Objects Thrown Into the Air

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Objects Thrown into the Air

- Gravity acts on all falling (<u>and rising</u>) objects.
- Down is considered to be in the negative direction. Up is positive.
- Acceleration due to gravity is $-9.8\ m/s^2$.
- The size of the initial and final velocities of the object are the same but are opposite in direction. (initial = positive, final = negative)
- The velocity at the top of its motion is $0\ m/s$.
- It takes the SAME amount of time to go up as it does to come back down.

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The Equations

- **When acceleration is constant, we can find other information about the object's motion using the following equations:**

$$v = v_o + at \qquad v^2 = v_o^2 + 2a(x - x_o)$$

$$x = x_o + v_o\, t + \frac{1}{2}at^2$$

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Practice Problem #1

- **You throw a stone into the air with a velocity of 18.0 m/s.**
  - **What is the maximum height that the stone reaches?** $V^2 = V_o^2 + 2A(x - x_o)$

    $0^2 = 18^2 + 2(-9.8)(x - 0)$

    $0 = 324 + (-19.6)x$

    $x = 16.5\,m$
  - **How long does it take to hit the ground?**

    $V = V_o + At$

    $-18 = 18 + (-9.8)t$

    $-36 = -9.8t$

    $t = 3.67\,s$

    $V = V_o + At$

    $0 = 18 + (-9.8)t$

    $-18 = -9.8t$

    $t = 1.835\,s$

	End	Max. Height ↓
V	$-18\,m/s$	$0\,m/s$
V_o	$18\,m/s$	$18\,m/s$
a	$-9.8\,m/s^2$	$-9.8\,m/s^2$
t	3.67	
~~Δx~~		16.5m
x_o	0	0

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Practice Problem #2

- **A shirt is shot straight up out of a t-shirt cannon. It reaches a maximum height of 15 m.**
  - **What is the velocity of the shirt as it comes out of the cannon?** $V^2 = V_0^2 + 2(A)(x - x_0)$
    $0^2 = V_0^2 + 2(9.8)(15-0)$
    $0^2 = V_0^2 - 294$
    $V = 17.15\ m/s$
  - **How long does it take for the shirt to hit the ground?** $V = V_0 + At$
    $-17.15 = 17.15 + (-9.8)t$
    $-34.3 = -9.8t$
    $t = 3.5\ s$

	End	Max. Height
V	-17.15	0 m/s
V_0	17.15	17.15
a	-9.8 m/s²	-9.8 m/s²
t		
~~Δx~~		15 m
x_0	0	0

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