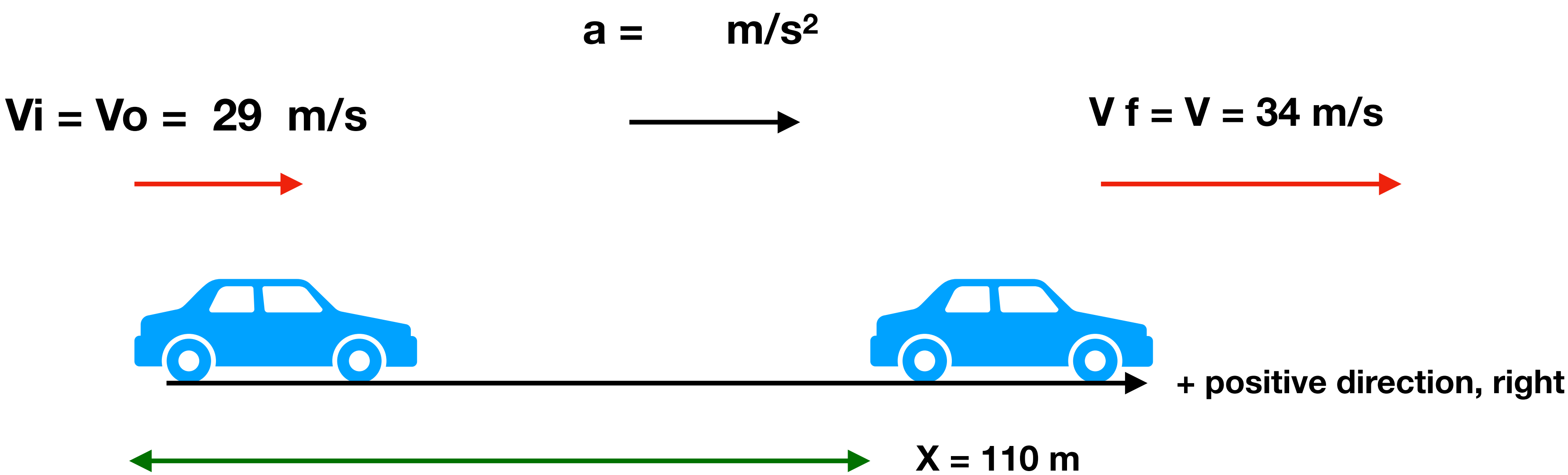
A car is traveling to the right with a speed of $29\ \frac{\text{m}}{\text{s}}$ when the driver slams on the accelerator to pass a truck. With a constant acceleration, the car passes the truck in $110\ \text{m}$ and reaches a speed of $34\ \frac{\text{m}}{\text{s}}$.

What was the acceleration of the car as it sped up?

Kinematic Equations for Motion with Constant Acceleration
$v = v_o + at$
$x = \frac{1}{2}(v_o + v)t$
$v^2 = v_o^2 + 2ax$
$x = v_o t + \frac{1}{2}at^2$

x Displacement (km, m)	**a** acceleration (m/s^2)	**t** time (s, h)	**Vo =Vi** initial velocity (m/s, km/h)	**V = Vf** Final velocity (m/s , km/h)
110 m	**find a =?**		**29 m/s**	**34 m/s**


a =   m/s²
Vi = Vo = 29 m/s
V f = V = 34 m/s
+ positive direction, right
X = 110 m

$$V^2 = V_o^2 + 2\ a\ x$$

$$(34)^2 = (\ 29)^2 + 2\ a \times 110$$

$$(34 \times 34) = (\ 29 \times 29) + 2\ \mathbf{a} \times 110$$

$$1156 = 841 + (a \times 220)$$

$$-841 \qquad -841$$

$$315 = a \times 220$$

$$\frac{315}{220} = \frac{a \times 220}{220}$$

$$1.43\ m/s^2 = a$$

A car is travelling to the right with a speed of $42\,\frac{m}{s}$ when the driver slams on the brakes. The car skids for 4.0 s with constant acceleration before it comes to a stop.

