Physics Pretest:

- Torque
1. Newton's 2nd Law
2. Kinematics (Free fall, graphs, and combined with $F_R = ma$)

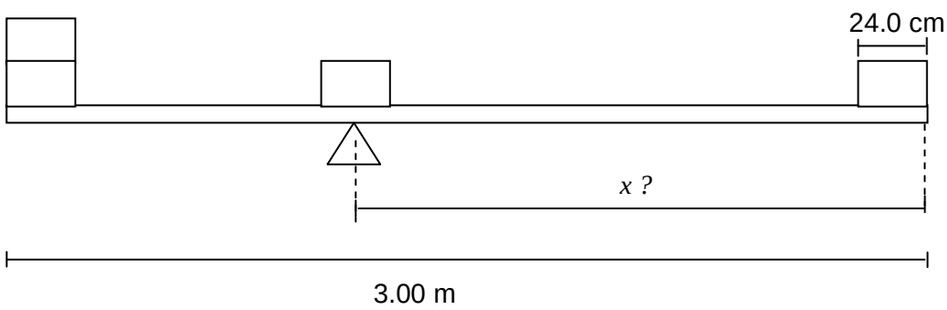
Practice Questions/Problems

1. What is Newton's 2nd Law? Name and explain it.
2. Prove that acceleration for an ideal inclined plane is *a = gsinA.*
3. Prove that acceleration for a real inclined plane is *a = g(sinA – kcosA).*
4. What is meant by "A car travels at 50 km/h"?
5. What is meant by "An apple falls at accelerates at a rate of 9.8 m/s^2"?

6. In automobile racing, there is a constant effort to increase the performance of the cars, particularly the acceleration. An engineer proposes the four following suggestions. Which one of these would, in fact, **REDUCE** acceleration? [B]

   A) Increase the propulsion force of the motor.
   B) Increase the weight of the car.
   C) Decrease the mass of the car.
   D) Reduce the friction forces.

7. A 20.0 kg *uniform* plank has four *uniform* concrete blocks placed on it, as illustrated. If each block has a mass of 10.0 kg and a ***width of 24.0 cm***, where is the fulcrum located from the right end?

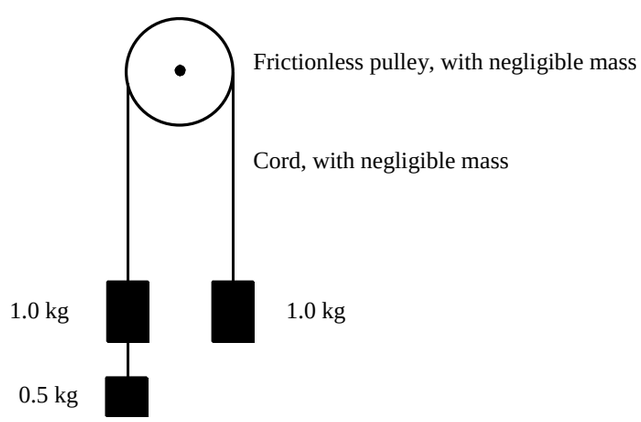


8. At La Ronde, the free-fall ride called the "Orbit" causes a 60.0 kg person to accelerate at a rate of 9.81 m/s^2 down.

   a) Had the person been sitting on a balance, what would the scale reading be in newtons? [0]
   b) What sensation does this situation account for? [A sense of weightlessness.]

9. A 1.0 kg mass is suspended from each side of a pulley. An extra 0.50 kg mass is added to the left side.

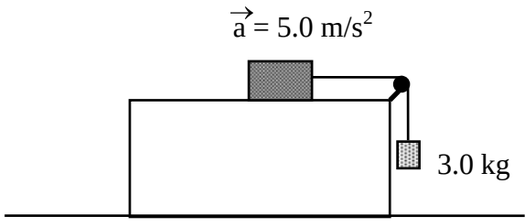
   What is the acceleration of the set of masses on this pulley? [2.0 m/s^2]



