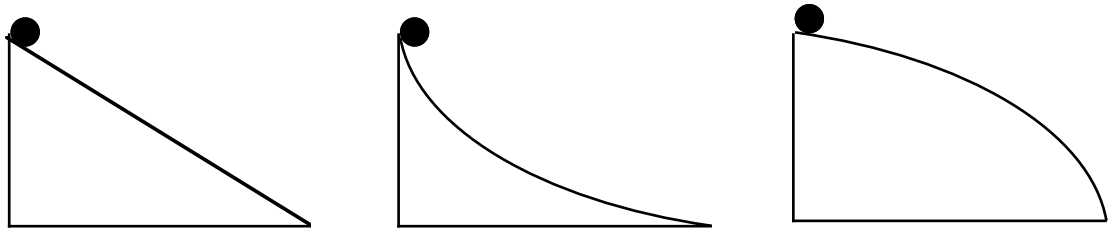
Unit 2: Uniform Acceleration
Worksheet 9, Acceleration Problems

Name_____

Date_____Period_____

1. An object has a speed of 2.00 m/s. Three seconds later it is going 8.00 m/s. What average acceleration did it experience? Answer: 2.00 m/s^2.
2. A car traveling in a straight line has a speed of 30.0 m/s at some instant. After 3.00 s, its speed is 20.0 m/s. What is its average acceleration in this time interval?
3. A car goes from 90.0 km/hr to a stop in 3.00 s. (SUPER BRAKES!) What is its acceleration?
4. An object is accelerated from rest at a constant rate of 5.00 m/s^2. What will be its speed after 8.00 seconds?
5. A car company claims that its car can accelerate from rest to a speed of 28.0 m/s in 20.0 s. Find the average acceleration of the car and the distance it goes in this time.
6. Describe what happens to the speed and acceleration of the ball as it rolls down each of the hills shown below. Sketch a velocity vs. time and an acceleration vs. time graph for ball on each hill.

