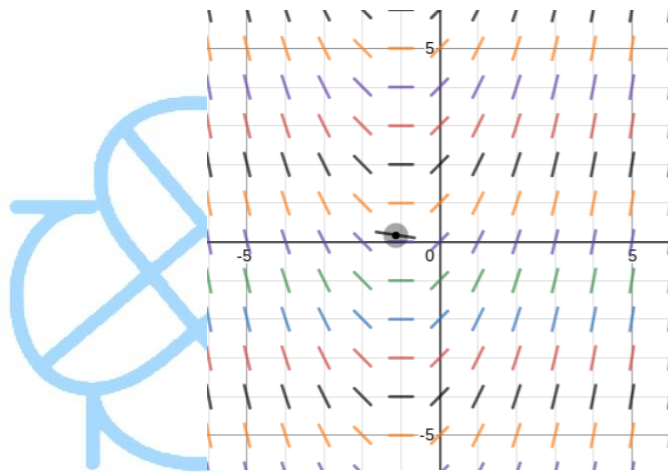$3\frac{\ln(5000/233)}{\ln(1622/233)} = t$

7.3 Sketching Slope Fields

- **A slope field is a collection of all the possible different solutions for the integral of a function.**

Sketching slope fields

1. dy/dx: x+1

point	dy/dx
(1,2)	1+1=2
(-2,1)	-2+1=-1
(1,0)	2
(1,1)	2
(1,-1)	2
(-1,2)	0
(0,2)	1

Area bounded by y=sinx , y=$x^3 + 2x + 1$, x=0 ,and x=π is revolved about the axis y=-1.

Approximating Solutions Using Euler's Method

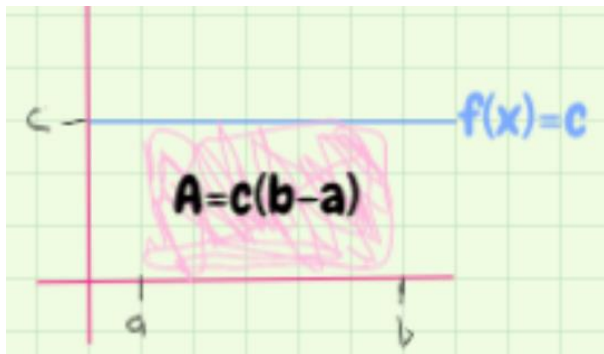Euler's Method of approximating where a function will be given a starting point

Use 4 steps to Approximate f(1) if f(2)=2 dy/dx=y-4x

x	x+Δx	y	$\dfrac{dy}{dx}$	$y+\dfrac{dy}{dx}\Delta x$
1	1 1/2	2	6	2+6*½=5
1/2	2	5	22.5	16.25
2	2.5	16.25	97.5	65
2.5	3	65	482.5	308.25
3		308.75		

https://app.fiveable.me/ap-calc/unit-4

Integrals with a constant domain

- Geometrically→ Δ= c (b-a)
- Calculus → Δ= $\int_\square^\square$ c dx

A=c(b−a)

$\int_a^b cdx = c(b-a)$ cdx=c and c(b-a)=c

$\int_{\square}^{\square}$ dx = (b-a) →Leads to the **first fundamental theorem of Calculus**

$\int_{\square}^{\square}$ f´(x)dx = f(b)-f(a)