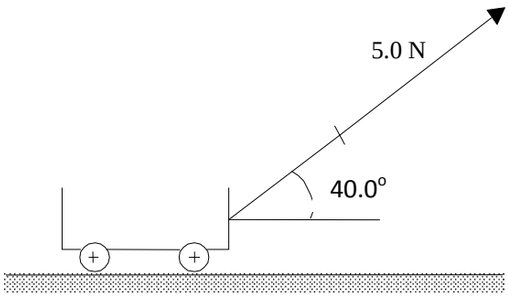
10. A 60.0 kg box is placed on a weighing scale in an elevator that is moving upwards. The scale shows a force of 700.0 N is acting on it. What is the acceleration of the elevator? [1.87m/s^2]

11. A 1000 kg car driving at a speed of 10 m/s along a horizontal, straight highway is accelerated by a 5000 N force parallel to the road. Neglecting the force of friction, what is the acceleration of the car? [5 m/s]

12. A 3.0 kg mass is suspended from a block placed on a table. The block then experiences an acceleration of 5.0 m/s^2. What is the mass of the block? (Neglect friction) [2.9 kg]



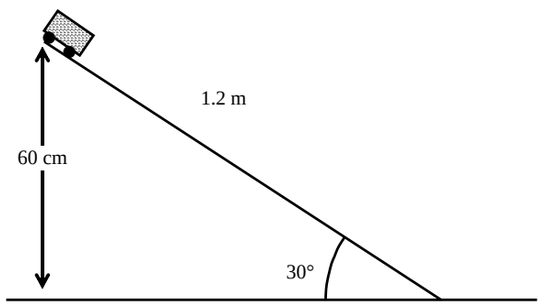
13. A newspaper delivery boy uses a small wagon with a mass of 3.0 kg to pull his newspapers without friction. Using the handle, he pulls the wagon with a force of 5.0 N at an angle of inclination of 40.0° with respect to the horizontal.



What is the acceleration of the wagon? [1.3 m/s^2]

14. A 10.0 kg box is pulled across a level floor, where the coefficient of friction is 0.350. What horizontal force is required for an acceleration of 2.00 m/s^2? [54.3 N]

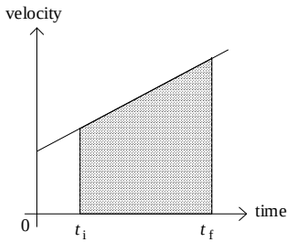
15. The incline is 1.2 m long and the cart begins at an elevation of 60. cm above the table. Ignoring frictional forces, at what speed is the cart going when it reaches the bottom? [3.5 m/s]



16. A car with a mass of 1.0 x 10^3 kg and moving at a speed of 30.0 m/s comes to rest over a distance of 1.0 x 10^2 metres. What is the force of friction (acting on the wheels of the car) which causes the car to stop? [4500 N]

17. A package falls from an airplane with an initial velocity of 5 m/s at an altitude of 500 m. What distance does it fall during the ***third*** second? [30 m]

18. The following graph shows the variation of the velocity of a train as a function of time.



What does the area of the shaded part of the graph represent?

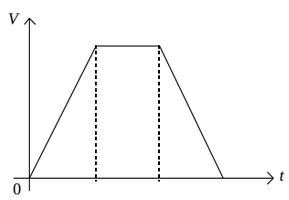
A) The acceleration of the train between times t_i and t_f.

B) The average velocity of the train between times t_i and t_f.

C) The change of velocity of the train between times t_i and t_f.

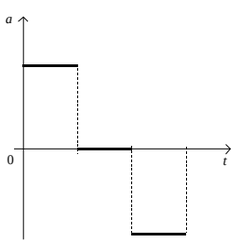
D) The distance covered by the train between times t_i and t_f.

19. The following graph shows the change in the velocity of a train, moving in a straight line path, as a function of time.

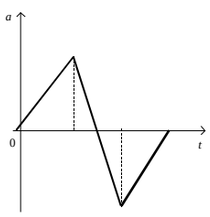


Which one of the following graphs shows the change of acceleration of the train as a function of time?

