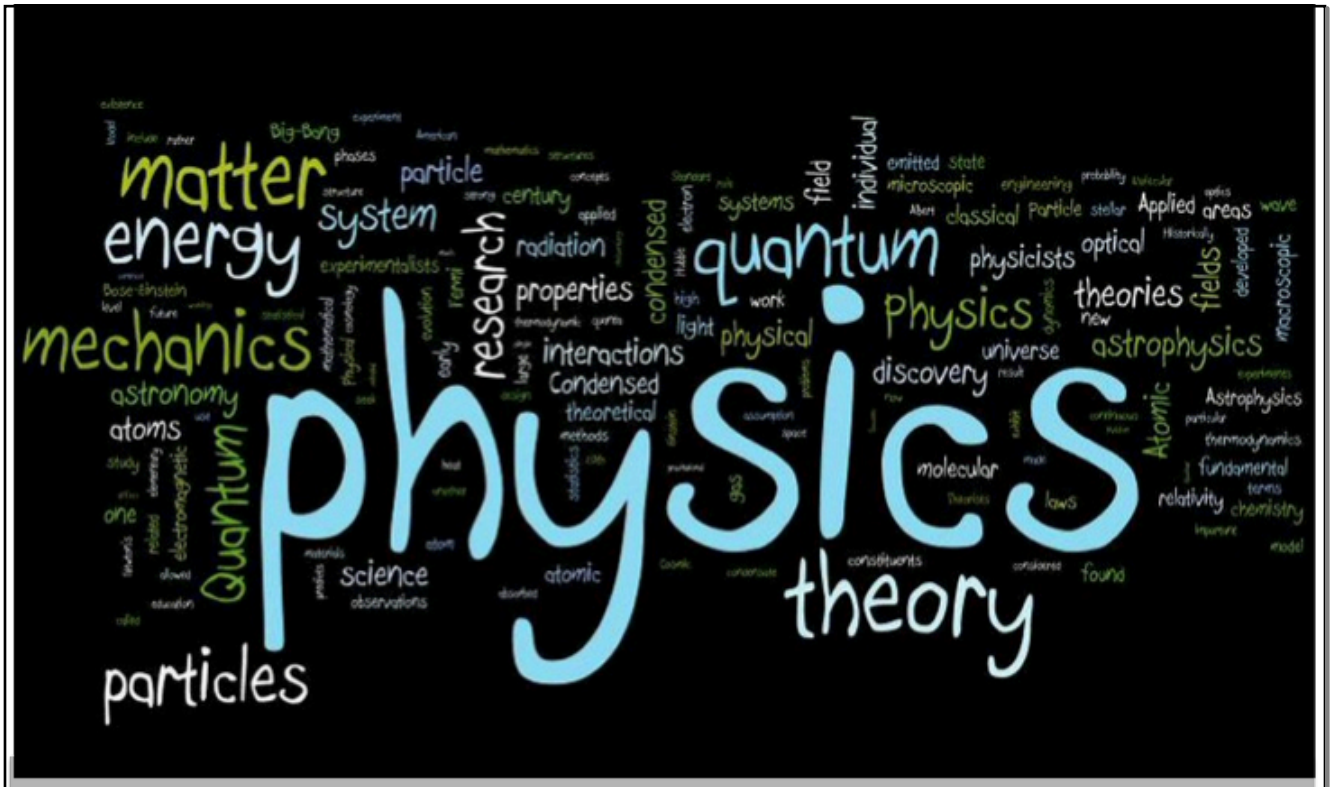
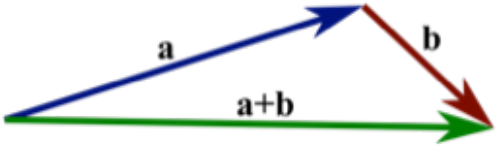
April 18, 2017



