Dimensional motion

It refers to the object that has motion in a single dimension, it's known as linear motion, it has some key points

- **Displacement** is the change in position from the intial position to the final position, it's a vector quantity with both magnitude and direction an can be positive or negative
- **Velocity** is the rate of the change of displacement per unit of time, it's also a vector quantity with a direction, magnitude, but can not be positive or negative because negative speed means going back in time
- **Acceleration** is the rate of the change of velocity, it has a positive and negative type and because it's a vector it has a direction and a magnitude

A **kinematic equation** is an equation used to describe the motion of objects

Some of them are

1. Final velocity (v) = Initial velocity (u) + (Acceleration (a) * Time (t))
   $V = u+at$
2. Displacement (s) = Initial velocity (u) * Time (t) + $\frac{1}{2}$Acceleration (a) * Time^2 (t^2)
   $S = ut + ½at^2$
3. Final velocity^2 (v^2) = Initial velocity^2 (u^2) + 2 * Acceleration (a) * Displacement (s)

Commented [SD1]: Amount of change in velocity

Commented [SD2]: Displacement of initial velocity

Commented [SD3]: The more distance you cover when you start speeding up, the .5 and the time squared are there because you're not going that fast all the time

$$V^2 = u^2 + 2as$$

Of course, those equations assume that the acceleration is constant and the motion is in a single direction

These equations are just complicated ways to know shit

Let's say you threw a ball in the air, if we know a few things like how fast the ball is moving **"velocity"** and how long it is in the air **"time"** we can use those mathematical equations to figure out how high it went **"displacement"**

AREA UNDER CURVE

Let's imagine you're on a road trip and you measure the velocity of the car in some points of time and you lay them on a graph

The **area under the curve**, if you highlighted it and measured it, you'll get the amount of change in the quantity, or in our case the displacement

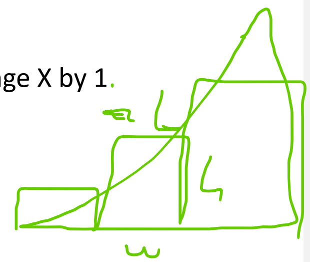
Because velocity x time = displacement

So area = **change in X x change in Y**

Reimann sums

You slice the curve into rectangles and get the area of each triangle and combine them to get the area

You do this equation for example and do X as 0 change X by 1.



F(x) = x^2 + 1

you get the range of **[0 , 4]**

to get the width of each rectangle = **(b – a) / n**

where **b** is the start

a is the end

n is the number of rectangles

then you get the height of each rectangle using this equation

then to get the result area, you do this equation $\alpha_f = \sum \alpha$

(1) (2)

under over

avg

(3)

FREE FALL MOTION

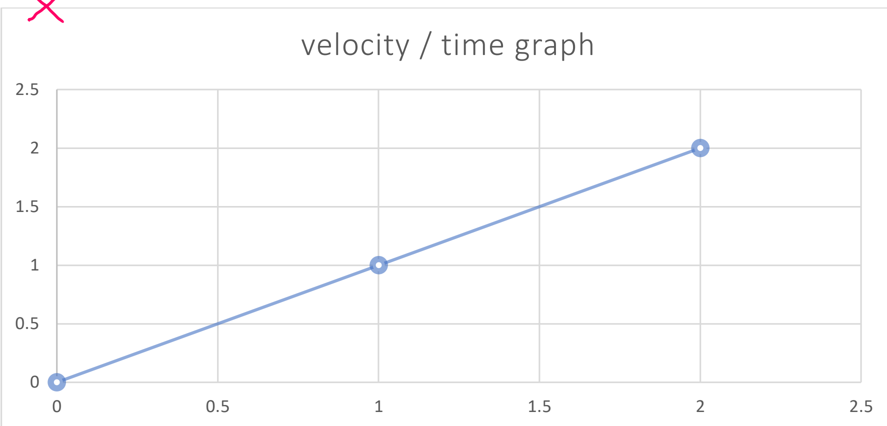
Imagine you drop a ball off a building, see the way it falls, that's free-fall motions, it's the type of motion experienced by an object that is dropped or under the influence of gravity, if you removed air resistance, object near earth's surface fall at a constant acceleration **"acceleration due to gravity"** which is $9.8m/s^2$

Velocity time graph

Slope > object's acceleration at that instance (instantaneous acceleration), because acceleration is the changing rate of velocity

Area > displacement at that instance, because displacement is the product of velocity and time, this now Is called a Reimann sum

$$\frac{D}{T} = V \quad \frac{V}{T} = A$$



Can someone predict where something would be if the acceleration is not constant?

Calculating the future position with a non-constant acceleration is tricky but doable, all we need is to know the function that describes how the acceleration is changing over time, then wwe can use it to find the velocity, then we take that new function to calculate the position with time, let's say you have a car speeding at different rates, if you were able to know the pattern, you can predict where the car would be with fancy math

CAPSTONE RELATION

Mechanics would help with determining water flow and how the dam will do, kinematic eqautions will help deisining the dam and the infurstructure around it, you can also use curves to predict the volume of water and the toughness of the dam