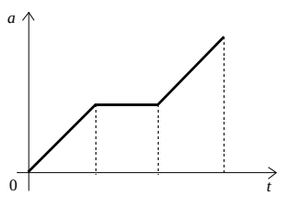
A)



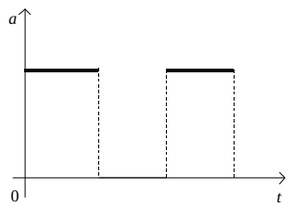
C)



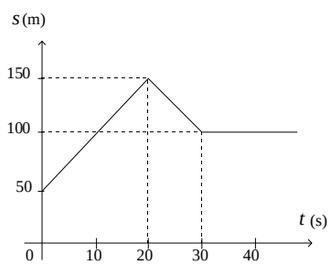
B)



D)

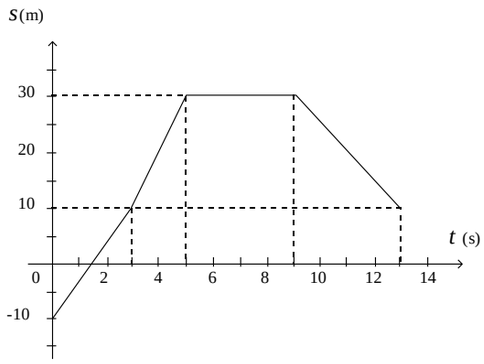


20. The following graph shows the position as a function of time of a cyclist going in a straight-line path.



What is the velocity of the cyclist at 25 seconds? [- 5 m/s]

21. A car is driving in a straight-line path. Its change of position as a function of time is given by the following graph.

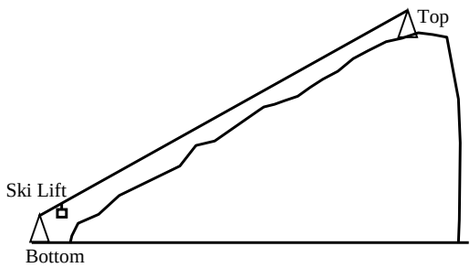


What is the displacement of the car from 0 to 13 seconds? [240 m]

22. An automobile is being driven at a constant velocity on a straight road. The car slows down when it comes to a village, comes to a stop at an intersection, then sets off again and accelerates at a constant rate leaving the village.

Show what has occurred by constructing the velocity-time graph for the automobile.

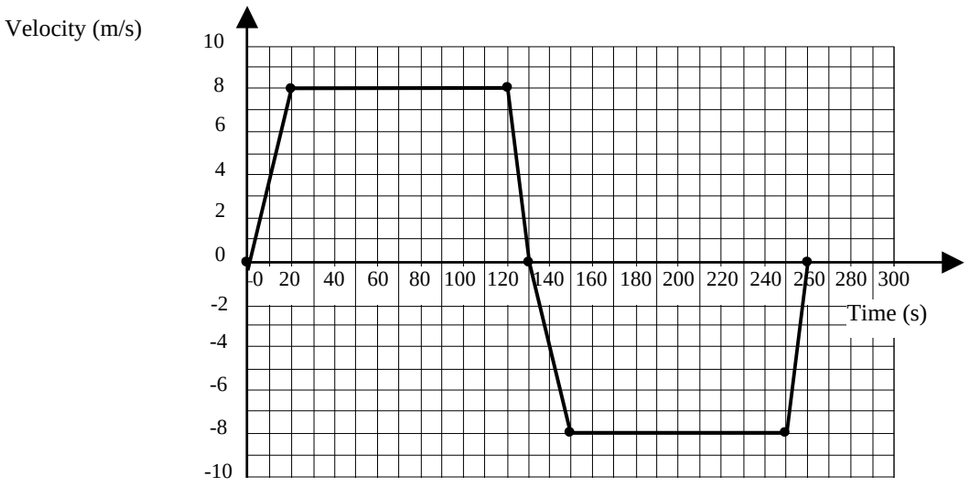
23. A ski lift moves up and down along a hill according to the following *V-t* graph. Unfortunately, it stalls on the way **down** at *t* = 200 s.



