Motion in 1-D

- Position $x(t)$ – set up coordinate system
- Motion diagram
- x-t diagram
- v-t diagram
- a-t diagram

Slope $v(t) = \dfrac{dx(t)}{dt}$

Slope $a(t) = \dfrac{dv(t)}{dt}$

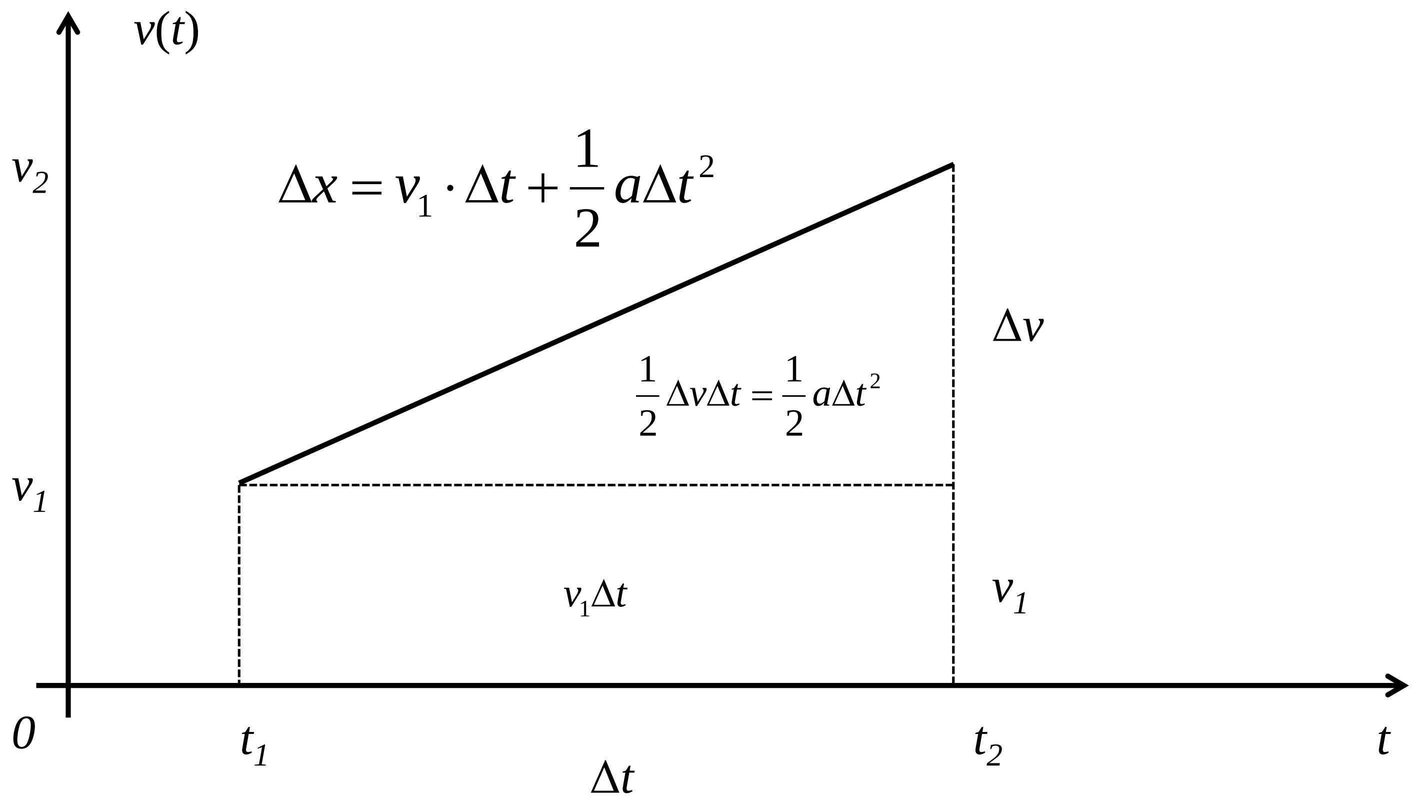
- from a to v $\quad \Delta v = a_{avg} \cdot \Delta t = \int_{t_1}^{t_2} a(t)dt \qquad \Delta v = a\Delta t$

  Only constant a problems

- from v to x $\quad \Delta x = v_{avg} \cdot \Delta t = \int_{t_1}^{t_2} v(t)dt$

Motion in 1-D with constant a

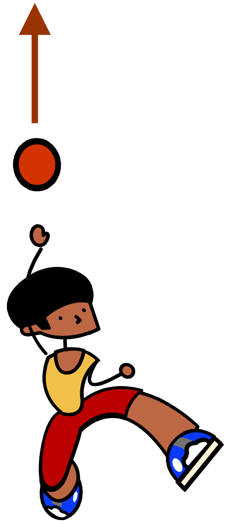
$$\Delta v = v_2 - v_1 = a\Delta t \qquad v_2 = v_1 + a\Delta t \qquad \Delta x = v_{avg} \cdot \Delta t = \int_{t_1}^{t_2} v(t)dt$$



Ball tossing up

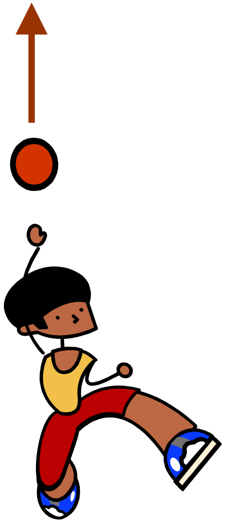
- Position $x(t)$ – set up coordinate system
- Motion Diagram (Positions at unit time intervals)
- Change of position $\Delta x(t)$
- Average Velocity $V_{avg} = \frac{\Delta x}{\Delta t}$
- x - t diagram
- Instantaneous velocity $V = \frac{dx}{dt}$ -- on x-t diagram ?
- V - t diagram
- Change of velocity ΔV
- Average acceleration $a_{avg} = \frac{\Delta v}{\Delta t}$
- Instantaneous acceleration $a = \frac{dv}{dt}$ -- on V-t diagram ?
- a - t diagram

You throw a ball vertically upward. While the ball is still moving up, which statement best describes the ***direction and magnitude*** of the ball's ***velocity***?



