Kinematics practice problems:

1. Georgia is jogging with a velocity of 4 m/s when she accelerates at 2 m/s^2 for 3 seconds. How fast is Georgia running now?

2. In a football game, running back is at the 10 yard line and running up the field towards the 50 yard line, and runs for 3 seconds at 8 yd/s. What is his current position (in yards)?

3. A cat is moving at 18 m/s when it accelerates at 4 m/s^2 for 2 seconds. What is his new velocity?

4. A race car is traveling at +76 m/s when is slows down at -9 m/s^2 for 4 seconds. What is his new velocity?

5. An alien spaceship is 500 m above the ground and moving at a constant velocity of 150 m/s upwards. How high above the ground is the ship after 5 seconds?

6. A bicyclist is traveling at +25 m/s when he begins to decelerate at -4 m/s^2. How fast is he traveling after 5 seconds?

7. A squirrel is 5.0 m away from you while moving at a constant velocity of 3 m/s away from you. How far away is the squirrel after 5 seconds?

8. A ball is dropped off a very tall canyon ledge. Gravity accelerates the ball at 9.8 m/s^2. How fast is the ball traveling after 5 seconds?

9. During a race, a dragster is 200 m from the finish line when something goes wrong and it stops accelerating. It travels at a constant velocity of 45 m/s for 3 seconds to try to finish the race. How far from the finish line is the dragster after 3 seconds?

10. A dog is 60 m away while moving at a constant velocity of 10 m/s towards you. Where is the dog after 4 seconds?

11. Isaac throws an apple straight up (in the positive direction) from 1.0 m above the ground, reaching a maximum height of 35 meters. Neglecting air resistance, what is the ball's velocity when it hits the ground?

12. Two kittens are on opposite sides of a field, 250 m apart. Kitten A runs at a constant speed of 25 m/s due east on a collision course with kitten B, which is traveling west at 12 m/s. How much time elapses before the two kittens collide?

Worksheet 2.6 - Kinematic Equations

1. A ball rolling down a hill was displaced 19.6 m while uniformly accelerating from rest. If the final velocity was 5.00 m/s. what was the rate of acceleration?

2. A car starts from rest and accelerates uniformly to reach a speed of 21 m/s in 7.0 s. What was the speed of the object after 2.0 seconds?

3. A bike rider accelerates uniformly at 2.0 m/s² for 10.0 s. If the rider starts from rest, calculate the distance traveled in the **fourth** second.
(i.e. between t = 3 s and t = 4 s).

4. If a bullet leaves the muzzle of a rifle at 600.0 m/s, and the barrel is 0.90 m long, what was the acceleration of the bullet while in the barrel?

5. The Jamaican bobsled team hit the brakes on their sled so that it decelerates at a uniform rate of 0.43 m/s². How long does it take to stop if it travels 85 m before coming to rest?

Bonus: A driver of a car going 90 km/h suddenly sees the lights of a barrier 40.0 m ahead. It takes the driver 0.75 s before he applies the brakes (this is known as reaction time). Once he does begin to brake, he decelerates at a rate of 10.0 m/s².

a) Does he hit the barrier?

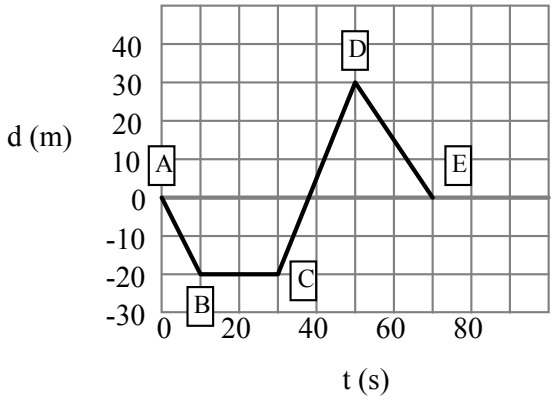
b) SUPER-BONUS: What would be the maximum speed at which the car could travel and NOT hit the barrier 40.0 m ahead?

Unit 2: Kinematics in 1-D
Exam Preparation

1. 1. A bike first accelerates from 0.0 m/s to 5.0 m/s in 4.5 s, then continues at this constant speed for another 4.5 s. What is the total distance traveled by the bike?

2. A car traveling at 20 m/s when the driver sees a child standing in the road. He takes 0.80 s to react, then steps on the brakes and slows at 7.0 m/s^2. How far does the car go before it stops?

3. Answer the following questions about the car whose motion is graphed below:



   a. When was the car 20 m west of the origin?
   b. where was the car at 50 s?
   c. The car suddenly reversed direction. When and where did that occur?

