

Uniform Motion

1. A ball is rolling on the ground at a speed of 2.5 m/s. After 5.0 seconds, how far does it have moved?
2. A student sprints at a constant speed of 8.10 m/s. How long will it take for him to run 100. m?
3. A woman jogs 1500 m west to the grocery store and walks 450 m east to the bus stop. If this takes her 1200 seconds, what is her...
 - a) average speed?
 - b) average velocity?
4. A bike travels with an average velocity of 8.0 m/s west for 30.0 minutes, then 10.0 m/s east for 20.0 minutes. a) What distance did the bike travel? b) What is the displacement of the bike?
5. A marathon runner completes the 42.0 km race in 2 hours and 57 minutes. What is his average speed?
6. A car travels east at 40.0 km/h for 30. minutes and east at 60.0 km/h for 15 minutes. How far does it travel in this time?
7. A race car circles 10 times around an 8.0 km track in 20.0 min.
 - a) What is its average speed?
 - b) What is its average velocity?
8. A motorist travels for 3.0 h at 80.0 km/h and 2.0 h at 100.0 km/h.
 - a) How far does she travel in this time?
 - b) What is her average speed?
9. A car drives 8.0 km at 10.0 m/s then 40.0 km at 25 m/s. What is the average speed?
10. In a 400 m relay race, the anchorman (the person who runs the last 100 m) for the Griffins can run 100. m in 9.8 s. His rival, the anchorman for the Jokers, can cover 100. m in 10.1 s. What is the largest lead the Joker runner can have when the Griffin runner starts the final leg of the race, in order for the Griffin runner not to lose the race?

Uniform Accelerated Motion

1. An airplane increases its speed from **120 m/s** to **160 m/s** at the average rate of **8.0 m/s²**.
How much time does it take for the complete increase in speed?
2. A car travelling at **60.0 km/h** accelerates at a rate of **2.0 m/s²**.
How much time is required for the car to reach a speed of 90.0 km/h?
3. A ball is thrown upwards at a velocity of **20.0 m/s**.
What is its velocity after 3.0 s?
4. A flowerpot falls from a window **36.0 m** above the ground.
 - a) **How fast is it moving when it hits the ground?**
 - b) **How long did it take to hit the ground?**
5. A Social Studies textbook is dropped out the window and takes **2.1 s** to hit the ground.
How high above the ground is the window?
6. A car goes from **40.0 m/s** to **80.0 m/s** over a distance of **200.0 m**.
What is its acceleration during this time?
7. A tennis ball is thrown upward and reaches a height of **99.0 m**.
What was the initial velocity of the ball?
8. An object travelling east goes from **14.0 m/s** to **4.0 m/s** in **10.0 s** with constant acceleration.
What is the acceleration?
9. A jet fighter plane is launched from a catapult on an aircraft carrier. After **2.0 s**, it reaches the end of the catapult with a speed of **42 m/s**.
Assuming the acceleration is constant, what is the length of the catapult?
10. A car with good tires on a dry road can decelerate at about **5.0 m/s²** when braking. If the car is travelling at **89.5 km/h**:
 - a) **How long does it take the car to stop under these conditions?**
 - b) **How far does the car travel during this time?**

Uniform Accelerated Motion (More!)

1. A rocket rises vertically, from rest, with an acceleration of 3.2 m/s^2 until it runs out of fuel at an altitude of 775 m.

After this point, its acceleration is that of gravity, downward.

- a) What is the velocity of the rocket when it runs out of fuel?
- b) How long does it take to reach this point?
- c) What maximum altitude does the rocket reach?
- d) How much time (total) does it take to reach maximum altitude?
- e) With what velocity does it strike the Earth?
- f) How long (total) is it in the air?

2. A rock is thrown upwards with a speed of 20 m/s from the top of a 100 m high cliff.

It reaches a maximum height and then falls to the base of the cliff.

- a) How long does it take to hit the ground? Solve using two (or more) different methods.
- b) At what other velocity could the rock be thrown to hit the ground at the same speed?
- c) Over which one-second interval of the rock's flight does it have the least displacement (i.e., the change in position from the beginning of the time interval to the position one second later is the least)?

3. Adin runs past Brad at a constant speed of 4.0 m/s .

Five seconds after Adin passes him, Brad remembers that he needs to tell him a message so he accelerates uniformly towards Adin at 0.80 m/s^2 .

