1. A 40.0 kg dolphin decelerates from 12.0 to 4.50 m/s in 3.20 s to join another dolphin in play. What average force (in N) was exerted to slow him if he was moving horizontally? (The gravitational force is balanced by the buoyant force of the water. Assume the positive direction is in the direction of motion. Indicate the direction with the sign of your answer.) kinematics
a = 4.5-12/3.2 = -2.3475, -2.3475 * 40 = -93.75, Ans: -93.75 N

2. A 60 kg man stands on a bathroom mass-scale inside an elevator. The elevator accelerates downward from rest at a rate of 9.8 m/s2 for 10 seconds. What does the scale read during this time interval?
w = 60*9.8 = 588, f-w=ma = -588, f = -588 + (w) = 0, Ans: = 0

3. The tension in a string from which a 4.0-kg object is suspended in an elevator is equal to 44 N. What is the acceleration of the elevator?
T - w = ma, 44 - (4*9.8) = ma = 4.8, 4.8/m = a = 1.2, Ans = 1.2

4. In the figure, if the tension in string 1 is 25N and the tension in string 2 is 20N, what is the mass of the object shown? (Hint: the angle between string 2 and the vertical is unknown.)
w = 25cos(40)+20cos(theta), 25sin(40)=20sin(theta), theta = 53.4641, w = 31.0576, w/g = m ANS, 3.15

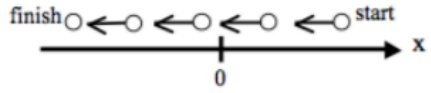
5. Romeo is chucking pebbles gently up to Juliet's window, and he wants the pebbles to hit the window with only a horizontal component of velocity. He is standing at the edge of a rose garden h = 8.5 m below her window and d = 7.0 m from the base of the wall (see figure). How fast are the pebbles going when they hit her window?
0 = voy^2 +2a(8.5), voy = 12.907, 0 = 12.907+(-9.8)(t), t = 1.32, 7 = vox(1.32), vox=5.303

6. A mass (M1 = 2.0 kg) is connected by a light cord to a mass (M2 = 4.0 kg), which slides on a smooth surface, as shown in the figure. The pulley is massless and rotates about a frictionless axle. The acceleration of M2 is 3.27 m/s2 . What is the tension in the string?
T = m2a, T-w1 = -m1a, T = -m1a+w1 = 26.12/2 = 13.06 Ans, 13.1

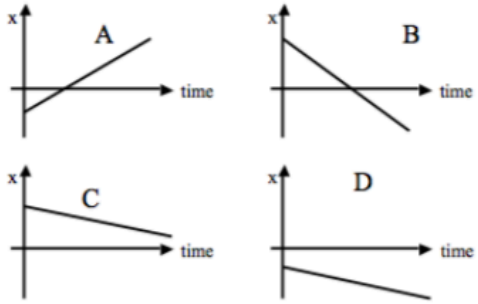
1. When applying the equations of kinematics for an object moving in any direction, which of the following statements *must* be true?

Ans: The acceleration of the object must remain constant

2. A object starts at x = +5 and moves left along the x-axis at constant speed:



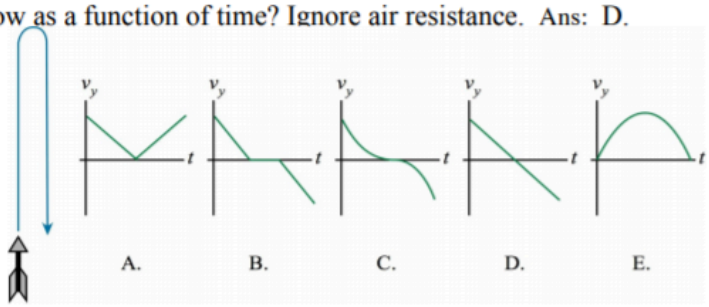
Which graph represents this motion?



Ans: B

E: None of these!

3. An arrow is launched vertically upward. It moves straight up to a maximum height, then falls to the ground. The trajectory of the arrow is noted. Which graph best represents the vertical velocity of the arrow as a function of time? Ignore air resistance. Ans: D.



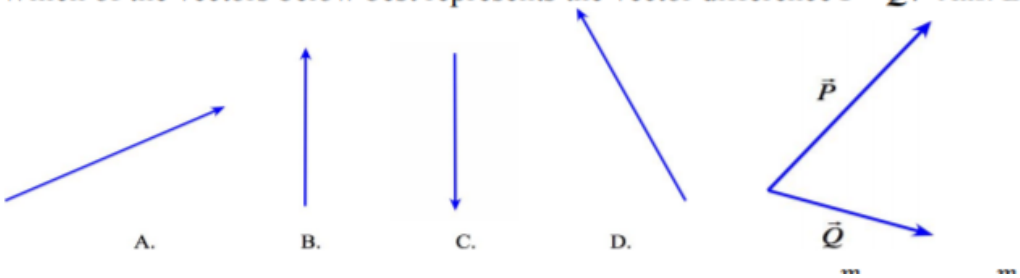
4. The position of a particle moving along the x axis is given by x =(21 – 22 t + 6.0 t 2) m, where t is in s. What is the average velocity during the time interval t = [1.0s, 5.0s]?
[21-22(5)+6(5)^2]-[21-22+6]/(5-1) = 14, Ans: 14

5.If you are driving on icy pavement at 4 m/s and hit your brakes, your car is decelerating at a rate of –2.0m/s². How much distance, will your car travel before coming to rest?
0 = 4^2+2(-2)x, -16/-4 = x = 4