AP Review

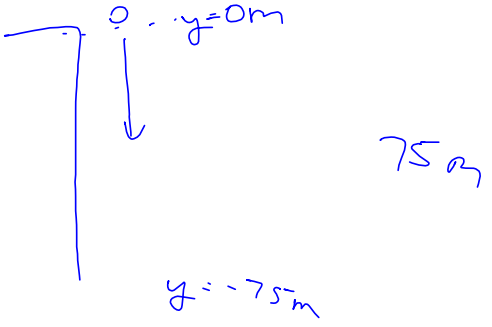
Kinematics

- Vectors and Vector Mathematics
  - Magnitude and direction
  - Resultant
  - Polar vs Rectangular



(r, θ) (2.4, 45°) (x, y) (2, 3)

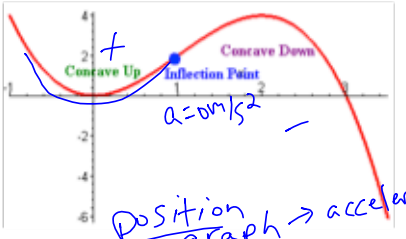
- * Definitions
  - Vector vs Scalar
  - Displacement vs Distance
  - Speed vs Velocity



- Free Fall
  - Acceleration only in the y-direction, $a = g = -9.8\ m/s^2$
  - * Often is rounded to $10\ m/s^2$ in 'estimation' problems
  - Assumptions of zero

Kinematics

- **Graphing**
  - Snowman – Slope vs Area
  - Tangent lines to graphs
  - Concavity



- Kinematics

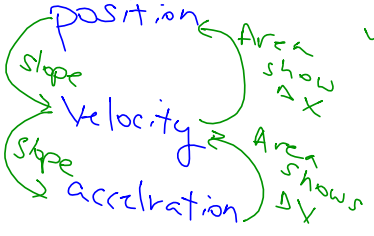
$$v = v_o + at$$

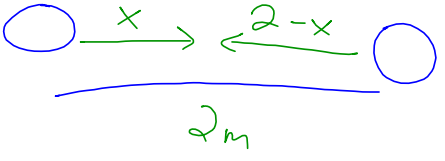
$$x = x_o + v_o t + \frac{1}{2}at^2$$

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

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

*Note: How many variables can be written in terms of other variables



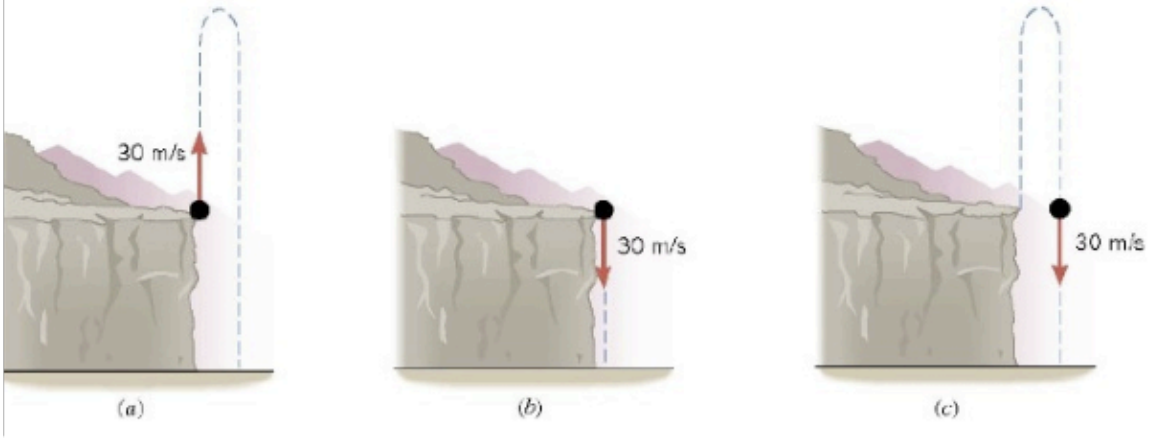


Free-Fall: Tips & Tricks

Symmetry is your friend!