Question: After how much time since Adin passed Brad will Brad be able to catch up to Adin?

4. A couple of mischievous students are dropping old physics textbooks off the tops of cliffs.

a) Matthew drops a textbook off a 300 m high cliff. How long will it be until he hears the textbook hit the ground?

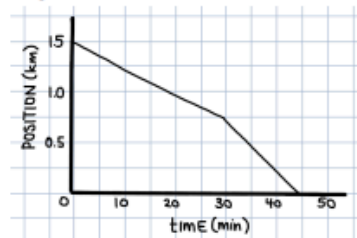
(The speed of sound in air is 343 m/s .)

b) Connor drops a textbook off a cliff and hears the textbook hit the ground 6.35 s later. How high is the cliff?

Motion Graphs

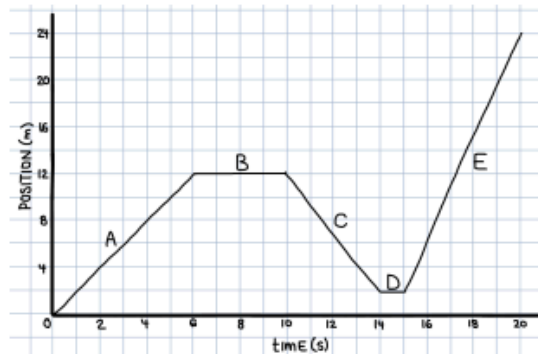
1. Use the following position vs. time graph to answer the following:

- What is the speed of the object between 0 and 30 minutes?
- What is the speed of the object 30 and 45 minutes?
- What is the average speed of the object from 0 to 45 minutes?



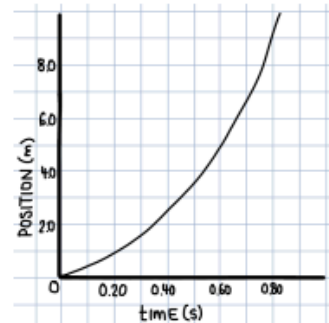
2. Use the following position vs. time graph to answer the following:

- When is the object moving the fastest?
- When is the object moving in the positive direction?
- When is the object moving in the negative direction?
- When is the object not moving?
- What is the average velocity of the object between 0 and 20 seconds?



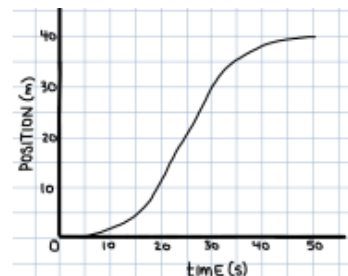
3. Use the following position vs. time graph to answer the following:

- What is the average speed of the object between 0 and 0.80 s?
- What is the instantaneous speed of the ball at 0.60 s?



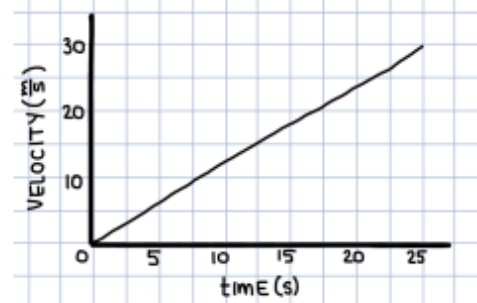
4. Use the following position vs. time graph to answer the following:

- What is the average speed of the object between 0 and 50 s?
- What is the instantaneous speed of the object at 25 s?
- When is the object speeding up?
- When is the object slowing down?



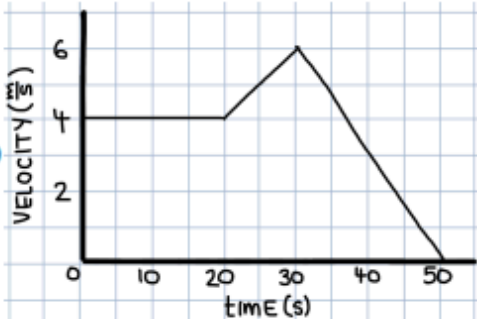
5. Use the following velocity vs. time graph to answer the following:

- What is the displacement of the object over the 25 seconds?
- What is the acceleration of the object in this time?