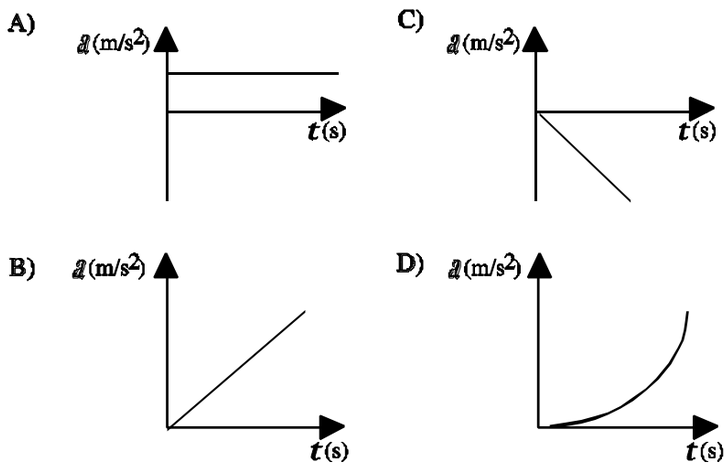
At this point, the rescue team must decide whether the skiers are closer to the top or the bottom of the hill.

Using the *V-t* graph, determine whether the ski lift is closer to the top or to the bottom of the hill and by how much. [closer to bottom by 40 m]

Ski Lift Velocity Graph

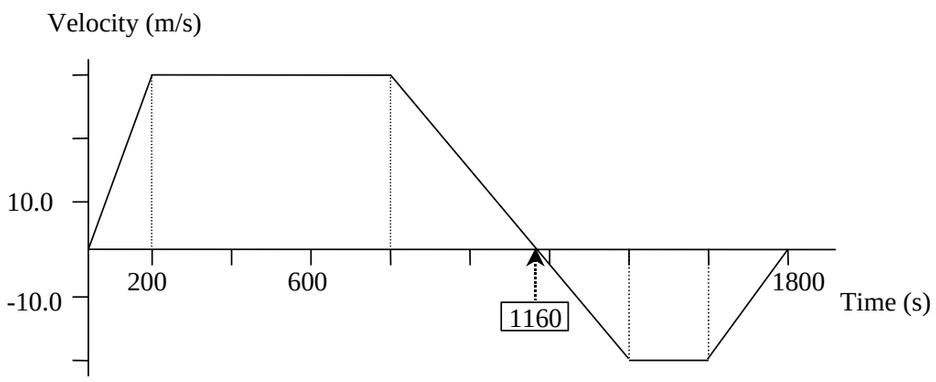


24. Which of the following graphs could be associated with a body in free-fall?



25. Ali is participating in the Tour de l'Île bicycle marathon held each year on the island of Montreal. The following velocity versus time graph represents Ali's course over a period of 1800 seconds.

Velocity-time Graph of Ali's Bicycle Race



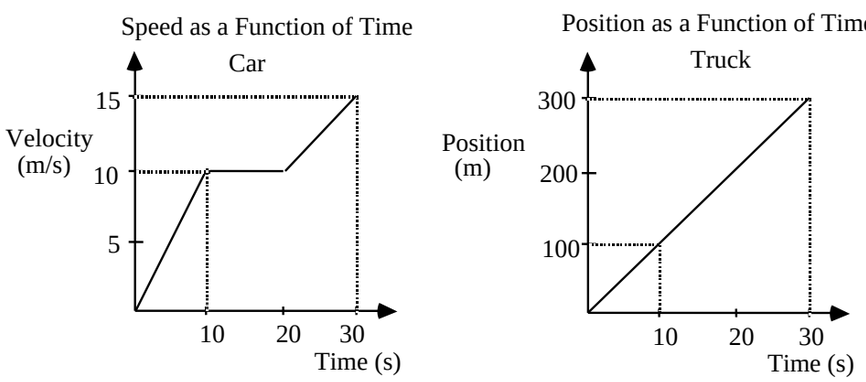
From the graph determine the following:

1. Ali's acceleration at 400 seconds. [0]

2. Ali's acceleration at 1200 seconds. [- 0.75 m/s]

3. Ali's displacement during the period between 800 seconds and 1400 seconds into the ride. [3000 m]

26. A car and a truck leave a traffic light at the same time, travelling in the same direction. The graphs below illustrate their motions.



How many metres apart are the two vehicles after 30 seconds? [25 m]