What is the displacement of the car as it skids to a stop?

Kinematic Equations for Motion with Constant Acceleration

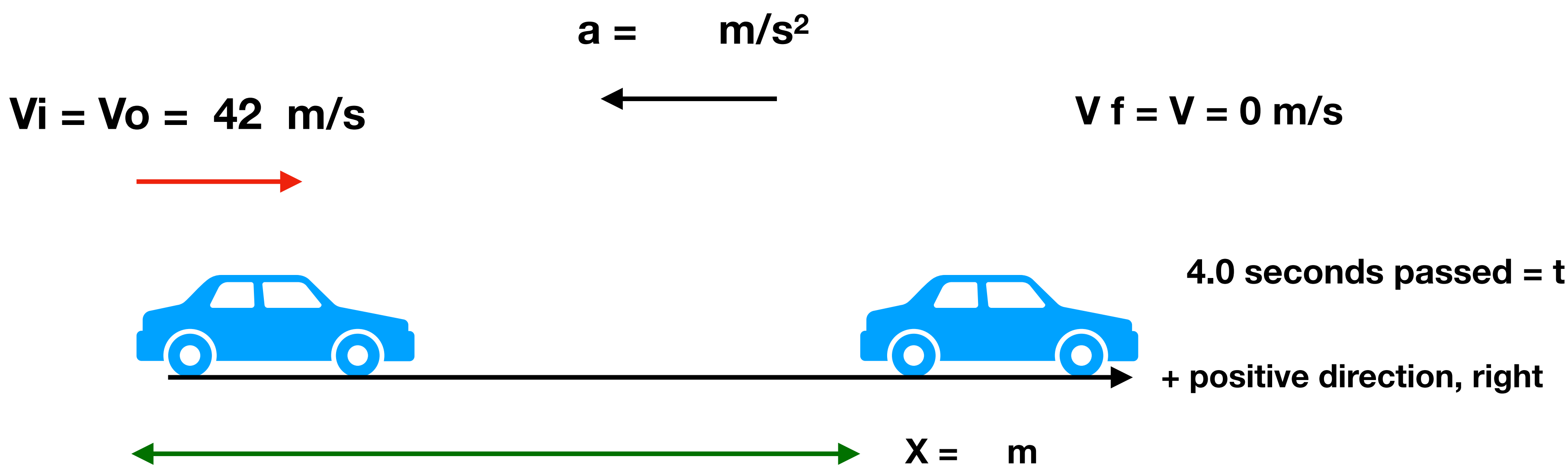
$$v = v_o + at$$

$$x = \tfrac{1}{2}(v_o + v)t$$

$$v^2 = v_o^2 + 2ax$$

$$x = v_o t + \tfrac{1}{2}at^2$$

x Displacement (km, m)	a acceleration (m/s ²)	t time (s, h)	Vo =Vi initial velocity (m/s, km/h)	V = Vf Final velocity (m/s , km/h)
X ?		4.0 s	42 m/s	Stop 0 m/s


a =   m/s²
Vi = Vo = 42 m/s
V f = V = 0 m/s
4.0 seconds passed = t
+ positive direction, right
X =   m

$$x = 1/2\ (Vi + V)\ t$$

$$x = 1/2\ (42 + 0\ )\ x\ 4$$

$$x = 1/2\ (42)\ x\ 4$$

$$x = 1/2\ (42\ x\ 4)$$

$$x = 168\ /\ 2 = 84\ m$$

A car is traveling to the right with a speed of $2.0\,\frac{\mathrm{m}}{\mathrm{s}}$ on an icy road when the brakes are applied. The car slows down with constant acceleration for $3.0\ \mathrm{m}$ until it comes to a stop.

How long does it take the car to slide to a stop?