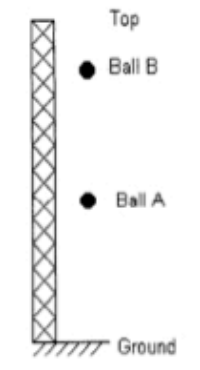
Conceptual Example 15 Taking Advantage of Symmetry

Does the pellet in part *b* strike the ground beneath the cliff with a smaller, greater, or the same speed as the pellet in part *a*?



Free Fall

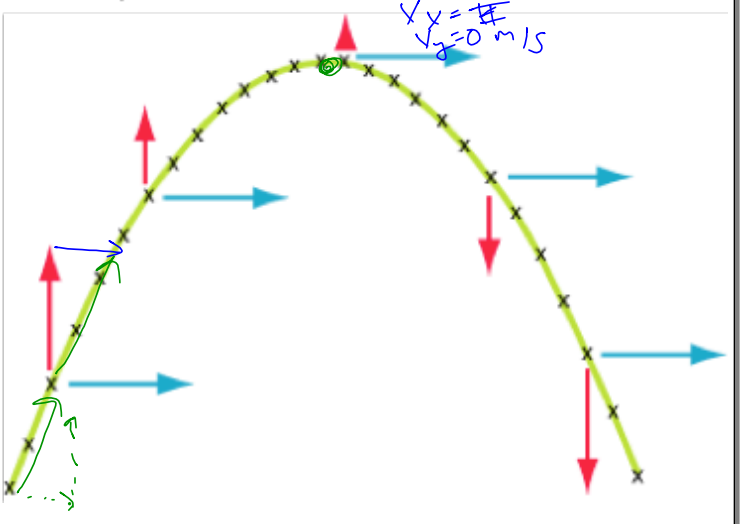
Two identical bowling balls A and B are each dropped from rest from the top of a tall tower as shown in the diagram to the right. Ball A is dropped 1.0 s before ball B is dropped but both balls fall for some time before ball A strikes the ground. Air resistance can be considered negligible during the fall. After ball B is dropped but before ball A strikes the ground, which of the following is true?



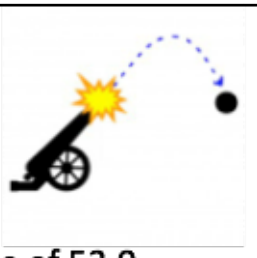
A. The distance between the two balls decreases.
B. The velocity of ball A increases with respect to ball (B)
C. The velocity of ball A decreases with respect to ball (B)
D. The distance between the two balls remains constant.
E. The distance between the two balls increases.

Kinematics

- Projectiles
  - Curved motion created by the combination of motion in the x- and y-direction
  - Acceleration of gravity is the only acceleration.
  - Velocity constantly changes in the y-direction, constant in the x-direction
  - Full vs ½
  - Assumptions
  - Symmetry
  - Adapted kinematics



Projectile Motion



A kicker kicks a football with a velocity of 20.0 m/s and at an angle of 53.0 degrees.

A. What is the maximum height of the football?

B. What are the x- and y-components of the velocity at the highest point?

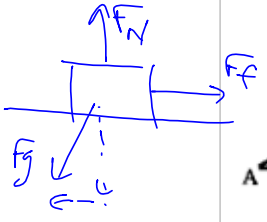
C. What are the x- and y-components of the acceleration at the highest point?

Dynamics

- Definitions
  - Force
  - Mass
  - Inertia
  - Weight
- Newton's First, Second, & Third Laws

$\Sigma F = 0$ $\Sigma F = ma$

- Sums of Forces, Equilibrium vs. Non-Equilibrium
- Free Body Diagrams *How to draw on AP
  - Normal Force
  - Tension
  - Friction
  - Inclines



