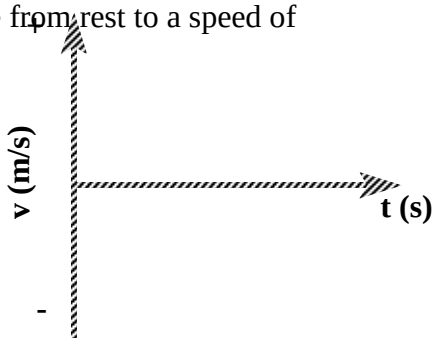
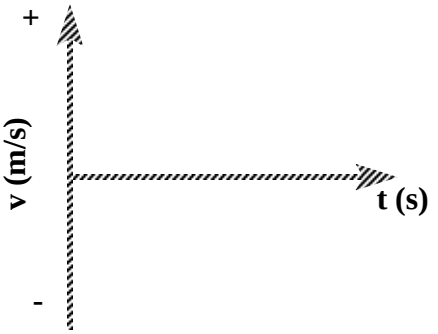
Worksheet 9

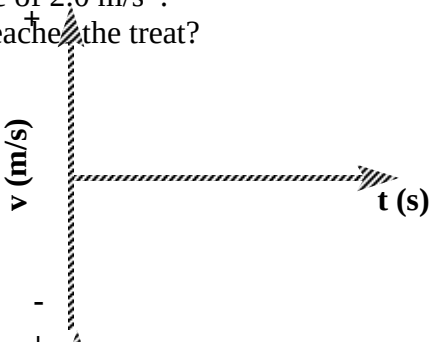
1. A poorly tuned Geo Metro (really old cheap, slow, car) can accelerate from rest to a speed of 28 m/s in 20 s.
   a) What is the average acceleration of the car?
   b) What distance does it travel in this time?



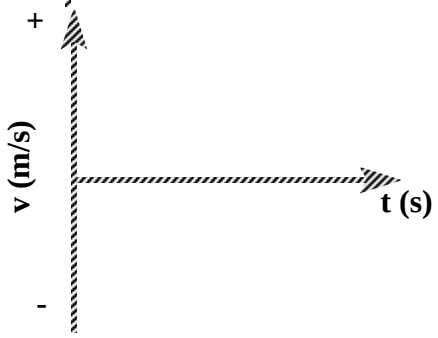
2. At t = 0 a car has a speed of 30 m/s. At t = 6 s, its speed is 14 m/s.
   What is its average acceleration during this time interval?



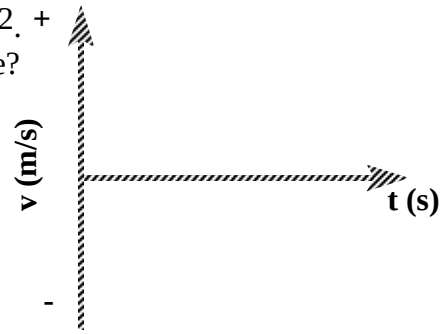
3. A bear spies some honey and takes off from rest, accelerating at a rate of 2.0 m/s^2.
   If the honey is 16 m away, how fast will his snout be going when it reaches the treat?



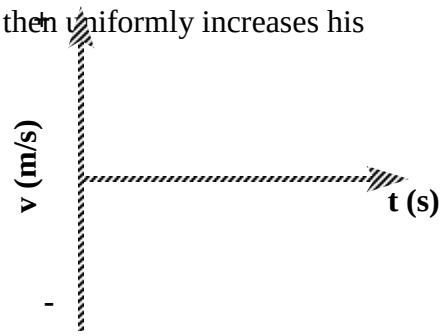
4. A bus moving at 20 m/s (t = 0) slows at a rate of 4 m/s each second.
   a) How long does it take the bus to stop?
   b) How far does it travel while braking?



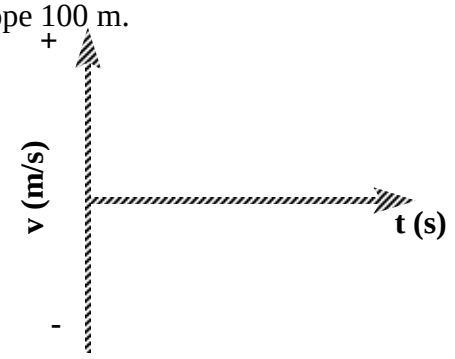
5. A physics student skis down a hill, accelerating at a constant 2.0 m/s^2.
   If it takes her 15 s to reach the bottom, what is the length of the slope?