Kinematic Equations for Motion with Constant Acceleration

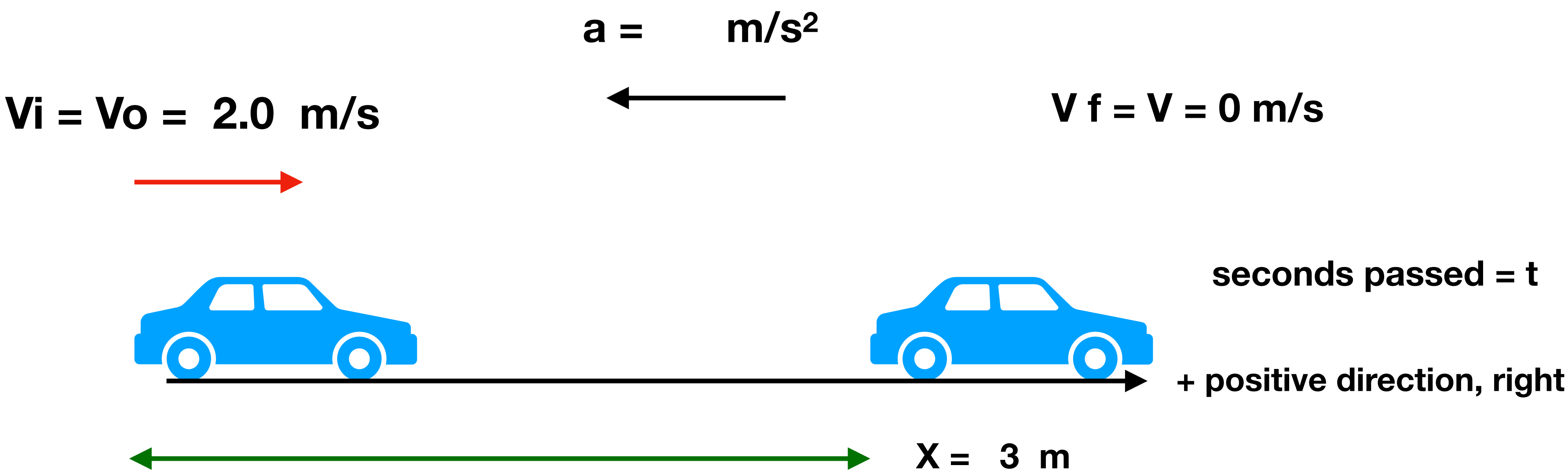
$$v = v_o + at$$

$$x = \tfrac{1}{2}(v_o + v)t$$

$$v^2 = v_o^2 + 2ax$$

$$x = v_o t + \tfrac{1}{2}at^2$$

x **Displacement** **(km, m)**	**a** **acceleration** **(m/s ²)**	**t** **time** **(s, h)**	**Vo =Vi** **initial velocity** **(m/s, km/h)**	**V = Vf** **Final velocity** **(m/s , km/h)**
3.0 m		**? s**	**2.0 m/s**	**0 m/s** **stop**


a =   m/s²
Vi = Vo = 2.0 m/s
V f = V = 0 m/s
seconds passed = t
+ positive direction, right
X =   3 m

