WebAssign
Lab #4: Calculating a Gravitational Force (Homework)

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Current Score : 19 / 19 **Due :** Tuesday, February 7 2012 11:59 PM EST

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1. 15/15 points | Previous Answers MI2 03.X.11

A planet of mass 4×10^{24} kg is at location < 4×10^{11}, -2×10^{11}, 0 > m. A star of mass 3×10^{30} kg is at location < -5×10^{11}, 3×10^{11}, 0 > m. It will be useful to draw a diagram of the situation, including the relevant vectors.

What is the relative position vector pointing from the planet to the star?
$\vec{r}$ = < -9e11 ✓ , 5e11 ✓ , 0 ✓ > m

What is the distance between the planet and the star?
$|\vec{r}|$ = 1.03e12 ✓ m

What is the unit vector $\hat{r}$ in the direction of $\vec{r}$?
$\hat{r}$ = < -0.87 ✓ , 0.49 ✓ , 0 ✓ >

What is the magnitude of the force exerted on the planet by the star?
$|\vec{F}_{\text{on planet}}|$ = 7.58e20 ✓ N

What is the magnitude of the force exerted on the star by the planet?
$|\vec{F}_{\text{on star}}|$ = 7.58e20 ✓ N

What is the force (vector) exerted on the planet by the star?
$\vec{F}_{\text{on planet}}$ = < -6.59e20 ✓ , 3.71e20 ✓ , 0 ✓ > N

What is the force (vector) exerted on the star by the planet?
$\vec{F}_{\text{on star}}$ = < 6.59e20 ✓ , -3.71e20 ✓ , 0 ✓ > N

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2. 4/4 points | Previous Answers MI2 03.X.15.01

Suppose you are going to program a computer to carry out an iterative calculation of motion involving nonconstant forces. Which of the following calculations should be done before starting the repetitive "loop" calculations?

- [x] Specify the initial (vector) position of each object
- [ ] Calculate the (vector) forces acting on the objects
- [ ] Update the (vector) momentum of each object
- [ ] Update the (vector) position of each object
- [x] Specify the mass of each object
- [x] Define constants such as *G*
- [x] Specify the initial (vector) momentum of each object
- [x] Specify an appropriate value for the time step Δt

✓

Inside the repetitive "loop", assuming that we use the final velocity in each time interval as the approximation to the average velocity in that time interval, what should be the sequence of calculations?

1: Calculate the (vector) forces acting on the objects ✔
2: Update the (vector) momentum of each object ✔
3: Update the (vector) position of each object ✔