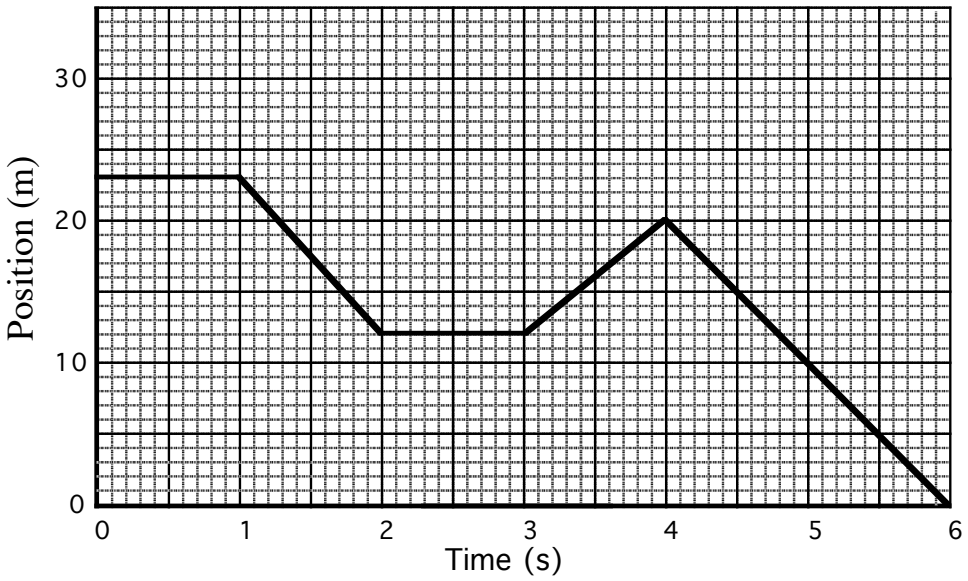


A B C

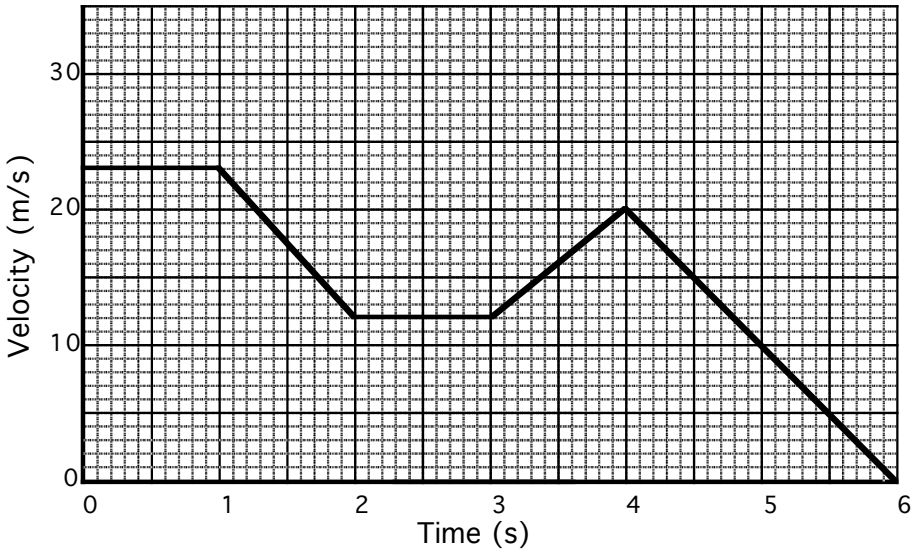
7. A bear spies some honey and takes off from rest at a rate of 2.00 m/s^2. If the honey is 9.00 m away, how fast will his snout be going at the moment of ecstacy?
8. Atom Ant is traveling with an initial velocity of 20.0 cm/s. He begins to accelerate at a rate of 8.00 cm/s^2 for 5.00 s. What is his total displacement in the 5.00 second interval? What is his displacement in the last second?
9. A skier starts from rest and slides 9.00 m down a slope in 3.00 s. In what time after starting will the skier acquire a velocity of 24.0 m/s? Assume constant acceleration. Answer: 12.0 s.
10. A bus moving at a speed of 20.0 m/s begins to slow at a rate of 3.00 m/s each second. Find how far it goes before stopping. Answer: 66.7 m
11. The engine of a model rocket accelerates the rocket vertically upward for 2.00 s such that its speed is given by the following data. At $t = 0$, its speed is zero; at $t = 1.00$ s, its speed is 5.00 m/s; at $t = 2.00$ s, its speed is 10.0 m/s, at $t = 3.00$ s, its speed is 15.0 m/s, and at $t = 4.00$ s its speed is 20.0 m/s. Plot a velocity vs. time graph for this motion and from it determine the average acceleration. What do you expect its acceleration to be at $t = 5.00$ s? Why? What will its velocity be at $t = 10.0$ s if it continues at this acceleration? How far will it have traveled after 10 s?
12. Until recently, the world's land speed record was held by Colonel John P. Stapp, USAF. On March 19, 1954, he rode a rocket-propelled sled that moved down the track at 632 mi/hr. He and the sled were safely brought to rest in 1.40 s. Determine the acceleration he experienced and the distance he traveled during this acceleration.
13. Find the speed at the end of 5.00 s, the average speed for the 5.00 s interval, and the distance traveled in the 5.00 s. Answers: 40.0 m/s, 20.0 m/s, 10<u>0</u> m.
14. A go-cart travels the first half of a 100 m track with a constant speed of 5.00 m/s. In the second half of the track, it experiences a mechanical problem and slows down at a rate of 0.200 m/s^2. How long does it take the go-cart to travel the 10<u>0</u> m distance?
15. A car moving at 30.0 m/s slows uniformly to a speed of 10.0 m/s in a time of 5.00 s. Determine the acceleration of the car and the distance it moves in the third second. Answers: - 4.00 m/s^2, 20.0 m.

16. The velocity of a train is reduced uniformly from 15.0 m/s to 7.00 m/s while traveling a distance of 90.0 m. a. Compute the acceleration. b. How much farther will the train travel before coming to rest, provided the acceleration remains constant? Answers: -0.980 m/s^2, 25.0 m.
17. A bullet is fired at right angles through a board 10.0 cm thick. If the initial speed of the bullet is 40$\underline{0}$ m/s, and it the speed as it emerges is 30$\underline{0}$ m/s, find the acceleration of the bullet and the time it is in contact with the board.
18. A late passenger, sprinting at 8.00 m/s, is 30.0 m away from the rear end of a train when the train starts from rest with a constant acceleration of 1.00 m/s^2. Will the passenger catch the train, and if so, how far must he run to do so? How long will he have to run?
19. In putting, the force with which a golfer strikes the ball is very different if he is putting uphill vs. downhill. If she is to stop the ball 1.00 m long or short even if the putt is missed, it is more difficult to do when putting downhill. To see why, assume that a ball decelerates at a rate of 3.00 m/s^2 going downhill, and 4.00 m/s^2 going uphill. If we are 7.00 m away from the cup, calculate the allowable range of initial velocities we may impart to the ball so that is stops within this 1.00 m range on either side of the cup. What in your result suggests that a downhill putt is more difficult?