6. A ball is thrown vertically upward such that it has a speed of 30m/s when it reaches two thirds of its maximum height above the launch point. Therefore the maximum height is:
H = 30^2/2*9.8 = (45.92 - ⅓)*3 = 138

7.A helicopter is ascending vertically with a speed of 4.90 m/s. At a height of 98 m above the Earth, a package is dropped from a window. How much time does it take for the package to reach the ground? [Hint: pay attention to the fact that the package is dropped from a moving helicopter]
98 = 4.9t -4.9t^2, t = 5 (quad form)

8. Which of the vectors below best represents the vector difference $\boldsymbol{P}-\boldsymbol{Q}$? Ans: B.



9. The velocity and acceleration of an object are given as V = 2.0i + 10j, and a = 0.5i - 0.1j, the object is: uniform (dot product = 0)

10. A ball is kicked from the ground with an initial velocity of V0x =20 m/s in the horizontal direction and V0y=10m/s in the vertical direction. What is maximum height attained by the ball?
H = 10^2/(2*9.8) = 5.102

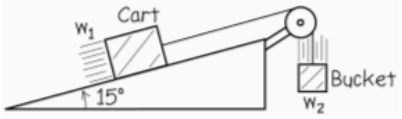
11. A ball is kicked from the ground with an initial velocity of V0x =20 m/s in the horizontal direction and V0y =10 m/s in the vertical direction. What is the range of the projectile (ball) (meaning: find the location on the ground, where the ball hits.)?
Vo = sqrt(vox^2 + voy^2), Vo = 22.361, angle = tan^-1(voy/vox) = 26.5651,
22.361^2 sin(2* 26.5651)/9.8 = 40.82

12. A fairground ride spins its occupants inside a flying saucer-shaped container. If the horizontal circular path the riders follow has a 20 m radius, at how many revolutions per minute are the riders subjected to a centripetal acceleration equal to that of gravity?
9.8 = rw^2, 9.8/20 = w^2 = .49, w = .07 rad/s convert to rev = 6.68 rad/s

13. A “net force” is: the vector sum of all the forces on an object

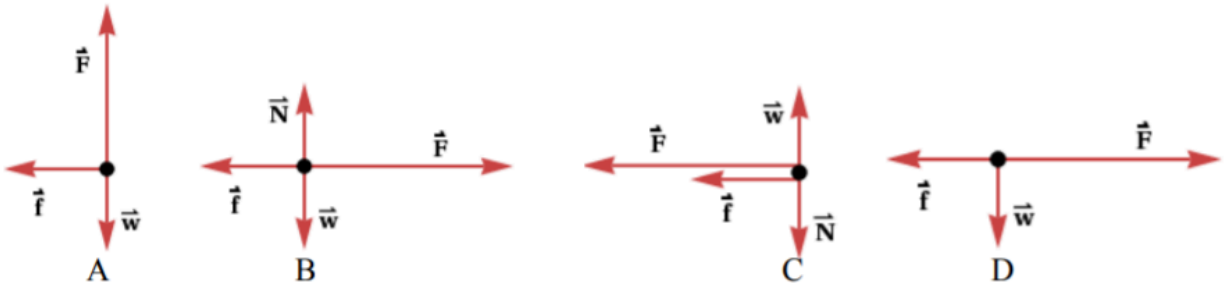
14. A cart (weight w_1) is attached by a lightweight cable to a bucket (weight w_2) as shown in the figure. The ramp is frictionless and the pulley is frictionless and does not rotate. When released, the cart accelerates up the ramp and the bucket accelerates downward. How does the cable tension T compare to w_2?

Ans: $T < w_2$



15. A car accelerates along a horizontal road. Draw a free-body diagram; be sure to include the friction of the road that opposes the forward motion of the car (the car is traveling to the right).

Ans: B



16. . Three forces (F1= F3=20N, F2=40N) are applied to a 20kg object, where F2 and F3 are making an angle θ=30o with respect to the Y-axis. Find the magnitude of the object's acceleration

Do x/y chart, -164.04 = ma, a = -8.2, magnitude = 8.2

17. Two forces are applied on a block as shown in the figure below. The horizontal surface on which the block slides is frictionless. The magnitude of both forces is the same: F = 25N, but one of them is making an angle of 30o with respect to the horizontal surface. Knowing that the mass of the block is M = 5.0kg, what is the magnitude of the resulting acceleration of the block?

Do x/y chart, 25cos(30)+25 = ma, a = 9.33

18. An object accelerates at a rate of 2m/s2 , if the only forces acting on this object are F1 = (3i-8j) N and F2 = (5i+3j)N, what is the mass of this object?

Add up i and j, ma = 8i + 5j, m = sqrt(8^2+5^2)/2 = 4.72

19. A 2000 kg truck is parked on a 30o slope (inclined plane with an angle of 30o). Determine the friction force applied on the truck?

Do x/y chart, f = wsin(3) = 9800

20. On an unbanked curve (θ=0) with radius of curvature R=10m and no friction, the minimum speed needed so that the car does not slide off is:

arctan(0) = 0

21. Complete the following statement: The maximum speed at which a car can safely negotiate a frictionless banked curve depends on all of the following except: mass of car

22. The terminal velocity of a 3.4✕10-5 kg raindrop is 8.0 m/s. Assuming a drag force FD=-bv, determine the value of the constant b? 3.4*10^-5 * 9.8/8 = -b, b = 4.165* 10 ^ -5