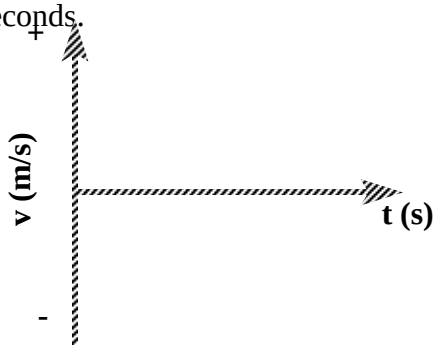
6. A dog runs down his driveway with an initial speed of 5 m/s for 8 s, then uniformly increases his speed to 10 m/s in 5 s.
   a) What was his acceleration during the 2nd part of the motion?
   b) How long is the driveway?



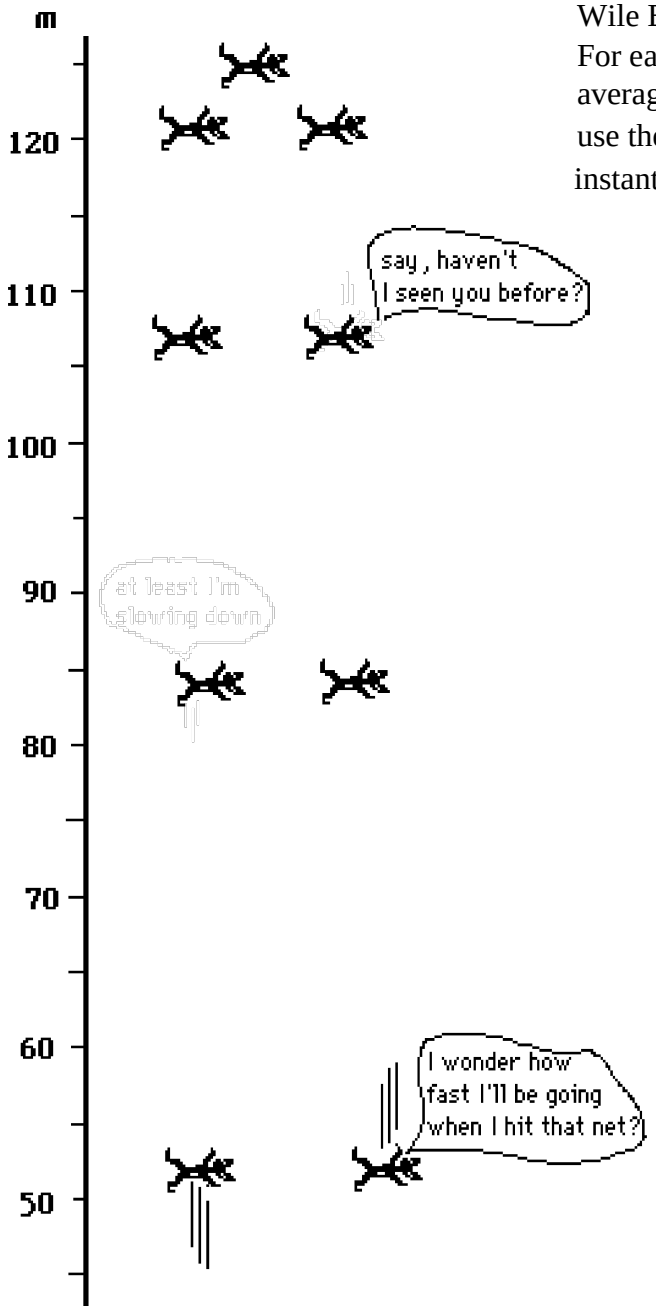
7. A mountain goat starts a rock slide and the rocks crash down the slope 100 m.
   If the rocks reach the bottom in 5 s, what is their acceleration?



8. A car whose initial speed is 30 m/s slows uniformly to 10 m/s in 5 seconds.
   a) Determine the acceleration of the car.
   b) Determine the distance it travels in the 3rd second
   (t = 2s to t = 3s).



