Blank Project

A quick reference guide covering essential kinematics concepts, formulas, and graphs.

Basic Definitions

Distance and Displacement

Distance	Total length of the path traveled by an object. It's a scalar quantity (magnitude only).
Displacement	The change in position of an object. It's a vector quantity (magnitude and direction). $\Delta x = x_{final} - x_{initial}$
Symbol	Distance: d Displacement: Δx
Units	Meters (m)
Key Difference	Distance always increases; Displacement can be positive, negative, or zero.

Speed and Velocity

Speed	The rate at which an object is moving. It's a scalar quantity. $speed = \frac{distance}{time}$
Velocity	The rate at which an object changes its position. It's a vector quantity. $velocity = \frac{displacement}{time}$
Symbol	Speed: v Velocity: $\vec{v}$
Units	Meters per second (m/s)
Average Speed/Velocity	Average Speed = (Total Distance) / (Total Time) Average Velocity = (Total Displacement) / (Total Time)

Acceleration

Acceleration	The rate at which an object's velocity changes over time. It's a vector quantity. $acceleration = \frac{\Delta velocity}{time}$
Symbol	$\vec{a}$
Units	Meters per second squared (m/s^2)
Constant Acceleration	Implies the velocity changes at a uniform rate.

Kinematic Equations

Constant Acceleration Equations

$v = v_0 + at$
$\Delta x = v_0 t + \frac{1}{2}at^2$
$v^2 = v_0^2 + 2a\Delta x$
$\Delta x = \frac{1}{2}(v + v_0)t$
$\Delta x = vt - \frac{1}{2}at^2$

Variables Definition

v	Final velocity
v_0	Initial velocity
a	Acceleration
t	Time
Δx	Displacement

Motion Graphs

Position vs. Time (x-t) Graphs

Slope	Represents the velocity of the object.
Straight Line	Indicates constant velocity.
Curve	Indicates changing velocity (acceleration).
Horizontal Line	Indicates the object is at rest.

Velocity vs. Time (v-t) Graphs

Slope	Represents the acceleration of the object.
Area under the curve	Represents the displacement of the object.
Straight Line	Indicates constant acceleration.
Horizontal Line	Indicates constant velocity (zero acceleration).
Curve	Indicates changing acceleration.

Acceleration vs. Time (a-t) Graphs

Area under the curve	Represents the change in velocity.
Horizontal Line	Indicates constant acceleration.
Line at zero	Indicates zero acceleration (constant velocity).

Problem-Solving Tips

General Strategies

1. **Read the problem carefully:** Identify what is given and what you need to find.
2. **Draw a diagram:** Visualize the situation to help understand the problem.
3. **Identify knowns and unknowns:** List all known variables with their values and identify the unknown variable(s).
4. **Choose the appropriate equation(s):** Select the kinematic equation(s) that relate the knowns and unknowns.
5. **Solve the equation(s):** Substitute the known values into the equation(s) and solve for the unknown(s).
6. **Check your answer:** Ensure the units are consistent and the answer makes sense in the context of the problem.

Dealing with Vectors

1. **Break vectors into components:** Resolve vectors into their x and y components.
2. **Apply kinematic equations separately:** Use kinematic equations for each component.
3. **Recombine components:** Combine the components to find the resultant vector.