$$X = 1/2\ (Vi + V)\ t$$

$$3 = 1/2\ (2 + 0)\ t$$

$$3 = 1/2\ (2)\ t$$

$$3 = 2/2\ \mathbf{t}$$

$$3 = 1\ \mathbf{t}$$

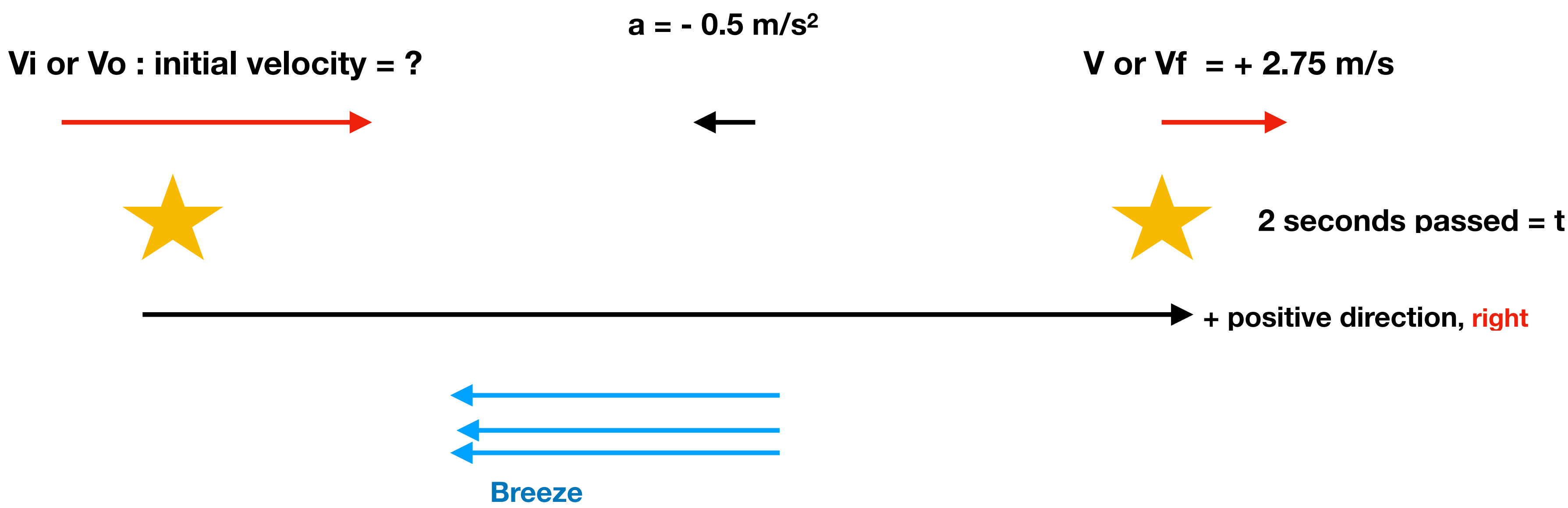
$$3\ s = \mathbf{t}$$

A bumblebee is flying to the right when a breeze causes the bee to slow down with a constant leftward acceleration of magnitude $0.50 \frac{\text{m}}{\text{s}^2}$. After 2.0 s, the bee is moving to the right with a speed of $2.75 \frac{\text{m}}{\text{s}}$.

What was the velocity of the bumblebee right before the breeze?

Kinematic Equations for Motion with Constant Acceleration
$v = v_o + at$
$x = \frac{1}{2}(v_o + v)t$
$v^2 = v_o^2 + 2ax$
$x = v_o t + \frac{1}{2}at^2$

x **Displacement** **(km, m)**	**a** **acceleration** **(m/s ²)**	**t** **time** **(s, h)**	**Vo =Vi** **initial velocity** **(m/s, km/h)**	**V = Vf** **Final velocity** **(m/s , km/h)**
	- 0.5 m/s²	**2.0 s**	**? m/s**	**2.75 m/s**


a = - 0.5 m/s²
Vi or Vo : initial velocity = ?
V or Vf = + 2.75 m/s
2 seconds passed = t
+ positive direction, right
Breeze