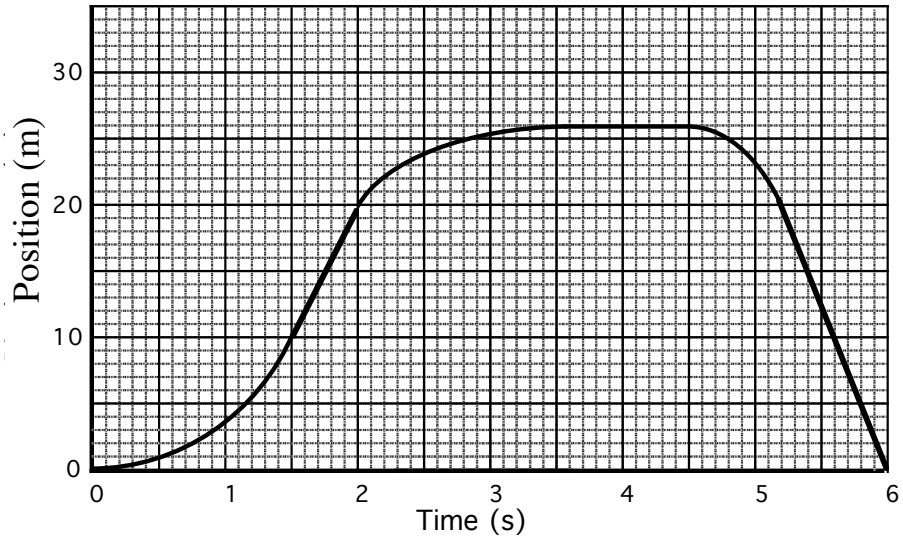
20. Use the position vs. time graph below to draw a velocity vs. time and an acceleration vs. time graph corresponding to the motion of the object. What is the instantaneous velocity of the object at a time of 5.00 seconds? What is the average speed for the whole trip?



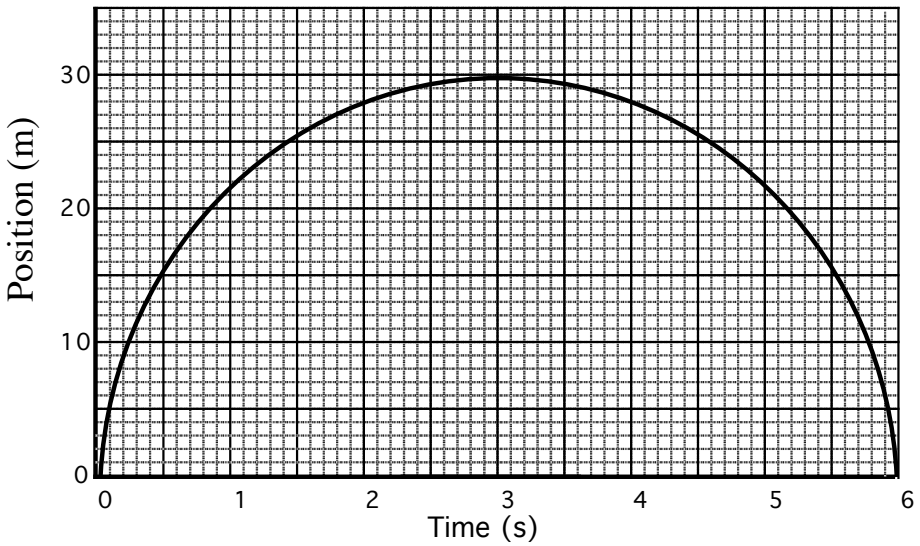
21. Use the velocity vs. time graph to the right to draw an acceleration vs. time graph corresponding to the motion of the object. What is the instantaneous velocity of the object at a time of 5.00 seconds? What is the acceleration of the object during each of the following intervals: 0 to 1.00 s, 1.00 s to 2.00 s, 2.00 s to 3.00 s, 3.00 s to 4.00 s, and 4.00 s to 5.00 s? What can you say about the acceleration during each of those intervals? What is the average acceleration for the whole trip?



22. Use the position vs. time graph to the right to sketch a velocity vs. time and an acceleration vs. time graph corresponding to the motion of the object.



23. A ball is thrown vertically upward at t = 0, and is caught at the same level at t = 6.00 s. The graph below describes the position of the ball above hand level as a function of time. Determine the instantaneous velocity and instantaneous acceleration of the ball at t = 0, t = 1.00 s, t = 2.00 s, t = 3.00 s, t = 4.00 s, t = 5.00 s, and t = 6.00 s. Use whatever method you feel is most appropriate.



24. The diagram below shows a ball starting at rest at point A, which travels from point A to point E.
    a. Sketch the position vs. time graph corresponding to the ball's trip from A to E.
    b. Sketch the velocity vs. time graph corresponding to the ball's trip from A to E.
    c. Sketch the acceleration vs. time graph corresponding to the ball's trip from A to E.