

Kinematics by Algebraic Means Mastery Assignment

Do all of your work in your solutions notebook.

Get help if you have trouble answering these questions. An “attempt” is not enough. On the due date or before, you will show this to me and keep it. I will give you credit and the right to take the mastery test. You will then look at the solutions in a notebook –not online. The mastery test will be given during 8th period. These problems do not need to go into your bound solutions book with your classwork and homework problems. You are allowed to work with anyone else you wish to work with. Working with a friend who did well on the test is a GREAT IDEA.

For each question below. Show all your work.

1. A ball rolls along the ground from 5 m/s to a rest in 6 m. What was the ball’s acceleration?
2. A bullet travels from a rest to 600 m/s in the barrel of a rifle. To do this it travels 0.85m in the barrel. How much time does this trip take?
3. A Jet is launched of the deck of an aircraft carrier from rest to 71 m/s in 2 seconds. What is the jet’s acceleration in g’s?
4. A monkey in a tree jumps nearly straight up at 5 m/s. on the way down the monkey misses the branch and falls to the ground 2 m below. How fast was the monkey traveling when he landed on the ground?
5. A bowling ball travels 19.16 m down a bowling lane. The ball was released at 11 m/s and impacted the pins at 9 m/s. How much time did this trip take?
6. The Saturn V is the rocket that launched astronauts to the moon in the early 70’s. This rocket started from rest and accelerated at 5 g’s. Eventually this rocket would reach a speed of 6 miles per second this is 9648 m/s. How much time did this maneuver take?
7. The Bugatti Veyron is one of the quickest production cars currently made. It also has some pretty good brakes. The Veyron can slow down from 87m/s to 22 m/s in 278 m. What is the car’s acceleration as measured in g’s when it applies the brakes?
8. The Toyota Corolla will brake from 33.3 m/s to a rest in 5.74 seconds. How many g’s of deceleration is this? How does this compare the Veyron?
9. The new Large Hadron Collider in Switzerland/France can accelerate a proton to 2.97×10^8 m/s. This collider has a track length of 17 miles. If the proton travels at a constant speed how much time will it take to travel this track?
10. A rattle snake can strike it’s victim in 0.08 seconds. During this time the snake travels from rest across a distance of 29 cm. What is the final speed of the snake when it strike its victim?
11. The Thrust SSC holds the official lands speed record. In an unofficial trip it travels over 820 mph! During this run it deployed a parachute at 490.7 mph and came to a stop some 1926 meters later. What was the SSC’s acceleration in g’s?

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12. The top of the Eiffel Tower in Paris, France, is 324 meters above the ground. If a bolt is thrown straight down from the top of the tower at 25 m/s, then how much time would it take to hit the ground?
13. The tallest single drop of the Mana'wai'nui Falls is 719m –nearly $\frac{1}{2}$ a mile. Neglecting air resistance, How fast is the water traveling at the bottom of the falls if it started from rest at the top.
14. On Mars Olympus Mars is the tallest volcano at 27,000 m. This about three times taller than Mount Everest. The acceleration due to gravity on Mars is about 3.7 m/s^2 -according to NASA. If a rock was thrown nearly straight up at 21 m/s on top of Mount Olympus on Mars, then how much time would it take to hit the ground below.
15. The acceleration due to gravity on the Sun is 274.13 m/s^2 on the surface. Providing you could take a probe to the Sun's surface and survive the hostile environmental conditions, then how high would have to go to drop an object such that it would take one second to hit the surface of the Sun? How high would you have to take this same object on the Earth so that it would also take one second to fall to the surface?
16. At a school pep rally, Miss Creant and Mr. Demeanor were having a bicycle race. Only each was trying to cheat at the starting line. They both passed the starting line at the same time, ...only Miss Creant was traveling 5 m/s and accelerating at 1.5 m/s^2 . Mr Demeanor was traveling at 1 m/s but was accelerating at 2.5 m/s^2 . How much time passed before Mr. Demeanor caught up to Miss Creant?
17. Not everyone knows the true details of the tortoise and the hare. You see the tortoise was at rest at the starting line but the hare was already moving at 4 m/s when they crossed the line at the same time. The tortoise accelerated at 0.333 m/s^2 while the Hare moved at a constant velocity. If the race is exactly 100 m long, then where did the tortoise pass the hare? Did the tortoise really win the race?
18. In a modern day rematch between the tortoise and the hare, they are each driving dragsters. The tortoise's car accelerates at 5 g's from rest for 100 m and then moves at a constant velocity for the remainder of the 402 meter long track. The hare's car accelerates from 5 m/s at 4.0 g's for 2 seconds and then travels the rest of the 402 m long track with an acceleration of $0.5g$'s. they each cross the starting line at the same time. Which won the race this time (the quickest down the track)? By how much time did the winner win by? What was the final velocity of each?
19. The AHS patriot mascot is getting to race the MHS Mustang mascot at a football game's halftime show. The Mustang mascot starts from rest and then accelerates at 4.00 m/s^2 for 1.33 s. Then accelerates at 1.00 m/s^2 for 10 meters before slowing down with a rate of 2 m/s^2 until he comes to a stop. Did the mascot finish the 50.0 meter race. If not, how many meters were left to travel? If he did finish the race, then how far past the finishing line was he?

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| 1. -2.08 m/s^2 | 6. 196.90 s | 11. 1.27 g/s | 16. 8 sec | 18. tortoise=5.0 |
| 2. 0.0028 s | 7. 1.30 g/s | 12. 5.97 s | 17. 96 m | 7s |
| 3. 3.62 g/s | 8. 0.59 g/s | 13. 118.71 m/s | | hare=5.17 s |
| 4. 8.01 m/s | 9. $9.21 \times 10^{-5} \text{ s}$ | 14. 126.62 s | | 19. $x = 27.11 \text{ m}$ |
| 5. 1.96 s | 10. 7.25 m/s | 15. 137.06m | | |