Wile E. Coyote Shot from a Cannon on Earth



Wile E. is shot upward from a cannon with V_i = 50m/s. For each second, determine the displacement and the average velocity over the interval to that point. Then, use the derivation below to help you calculate the instantaneous velocity, V_f, at each second.

$$\bar{v} = \frac{v_i + v_f}{2}$$

$$2\bar{v} = v_i + v_f$$

$$2\bar{v} - v_i = v_f$$

T (s)	Y (m)	$\bar{V}$ (m/s)	V_f (m/s)
0	0	xxxx	50
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

1. Draw velocity and acceleration vectors on each picture of Wile E.

2. Create a Velocity vs. Time graph for Wile E's flight. Which velocity do you use? Explain.

   a. What is Wile E's velocity at 5 s?

   b. What is his acceleration at 5 s?

   c. From the graph, determine his displacement for each half of the trip

Worksheet 10

For each of the following problems write the fundamental mathematical model to use, rearrange it to the form required to solve the problem, then solve the problem. Be sure to label appropriately.

1. A body falls freely from rest on Earth. Find:
   a. its displacement at t = 3s
   b. the time for it to reach a speed of 25 m/s
   c. the time required for it to fall 300 m
   d. its speed after falling 70 m

2. Repeat question 1 for a body falling freely on the moon. The acceleration due to gravity there is 1.7 m/s^2.

3. A ball is dropped from rest at a height of 80 m above the ground.
   a. What is its speed just as it hits the ground?
   b. How long does it take for it to reach the ground?

4. A marble dropped from a bridge strikes the water in 6.0 s. Calculate:
   a. the speed with which it strikes the water
   b. the height of the bridge

Free Fall with $v_0 \neq 0$

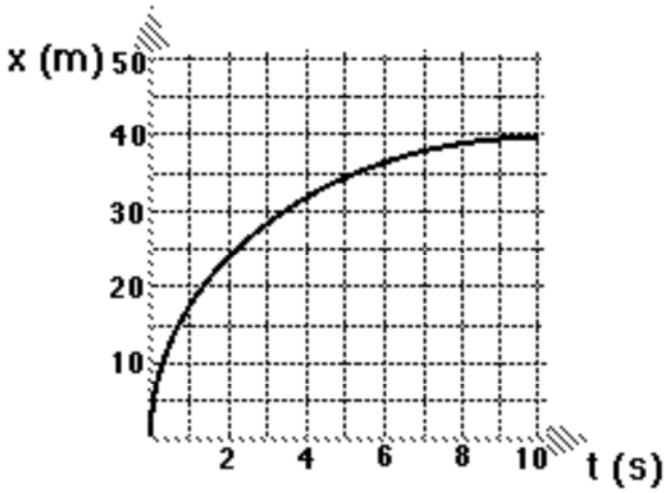
5. A body is thrown downward with an initial speed of 20 m/s on Earth. What is the:
   a. acceleration of the object
   b. displacement after 4 s
   c. time required to reach a speed of 50 m/s
   d. time required to fall 300 m (Hint: factor the quadratic)
   e. speed after falling 100 m

6. A student throws his worthless lab partner off a 120 m high bridge with an initial downward speed of 10 m/s
   a. How long does it take the deadbeat to hit the ground below?
   b. How fast is he going at the moment of impact?

7. When a kid *drops* a rock off the edge of a cliff, it takes 4.0 s to reach the ground below. When he *throws* the rock down, it strikes the ground in 3.0 s. What initial speed did he give the rock?

Review

Use the graph below to answer questions #1-4 that follow:



1. Give a written description to describe the motion of this object.

2. Explain how you could determine the instantaneous velocity of the object at **t** = 2 s.

3. Assume the initial velocity was 50 m/s; determine the acceleration of the object.

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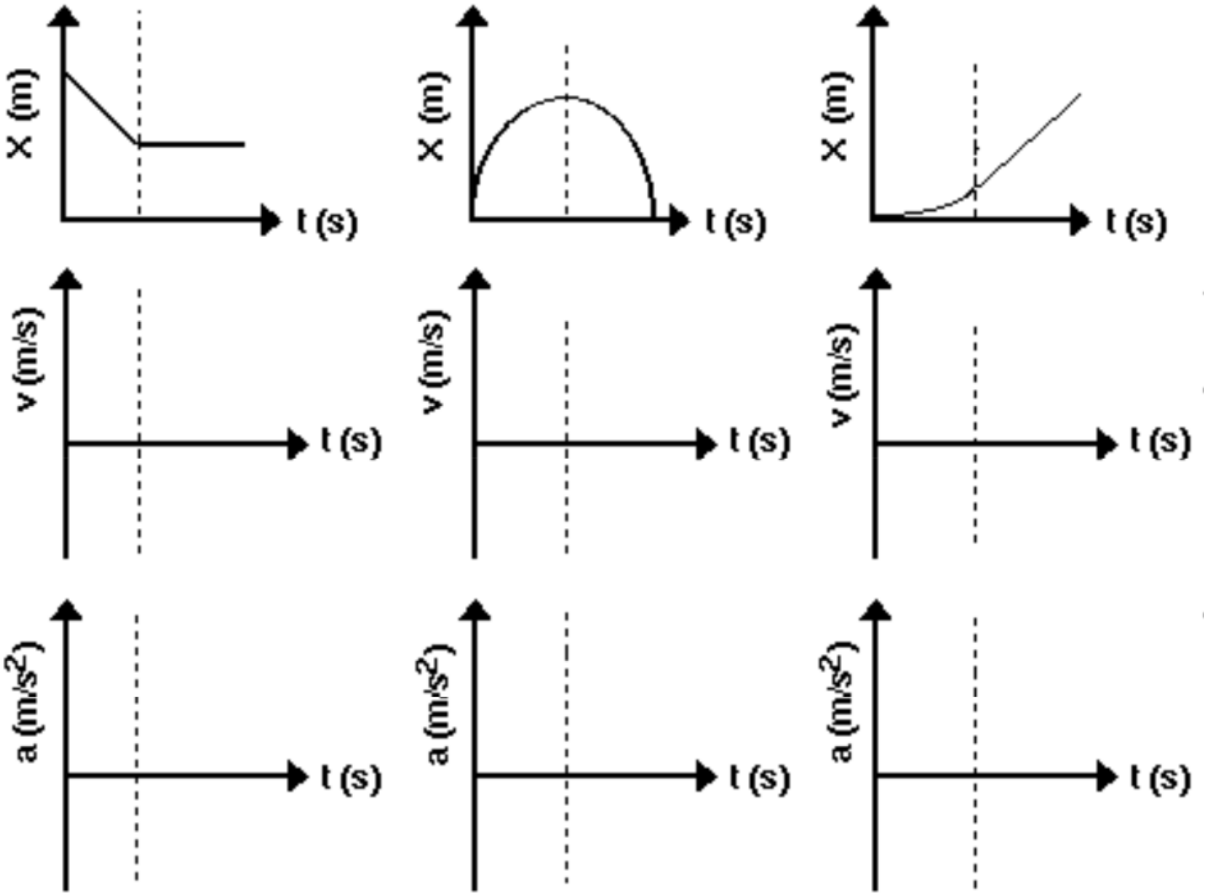
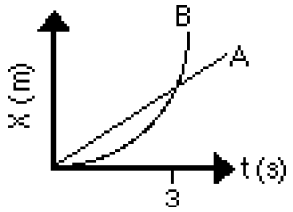
4. A Pontiac Trans-Am, initially at rest, accelerates at a constant rate of 4.0 m/s^2 for 6 s. How fast will the car be traveling at **t** = 6 s?

5. A tailback initially running at a velocity of 5.0 m/s becomes very tired and slows down at a uniform rate of 0.25 m/s^2. How fast will he be running after going an additional 10 meters?

6. For each of the position vs time graphs shown below, draw the corresponding **v** vs **t**, and **a** vs **t** graph



7. Using the graph below, compare the kinematic behavior of the two objects.



Comparison:	**is A > B, A < B, or A = B,**	**How do you know?**

a. Displacement at 3 s

b. **Average** velocity from 0 - 3 s

c. **Instantaneous** velocity at 3 s

8. If a freely falling object were somehow equipped with a speedometer, its speed would increase each second by about
   a. 5. m/s.
   b. 10. m/s.
   c. 15. m/s.
   d. a variable amount.
   e. It depends on its initial speed.

__ 9. If a freely falling object were somehow equipped with an odometer to measure the distance it travels, then the distance it travels each succeeding second would be
   a. the same.
   b. less than the previous second.
   c. greater than the previous second.
   d. The distance cannot be predicted.

__ 10. A projectile is launched straight upwards at 75 m/s. Three seconds later, its velocity is
   a. 60 m/s
   b. 45 m/s
   c. 30 m/s
   d. zero

__ 11. Starting from rest, a freely-falling object will fall, in 10. seconds, a distance of about
   a. 10. m.
   b. 50. m.
   c. 100. m.
   d. 500. m.
   e. more than 500. m.