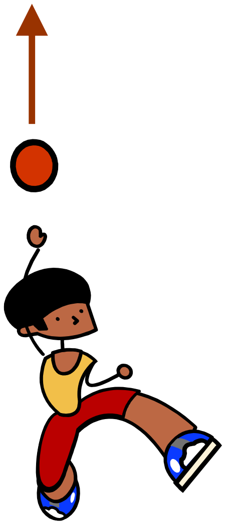
1. Upward, constant magnitude
2. Upward, increasing magnitude
3. Upward, decreasing magnitude
4. Downward, constant magnitude
5. Downward, increasing magnitude
6. Downward, decreasing magnitude
7. None of the above

You throw a ball vertically upward. While the ball is still moving up, which statement best describes the ***direction and magnitude*** of the ball's ***acceleration***?



1. Upward, constant magnitude
2. Upward, increasing magnitude
3. Upward, decreasing magnitude
4. Downward, constant magnitude
5. Downward, increasing magnitude
6. Downward, decreasing magnitude
7. Zero

You throw a ball vertically upward. When the ball is exactly at its highest position, which statement best describes the ***direction and magnitude*** of the ball's ***acceleration***?



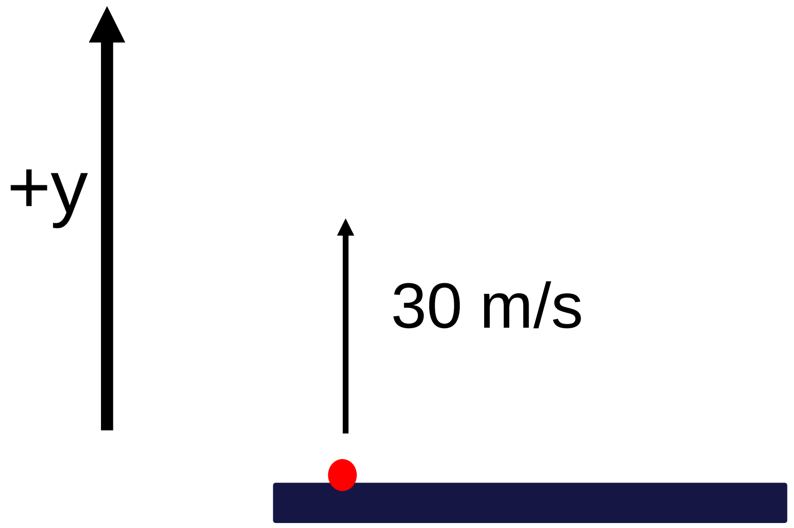
1. Upward, constant magnitude
2. Upward, increasing magnitude
3. Upward, decreasing magnitude
4. Downward, constant magnitude
5. Downward, increasing magnitude
6. Downward, decreasing magnitude
7. Zero

Motion in 1-D with constant *a*

$$\Delta v = v_2 - v_1 = a\Delta t \qquad \Delta x = v_1 \cdot \Delta t + \frac{1}{2} a \Delta t^2 \qquad v_2^2 - v_1^2 = 2a\Delta x$$

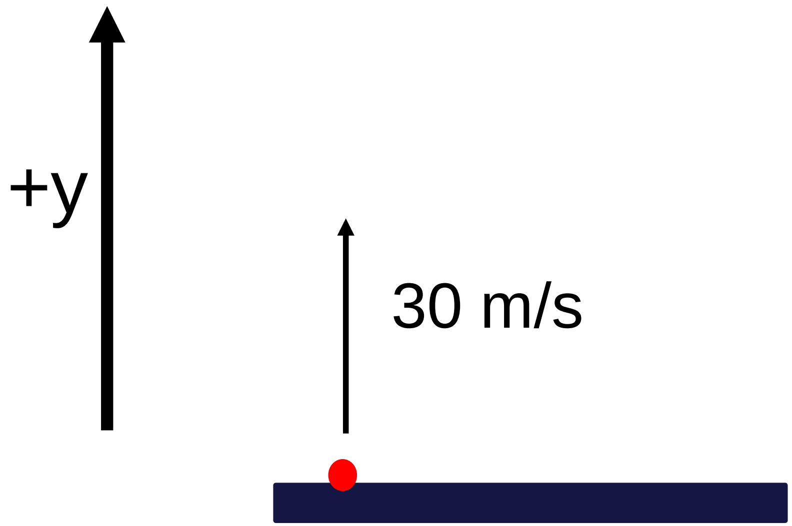
A car is initially traveling at a speed of 20 m/s. It needs to uniformly slowing down to a complete stop within a distance of 50 m. What is the acceleration?

A ball is launched vertically upward from ground level with an initial velocity of 30 m/s. How much time does it take before it lands on the ground? Use $|g|=10\ m/s^2$.



1. 1 s
2. 2 s
3. 3 s
4. 4s
5. 6 s
6. None of the above.

A ball is launched vertically upward from ground level with an initial velocity of 30 m/s. what maximum altitude does it reach above the ground? Use $|g|=10\ m/s^2$.



1. 10 m
2. 15 m
3. 30 m
4. 45 m
5. 60 m
6. None of the above.