

the kinematics equation, when $a=0$ (i.e., constant velocity)

x equation: $\Delta x = v_x t$	y equation: $\Delta y = v_y t$
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the kinematics variables, when $a \neq 0$ (i.e., changing velocity)

$\Delta x, v_{ix}, v_{fx}, a_x, t$	$t, \Delta y, v_{iy}, v_{fy}, a_y$
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the kinematics equations, when $a \neq 0$ (i.e., changing velocity)

x equations	missing variables	y equations	missing variables
$v_{fx} = v_{ix} + a_x t$	Δx	$v_{fy} = v_{iy} + a_y t$	Δy
$\Delta x = \frac{v_{ix} + v_{fx}}{2} t$	a_x	$\Delta y = \frac{v_{iy} + v_{fy}}{2} t$	a_y
$v_{fx}^2 = v_{ix}^2 + 2a_x \Delta x$	t	$v_{fy}^2 = v_{iy}^2 + 2a_y \Delta y$	t
$\Delta x = v_{ix} t + \frac{1}{2} a_x t^2$	v_{fx}	$\Delta y = v_{iy} t + \frac{1}{2} a_y t^2$	v_{fy}

Kinematics equations require consistent units, but they don't require S.I. units.

how to solve projectile motion problems

<p>1. Check if the object's movement is true projectile motion. Projectile motion occurs when the only force on the object is gravity. If there are other forces on the object besides gravity, you cannot use this projectile motion approach.</p>	
<p>2. Draw the object's path.</p>	
<p>3. Label the initial and final positions.</p>	
<p>4. Write down axes and positive directions.</p>	
<p>5. Break displacement and velocity into components.</p>	
<p>6. For projectile motion, $a_x=0$ and $a_y = 9.8 \text{ m/s}^2$ down.</p>	
<p>7. For the x-component, since $a_x=0$, write down:</p> $\Delta x = v_x t$	<p>7. For the y-component, since $a_y \neq 0$, write down:</p> $t, \Delta y, v_{iy}, v_{fy}, a_y$ $\pm 9.8 \frac{\text{m}}{\text{s}^2}$
<p>8. Underneath the variables, write down the given values, including signs, and indicate the question with a “?”. Velocity is zero in a component when you are released from rest, come to rest, or change direction in that component. Remember that projectile motion is symmetric.</p>	
<p>9. When you know values for two of the three x-variables, you can solve the "$\Delta x = v_x t$" equation for the remaining variable.</p>	<p>9. When you know values for three y-variables, you can choose an equation to solve for either of the other two variables. Choose the equation that includes the three values you know and the variable you want to find. Plug in and solve.</p>
<p>You will usually need to use one component to find t, then use this value for the other component.</p>	

how to solve general kinematics problems

1. Check if the object's acceleration is constant. Acceleration is constant for problems where the net force on the object is constant. If the net force and acceleration are changing, you cannot use this kinematics approach.	
2. Draw the object's path.	
3. Label the initial and final positions.	
4. Write down axes and positive directions. Choose the direction of motion as positive.	
5. Break displacement, velocity, and acceleration into components.	
6. For each component, identify whether a is zero or non-zero.	
7. If $a=0$ (i.e., constant velocity) for a component, write down "$\Delta x = v_x t$" or "$\Delta y = v_y t$" for that component.	7. If $a \neq 0$ (i.e., changing velocity) for a component, write down the five kinematics variables for the component.
8. Underneath the variables, write down the given values , including signs, and indicate the question with a "?". Where applicable, indicate the "sub-question". Velocity is zero in a component when you are released from rest, come to rest, or change direction in that component. Remember that constant-acceleration motion is symmetric.	
9. If $a=0$, when you know values for two of the three kinematics variables, you can solve the equation for the remaining variable.	9. If $a \neq 0$, when you know values for three variables, you can choose an equation to solve for either of the other two variables. Choose the equation that includes the three values you know and the variable you want to find. Plug in and solve.
If necessary, use one component to find t , then use this value for the other component.	