https://trinket.io/glowscript/4860494cd2

Problem 1: For this problem, you will simulate the motion of a baseball that has been hit by a bat using the computer simulation here:

https://trinket.io/glowscript/4860494cd2

At the top of the simulation, you will see the following list of parameter values:

```
# Parameters
speed = 50 # Speed of the ball immediately after being hit, in meters/second
angleInDegrees = 45 # Angle in degrees above horizontal immediately after hit
distanceToWall = 100 # distance to wall (for homerun) in meters
wallHeight = 10 # Height of outfield wall in meters
density = 0 # Density of air (needs to be in SI units)
```

Initially, the ball has been hit at a speed of 50 m/s (112 mph) at an angle of 45 degrees above horizontal, and the air density has been set to zero, so air resistance is initially "turned off".

To answer the questions below, you will change the values of these parameters, and then click the small "play" button (black triangle) to run the simulation using the new parameter values.

Part (a) First, run the simulation using the default parameter values listed above. Using these parameter values, how high above the ground is the ball when it clears the wall? (Tip: Numerical values of x and y are printed below the animation.)
Numeric : A numeric value is expected and not an expression.
y = ____

Part (b) Without changing the values of the other parameters, vary the value of the angle to find the minimum angle that would still result in a homerun. (To get a homerun, the ball needs to clear the 10 meter tall wall.)
Numeric : A numeric value is expected and not an expression.
Angle = ____

Part (c) Your simulation results from Parts (a) and (b) are actually very unrealistic because a *real* baseball experiences significant air resistance when it flies through the air at these high speeds. To correct this, look up the density of air at sea level, and change the value of **density** in the simulation to this value. What is the density of air at sea level?
Numeric : A numeric value is expected and not an expression.
air density = ____

Part (d) In Part (a) you found that (without air resistance) the baseball was able to fly *high* above the wall. Now run your simulation *with* air resistance. Now that air resistance is included, what is the maximum wall height that the baseball would be able to clear? To answer this question, vary the angle (without changing the speed), and run this simulation to determine the maximum possible height that the ball can have when it reaches the wall.
Numeric : A numeric value is expected and not an expression.
Maximum height at the wall = ____

Part (e) What is the *minimum speed* that you would need to hit the ball in order for it to just clear the wall? Run your simulation (with air resistance included), and vary both the speed and the angle in order to find the minimum speed that would allow the baseball to clear to 10 meter tall wall.
Numeric : A numeric value is expected and not an expression.
Minimum speed = ____

https://trinket.io/glowscript/e0e8d8e381

Problem 2: For this problem, you will simulate the motion of a planet orbiting around a star using the computer simulation here:

https://trinket.io/glowscript/e0e8d8e381

At the top of the simulation, you will see the following list of parameter values:

```
# PARAMETERS:
G = 6.67e-11         # Units: N * m^2 / kg^2
distance = 1.5e11    # Distance in meters
planetSpeed = 3.0e4  # Speed in meters per second
planetMass  = 6.0e24 # Mass in kilograms
starMass = 1.99e30   # Mass in kilograms
```

These values correspond to the actual values for the Earth orbiting around the sun.

To answer the questions below, you will change the values of these parameters, and then click the small "play" button (black triangle) to run the simulation using the new parameter values.

Part (a) First, run the simulation using the default parameter values listed above to simulate the Earth orbiting around the sun. Describe what you see. What is the shape of the orbit? (1 sentence)
ShortResponse :
y = ____

Part (b) In the simulation, change **planetSpeed** to have a value of 2.0e4 (20,000 m/s). Run the simulation, and describe what you see. What is the shape of the orbit? **Why** does it make sense that the orbit would change in this way? (2-3 sentences)
Essay :
y = ____

Part (c) In the simulation, change **planetSpeed** to have a value of 3.5e4 (35,000 m/s). Run the simulation, and describe what you see. What is the shape of the orbit? **Why** does it make sense that the orbit would change in this way? (2-3 sentences)
Essay :
= ____

Part (d) Calculate the distance (between the sun and the Earth) that would be needed in order for the Earth to have a circular orbit with this (faster) speed of 35,000 m/s. You can check your answer by running the simulation using this value of distance.
Numeric : A numeric value is expected and not an expression.
distance = ____

Part (e) In the simulation, reset the values of the parameters to their default values shown above, and run the simulation using the default values. Then change **planetMass** to have a value of 6.0e26. This means that you are making the (simulated) Earth 100 times more massive than the *real* Earth. Run the simulation using the more massive Earth, and describe what you see. Why does this result make sense? (2 sentences)
Essay :
= ____

Part (f) In the simulation, change **planetMass** to have a value of 6.0e29. This means that you are making the (simulated) Earth 100,000 times more massive than the *real* Earth. Run the simulation using the *much* more massive Earth, and describe what you see. Why does this result make sense? (2 sentences)
ShortResponse :
= ____