$\Delta x = \frac{1}{2}(v_f + v_i)t$ for 1D motion

$v_f = v_i + at$

$a = \frac{v_f - v_i}{t}$

a = 0 m/s² for constant velocity

$t = \frac{v_f - v_i}{a}$

$h = -\frac{1}{2}a_y t^2$

$t = \sqrt{-\frac{2h}{a_y}}$

$\Delta x = v_i t$ for projectile motion

$v_{f,x} = v_i \qquad v_{f,y} = a_y t$

$\bar{v}_f = \sqrt{v_{f,x}^2 + v_{f,y}^2}$

(10 Points) A truck initially moving at 25 m/s enters a construction zone and applies the brakes. The truck experiences an acceleration of -2.0 m/s² and takes 8.0 s to slow down.

    a) Determine the velocity of the truck after it has slowed down.
    b) Determine the displacement of the truck after it has slowed down.

(15 Points) Determine the final velocity of an object that falls for 3.0 s

    a) on Earth, where a_y = -9.81 m/s².
    b) on Mercury, where a_y = -3.70 m/s².
    c) on Neptune, where a_y = -11.3 m/s².
    d) on Jupiter, where a_y = -25.9 m/s².
    e) on Pluto, where a_y = -0.610 m/s².

(10 Points) A sailboat is being propelled across the ocean by one wind blowing at 8.0 m/s to the east and another wind blowing at 12 m/s north.

    a) What is the resultant velocity of the sailboat?

    b) If the sailboat travels at this constant velocity for an hour, or 3600 s, how far will the sailboat have moved from its initial position?

(15 Points) A car tire initially rolling at 7.5 m/s rolls off the rooftop of a 35-m-high building and eventually hits the ground below. Determine

    a) the time the tire spends in the air.

    b) the horizontal range of the tire.

    c) The velocity of the tire just as it hits the ground.

(Bonus) An arrow is fired straight into the air with an initial velocity of 25 m/s.
   a) For how long is the arrow in the air before it hits the ground?
   b) What is the maximum height reached by the arrow?

1. A 300-N construction worker and a 50-N bucket of cement rest on a horizontal steel girder supported by two identical steel cables. If the girder itself weighs 450 N, what is the tension in each cable?
A) 50 N
B) 200 N
C) 225 N
D) 400 N
E) 800 N

2. A man on a bicycle, a semi-trailer truck, a wooden wheel and a sports car are all moving at the same velocity. Rank these objects by their inertia from greatest to least.
A) Man on bicycle, semi-trailer truck, wooden wheel, sports car
B) Wooden wheel, sports car, man on bicycle, semi-trailer truck
C) Semi-trailer truck, sports car, man on bicycle, wooden wheel
D) Wooden wheel, man on bicycle, sports car, semi-trailer truck
E) Semi-trailer truck, sports car, wooden wheel, man on bicycle

3. A rock is dropped off a cliff and strikes the ground with an impact velocity of 30 m/s. How high was the cliff?
A) 20 m
B) 30 m
C) 45 m
D) 60 m

4. Which one of the following statements is true concerning the motion of an ideal projectile launched directly upward?
A) The acceleration is positive on the way up and negative on the way down.
B) The velocity at the top of the trajectory is zero.
C) The object's total speed remains constant during the entire flight.
D) The vertical speed decreases on the way up and increases on the way down.

5. In the absence of a net force, a moving object will
A) slow down and eventually stop.
B) stop immediately.
C) turn right.
D) turn left.
E) move with constant velocity.

6. A stone is thrown horizontally from a bridge with an initial speed of 10 m/s. Assuming air resistance is negligible, how long would it take the stone to strike the water 80 m below?
A) 1 s
B) 2 s
C) 4 s
D) 8 s
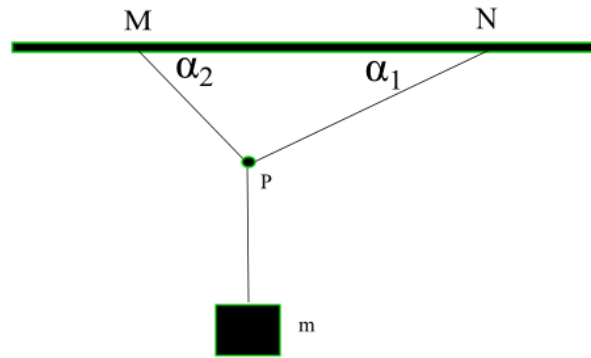
7. Two ropes of unequal length are supporting the weight of a block from a ceiling, as shown in the diagram above. Rank the three forces present by magnitude from greatest to least.
A) $T_M > T_N > F_W$
B) $T_M > F_W > T_N$
C) $F_W > T_N > T_M$
D) $F_W > T_M > T_N$

8. The acceleration due to gravity is greater on Jupiter than on Earth. The mass and weight of a rock on Jupiter compared to that on Earth would be
A) the same, more
B) the same, less
C) more, more
D) more, less
E) the same, the same

9. A sailboat is guided along the ocean by two winds, one blowing north at 12 m/s and another blowing east at 5 m/s. What is the resultant velocity of the sailboat?
A) 17 m/s
B) 7 m/s
C) 11 m/s
D) 13 m/s

10. Two cannonballs are fired horizontally from atop the same cliff and hit the ocean below at the same time. Cannonball B has twice the initial velocity of cannonball A. Compared to the range of cannonball A, the range of cannonball B is
A) half as great.
B) twice as great.
C) four times greater.
D) the same.