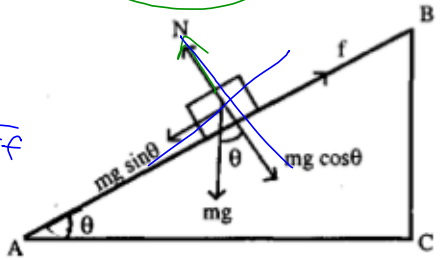
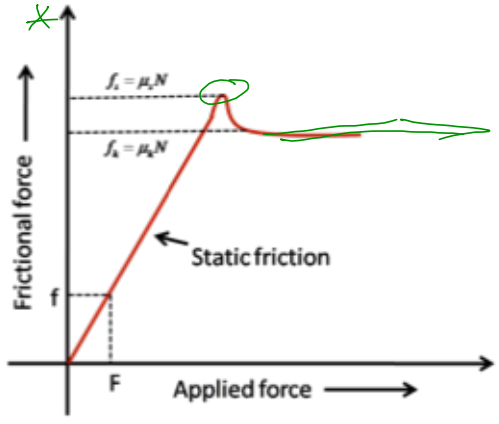


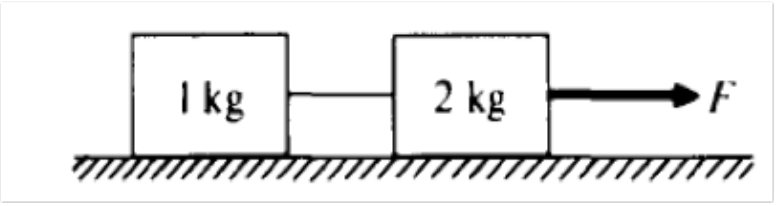
Fig. 8.7 : Motion on inclined plane



Dynamics - Tension

When the frictionless system shown is accelerated by an applied force of magnitude, the tension in the strings between the blocks is:

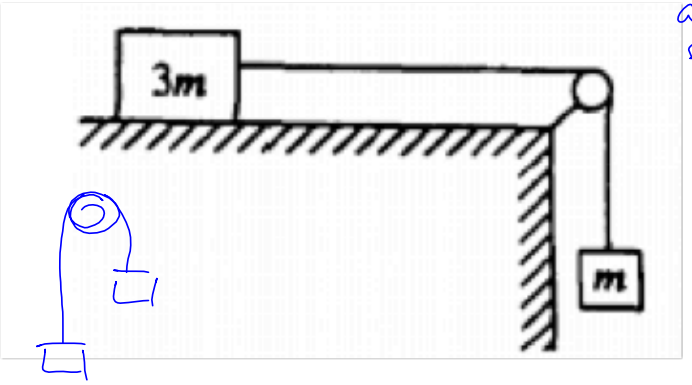
A. 2F
B. F
C. 2/3 F
D. ½ F
E. 1/3 F



Dynamics - Atwood

A block of mass 3m can move with friction on a horizontal table. The block is attached to another block of mass m by a cord that passes over a frictionless pulley, as shown. If the masses of the cord and the pulley are negligible, what is the magnitude of the acceleration of the descending block?

A. Zero
B. g/4
C. g/3
D. 2g/3
E. g



a = same
F_T =

Bathroom Scale in Elevators (why not?!)

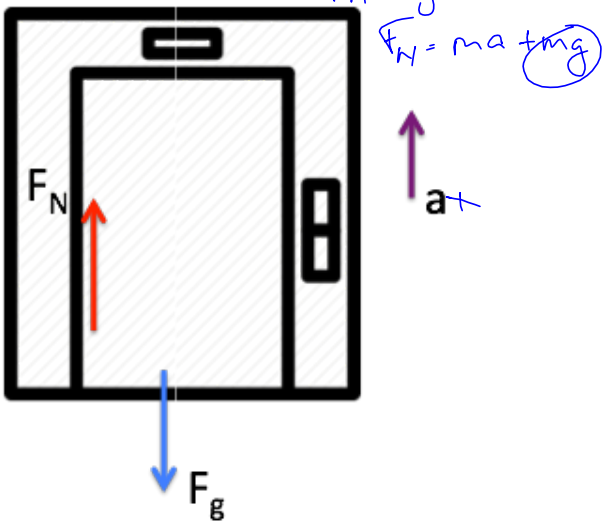
- Let's see what happens if we put the scale in the elevator

Going Up

$F_N - F_g = 0$

$F_N - F_g = ma$

$F_N = ma + mg$



Going Down

$F_N - F_g = -ma$

$F_N = mg - ma$