$$V_f = V_i + (a \times t)$$

$$\mathbf{\underline{V} = V_o + (\underline{a} \times \underline{t})}$$

$$2.75 \text{ m/s} = V_o + (-0.5 \text{ m/s}^2 \times 2 \text{ s})$$

$$2.75 = V_o + (-0.5 \times 2)$$

$$2.75 = V_o + (-1)$$

$$2.75 = V_o - 1$$

$$2.75 = V_o - 1$$

$$+1 \qquad\qquad +1$$

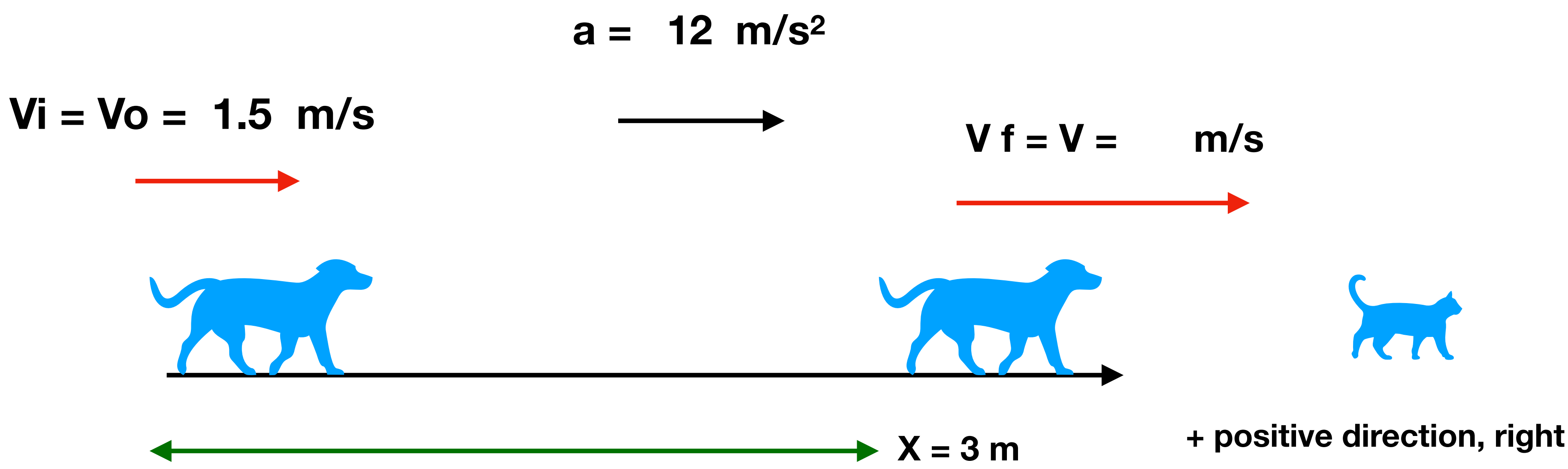
$$3.75 \text{ m/s} = V_o$$

A dog walking to the right with a speed of $1.5\ \frac{\text{m}}{\text{s}}$ sees a cat and speeds up with a constant rightward acceleration of magnitude $12\ \frac{\text{m}}{\text{s}^2}$.

What is the velocity of the dog after speeding up for $3.0\ \text{m}$?

Kinematic Equations for Motion with Constant Acceleration
$v = v_o + at$
$x = \frac{1}{2}(v_o + v)t$
$v^2 = v_o^2 + 2ax$
$x = v_o t + \frac{1}{2}at^2$

x Displacement (km, m)	a acceleration (m/s ²)	t time (s, h)	Vo =Vi initial velocity (m/s, km/h)	V = Vf Final velocity (m/s , km/h)
3.0 m	12 m/s²		1.5 m/s	? m/s