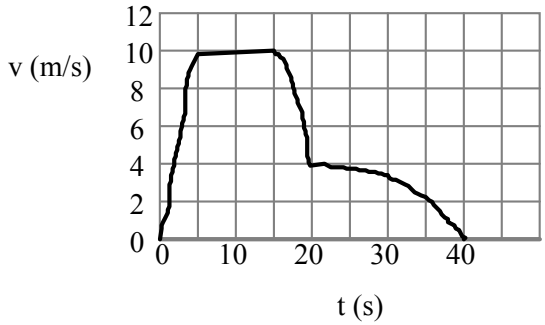
4. A car starts 200 m west of the town square and moves with a constant velocity of 15 m/s toward the east. Draw a graph that represents the motion of the car
   a. Where will the car be 10 minutes later?
   b. When will the car reach the town square?

5. At the same time the car in #4 left, a truck was 400 m east of the town square moving west at a constant velocity of 12 m/s.
   a. Add the truck's motion to the graph you drew for question #4.
   b. Find the time where the car passed the truck.

6. A car is coasting backwards downhill at a speed of 3.0 m/s when the driver gets the engine started. After 2.5 s, the car is moving uphill at 4.5 m/s. Assuming that uphill is positive direction, what is the car's average acceleration?

7. A car slows from 22 m/s to 3.0 m/s at a constant rate of 2.1 m/s^2. How many seconds are required before the car is traveling 3.0 m/s?

8. Look at the velocity-time graph given



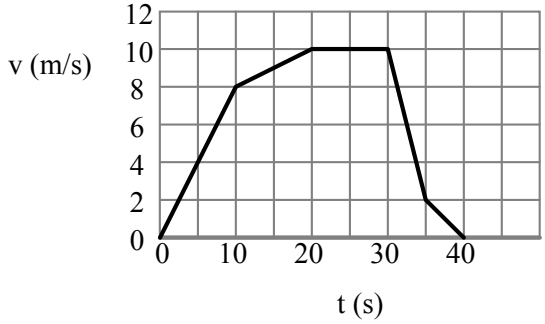
a. During which time interval or intervals is the speed constant?
b. During which interval or intervals is the train's acceleration positive?
c. During which time interval is its acceleration most negative?
d. Find the average acceleration during the following time intervals:
i. 0 to 5 s. ii. 15 to 20 s. iii 0 to 40 s.

9. An airplane starts from rest and accelerates at a constant rate of 3.00 m/s^2 for 30.0 s before leaving the ground.
a. How far did it move?
b. How fast was it going when it took off?

10. A brick is dropped from a high scaffold.
a. What is its velocity after 4.0 s?
b. How far does the brick fall during this time?

11. A tennis ball is thrown straight up with an initial speed of 22.5 m/s. It is caught at the same distance above the ground.
a. How high does the ball rise?
b. How long does the ball remain in the air?

12. Consider the following velocity-time graph.



Determine the displacement after t = ...
a. 10 s. b. 20 s. c. 30 s. d. 40 s.

13. A bag is dropped for a hovering helicopter. When the bag has fallen for 2.00 s,
a. what is the bag's velocity?
b. how far has the bag fallen?

1) 33.8 m 2) 44.6 m 3) a. Between B and C b. 30 m East c. D 4) a. 8800 m b. 13.3 s 5) b. 22.2 s 6) 3.0 m/s 7) 9.04 s 8) a. Between 5 and 15 s b. Between 0 and 5 s c. Between 15 and 20 s d. i. 2.0 m/s^2 ii. 1.2 m/s^2 iii 0 m/s^2 9) a. 1350 m b. 96 m/s 10) a. 39.2 s b. 78.4 m 11) 25.8 m b. 4.6 s 12) a. 40 m b. 130 m c. 230 m d. 265 m 13) a. 19.6 m/s b. 19.6 m

Worksheet 2.7 – Uniform Accelerated Motion

1) Bumblebee jumps straight upwards with a velocity of 14.0 m/s. What is his displacement of after 1.80 s?

(9.32 m)

2) A surprisingly spherical decepticon is rolled up a constant slope with an initial velocity of 9.3 m/s. What is the acceleration of the decepticon if its displacement is 1.9 m up the slope after 2.7 s?

($-6.4 m/s^2$)

3) Optimus Prime coasts up a hill initially at 11.0 m/s. After 9.3 s he is rolling back down the slope at 7.3 m/s. What is his acceleration?

