

# Linear Motion Algebra (Algebraic Kinematics)

## 1. Variables and Units

**Position** –  $x$  – in a distance unit – meters, feet, miles

Initial  $x \rightarrow x_0$

Final  $x \rightarrow x$

**Displacement** –  $\Delta x$  – difference between starting and ending point – in meters -

**Velocity** –  $v$  – rate of change of displacement

$$v = \frac{\Delta x}{\Delta t} = \frac{x - x_0}{t - t_0}$$

Always in a distance unit divided by a time unit – meters/second, furlong/fortnight, miles/hr

**Acceleration** –  $a$  – rate of change of velocity

$$a = \frac{\Delta v}{\Delta t} = \frac{v - v_0}{t - t_0}$$

Always in a distance unit divided by a time unit squared or two time units – meters/second<sup>2</sup>, furlong/fortnight•hour, miles/hr•min

## 2. Equations

$v = v_0 + at$  - Commonly used when you do not know the displacement

$x = v_0 t + \frac{1}{2} at^2$  - Commonly used when you do not know the final velocity

$x = \left(\frac{v+v_0}{2}\right) t$  - Commonly used when you do not know the acceleration

$v^2 = v_0^2 + 2ax$  - Commonly used when you do know know the time

## 3. Problem Solving Tips

a. Use the **GUESS** method to solve the problems

**GIVEN** – Read the problem and identify all the given values; do any conversions to get the correct units.

**UNKNOWN** – Read the problem and identify what is being asked for

**EQUATION** – Identify the equation(s) you need to solve the problems

**SIMPLY** – simplify the equation to isolate the unknown variable

**SOLVE and CHECK** – plug in the appropriate values and find the unknown number and verify that the answer makes sense and you include the appropriate units.

b. Try using tables to organize your variables

Variable	Initial	Final
x		
v		
a		
t		

Include a column for every important time interval in the problem

c. Be methodical in your problem solving. Keep algebra in a column with each part of each problem in a separate column.