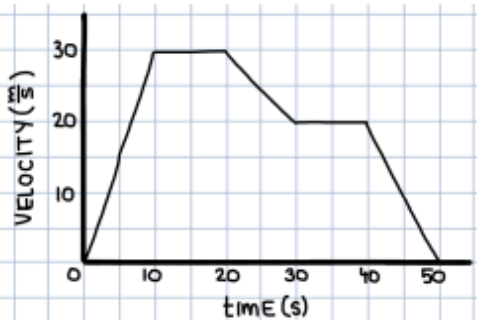
6. Use the following velocity vs. time graph to answer the following:

- What is the displacement of the object over the 50 seconds?
- Describe the motion of the object between 0 and 20 s.
- When is the object moving in the positive direction? negative direction?
- What is the acceleration of the object between 20 and 30 s?
- What is the acceleration of the object between 30 and 50 s?
- What is the average acceleration of the object over the 50 seconds?
- What is the average speed of the object over the 50 seconds?



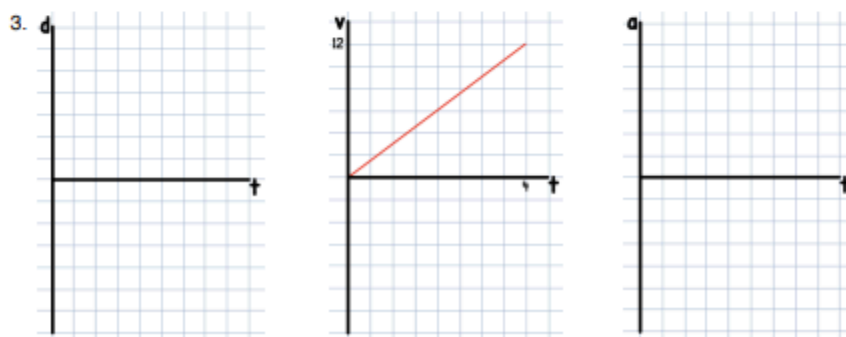
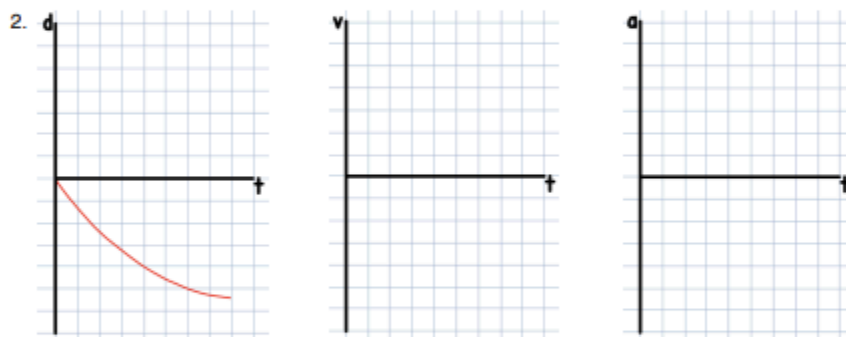
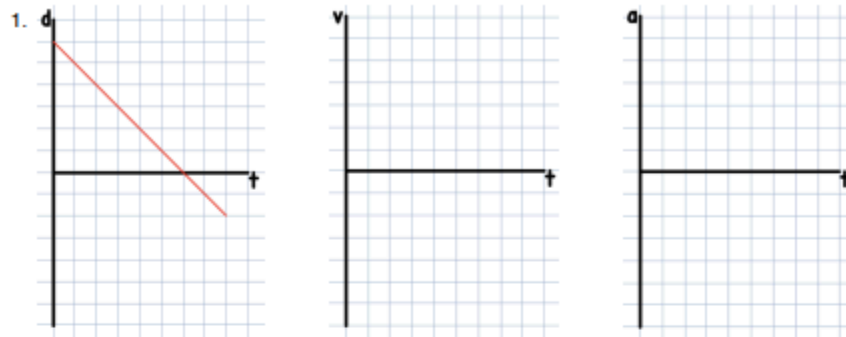
7. Use the following velocity vs. time graph to answer the following:

- When is the velocity of the object the greatest?
- When is the acceleration of the object the greatest (most positive)?
- When is the acceleration of the object zero?
- When is the object slowing down?
- What is the displacement of the object over the 50 s?



Motion graph part 2

For each question, use the given graph to complete the other two.



show values
initial position = 0

show values