($-2.0 m/s^2$)

4) Sonic (you know, the Hedgehog) rolls up a slope at 9.4 m/s. After 3.0 s he is rolling back down at 7.4 m/s. How far up the hill is he at this time?

(3.0 m)

5) Luigi jumps straight upwards at 15.0 m/s. How high is he when he is travelling at:

a) 8.0 m/s upwards?

(8.2 m)

b) 8.0 m/s downwards?

(8.2 m, weird huh?)

6) Sick of his guff, Optimus decides to throw Megatron down off the top of a building at 5.0 m/s. Megatron hits the ground traveling at 32.0 m/s.
a. How long does it take to hit the ground?

(2.8 s)

b. How far does he fall?

(- 51 m)

7) Mario rolls a coin up a slope at 2.0 m/s. It travels 2.7 m, comes to a stop and rolls back down. What is the coin's entire time of travel?

(5.4 s)

8) While strolling along on Planet X an astronaut decides to throw a hammer and a feather upwards at 5.0 m/s. They both return to the point of release in 3.0 s. What is the acceleration due to gravity on Planet X.

(-3.3 m/s^2)

9) Princess Toadstool stands on the edge of a 30.0 m high cliff. She throws Bowser upwards at 20.0 m/s. If Bowser falls all the way to the bottom of the cliff, find:
a. his velocity when he hits the ground.

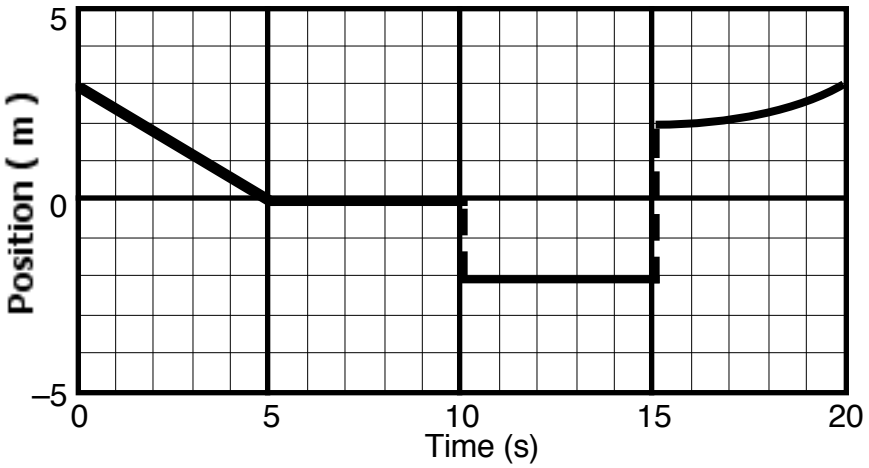
(-31.4 m/s)

b. the time it takes to hit the ground.

(5.24 s)

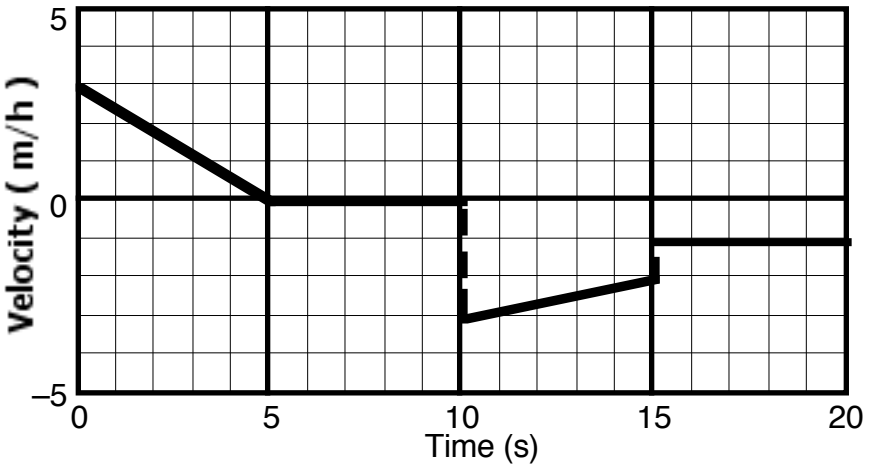
Graphing:

1.



a. Which 5 second interval(s) show a negative velocity?
b. Which 5 second interval(s) show a positive acceleration?
c. Which 5 second interval(s) show a velocity that is constant?
d. Which 5 second interval(s) show a velocity of zero?
e. What is the velocity at 6 seconds?
f. What is the velocity at 19 seconds?
g. What is the displacement from 5 to 15 seconds?
h. What are the units of slope from the graph above?

2.



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