__ 12. A projectile is fired straight up at a speed of 100. m/s. When the projectile returns to its starting position, its speed is
   a. less than 100. m/s.
   b. more than 100. m/s.
   c. 100. m/s.
   d. It depends on how long it takes to return.

__ 13. When a rock thrown straight upward gets to the exact top of its path, the magnitude of its
   a. velocity is zero and its acceleration is zero.
   b. velocity is zero and its acceleration is about 10. $m/s^{2.}$
   c. velocity is about 10. m/s and its acceleration is zero.
   d. velocity is about 10. m/s and its acceleration is about 10. $m/s^{2.}$

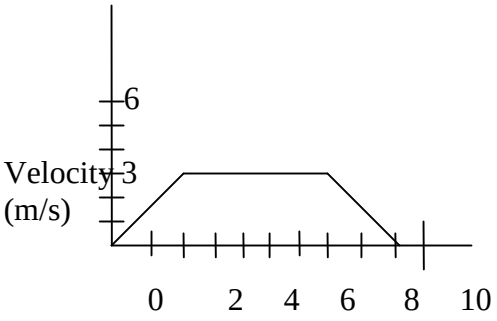
1-D Motion Unit Review

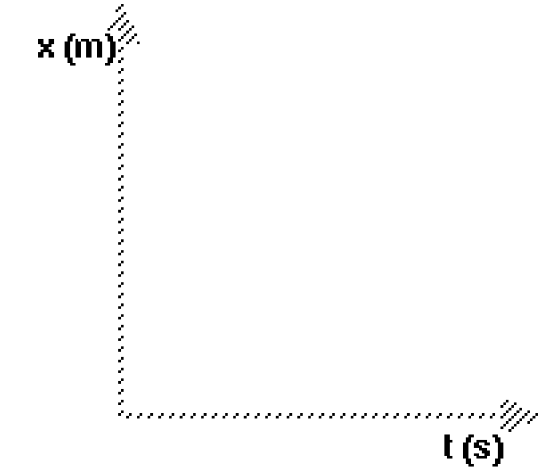
Graph Problem: Using the following graph,

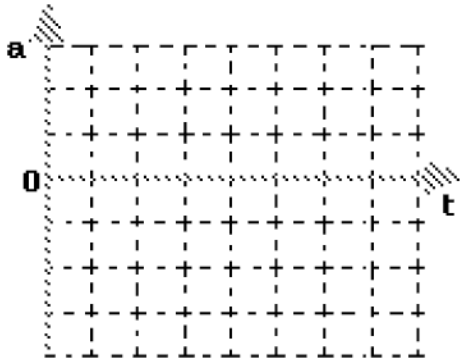
a. In complete sentences, describe the motion taking place in the graph. Be sure to include position, velocity and acceleration, and how they change. Use phrases like “speeding up” and “moving forward.”

b. Create a displacement versus time graph for this situation.

c. Create an acceleration versus time graph for this situation.







Word Problems:

14. What is the total distance traveled by an object that moves with an average speed of 6.0 meters per second for 8.0 seconds?

15. An object travels 40 meters with an average speed of 160 meters per second. How much time does this take?

16. A car is accelerated at 4.0 m/s^2 from rest. How long will it take the car to reach a speed of 28 meters per second?

17. If a car increases its speed from 15 m/s to 30 m/s in 15 seconds, what is the average acceleration during this time?

18. Starting from rest, an object rolls freely down an incline that is 10 meters long in 2 seconds. What is the acceleration of the object?

19. Six seconds after a horse race starts, the leading horse has covered 200 meters. What is his acceleration?

20. As a projectile rises and then falls back to the ground, what happens to its acceleration?

A. decreases, then increases
B. increases, then decreases
C. increases, only
D. remains the same

21. Object A is dropped from rest on a planet that has acceleration A and it falls for 2 seconds. Object B is dropped from rest on a planet where the acceleration is twice as large and it is allowed to fall for 1 sec. What can be said about the distance each object has traveled?

A. B travels one-half as far
B. B travels twice as far
C. B travels 3 times as far
D. B travels 4 times as far

22. How much time does it take for a rock to hit the ground if you toss it up with a velocity of 3 m/s at a height of 1 m above the ground? How far would a rock dropped from a tall tree fall after 4 seconds?