**Kinematics 1 :** $v\_{f}=v\_{0}+at$

**rearranging and solving for each variable from the 1st kinematics equation**

Solving for final velocity $v\_{f}$

The kinematics first equation is already solved for final velocity and all that needs to be done is to substitute in the values you have for initial velocity, acceleration and time

|  |  |
| --- | --- |
| **Equation** | **Reason** |
| $$v\_{f}=v\_{0}+at$$ | **The work is done. The equation is solved for final velocity.** |

Solving for acceleration$a$

|  |  |
| --- | --- |
| **Equation** | **Reason** |
| $$v\_{f}=v\_{0}+at$$ | Start with the kinematics equation. In this case you could also just start with the acceleration equation too. |
| $$v\_{f}=v\_{0}+at$$$$-v\_{0} -v\_{0} $$ | We are trying to get acceleration by itself. The initial velocity is being added to acceleration times time so we subtract it from both sides |
| $$v\_{f}-v\_{0}=at$$ | Re-write what you have. Initial velocity cancels out from the equation on the right and is still on the left side. |
| $$\frac{v\_{f}-v\_{0}}{t}=\frac{at}{t}$$ | We are trying to get acceleration alone so we need to get time away from acceleration. It is being multiplied so we divide to get rid of it. Divide both sides by t. |
| $$\frac{v\_{f}-v\_{0}}{t}=a $$ | Re-write what you have. The time on the right side is cancelled out because t divided by t is one. |
|  | **You are done. The equation is solved for acceleration and all that is left is to substitute in the known values. Notice that this is the equation that defines acceleration (the change in velocity in a given amount of time).** |

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Solving for initial velocity (the beginning or original velocity) $v\_{0}$

|  |  |
| --- | --- |
| **Equation** | **reason** |
| $$v\_{f}=v\_{0}+at$$ | Start with the original equation. We are going to arrange it (algebra) so that it is solved for initial velocity |
| $$v\_{f}=v\_{0}+at$$$$- at -at $$ | we want $v\_{0}$ by itself so we need to get “at” to the other side of the equal sign. “at” is being added to $v\_{0}$ so do the opposite. Subtract “at” from both sides |
| $$v\_{f}-at=v\_{0}$$ | Re-write the equations. The “at” on the right side of the equation went away because it was added and subtract (cancels out) |
|  | **The work is done. You have solved for initial velocity and just need to substitute values in to solve.** |

Solving for time $t$

|  |  |
| --- | --- |
| **Equation** | **Reason** |
| $$v\_{f}=v\_{0}+at$$ | Start with the original kinematics equation. We are trying to solve for t. |
| $$v\_{f}=v\_{0}+at$$$$-v\_{0} -v\_{0} $$ | To get time by itself we need to get $v\_{0}$ and acceleration to the other side. Begin by subtracting $v\_{0}$ from both sides |
| $$v\_{f}-v\_{0}=at$$ | Re-write what you have. Initial velocity is cancelled out from the right side of the equation. But, we’re not done. We need time by its self. |
| $$\frac{v\_{f}-v\_{0}}{a}=\frac{at}{a}$$ | Acceleration is multiplied with time. To “get rid” of it, we divide by acceleration on both sides. |
| $$\frac{v\_{f}-v\_{0}}{a}=t$$ | Re-write what you have. Acceleration is cancelled out from the right side of the equation, leaving time by itself.  |
|  | **You are done. The equation is solved for time and you just need to substitute in your known values and solve.** |

Solving for initial velocity (the beginning or original velocity) $v\_{0}$

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| **Equation** | **reason** |
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