a = 12 m/s²
Vi = Vo = 1.5 m/s
V f = V = m/s
X = 3 m
+ positive direction, right

$$V^2 = V_o^2 + 2\ a\ x$$

$$V^2 = 1.5^2 + 2 \times 12 \times 3$$

$$V^2 = 2.25 + 72$$

$$V^2 = 74.25$$

$$\sqrt{V^2} = \sqrt{74.25}$$

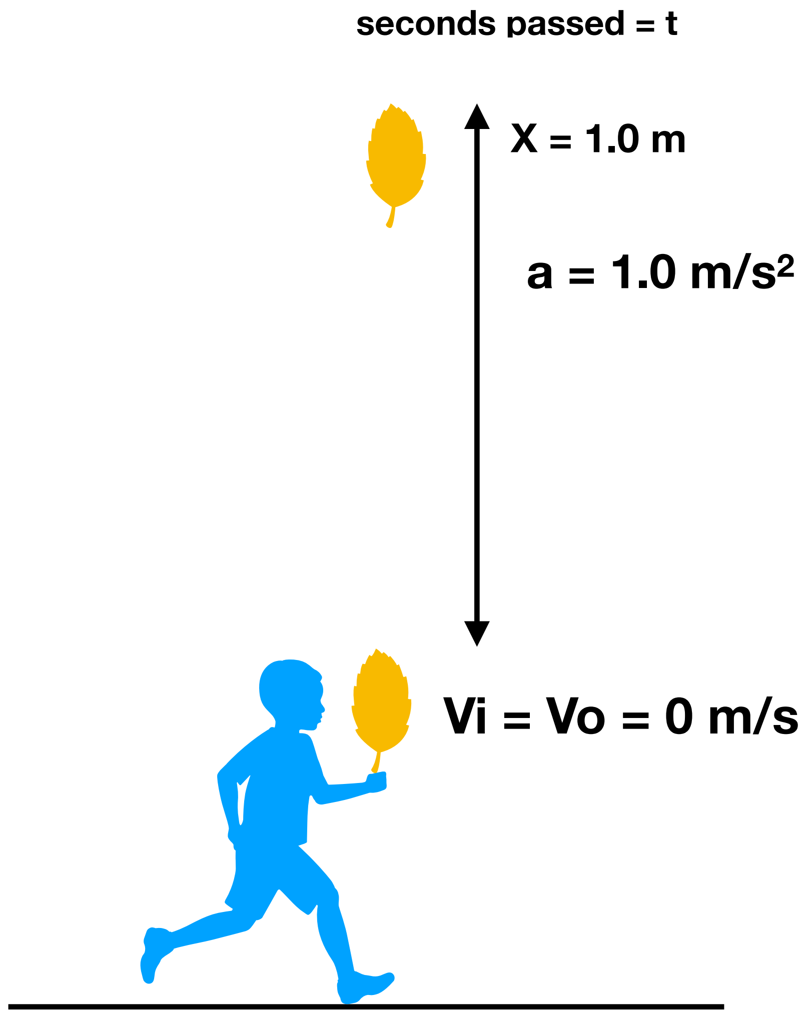
$$V = 8.6\ \text{m/s}$$

A child blows a leaf from rest straight up in the air. The leaf has a constant upward acceleration of magnitude $1.0\ \frac{\text{m}}{\text{s}^2}$.

How much time does it take the leaf to displace $1.0\ \text{m}$ upwards?

Kinematic Equations for Motion with Constant Acceleration
$v = v_o + at$
$x = \frac{1}{2}(v_o + v)t$
$v^2 = v_o^2 + 2ax$
$x = v_o t + \frac{1}{2}at^2$

x **Displacement** **(km, m)**	**a** **acceleration** **(m/s ²)**	**t** **time** **(s, h)**	**Vo =Vi** **initial velocity** **(m/s, km/h)**	**V = Vf** **Final velocity** **(m/s , km/h)**
1.0 m	**1.0 m/s²**	**? s**	**Rest** **0 m/s**	


seconds passed = t
X = 1.0 m
a = 1.0 m/s2
Vi = Vo = 0 m/s

$$X = V_o\, t + 1/2\ a\, t^2$$

$$1.0 = 0 \times t + 1/2 \times 1.0\ (t)^2$$

$$1.0 = 0 + 0.5 \times t^2$$

$$1.0 = 0.5 \times t^2$$

$$\frac{1.0}{0.5} = \frac{0.5}{0.5} \times t^2$$

$$2 = t^2$$

$$\sqrt{2} = \sqrt{t^2}$$

$$1.4\ s = t$$

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