Welcome to the homework page test1. If this isn't you then please go back to the homework login page.

= KEY =

You may log out and return later if you wish without losing any saved data. You will have **TEN** attempts for each assigned problem. Every unsuccessful attempt will lower that part of the problem's value by 5%.

For example, if you get it right on the first try, then you will receive 100% for that problem. If you are twice incorrect and submit the correct on the third try, then you will receive a 90% for that part of the problem. You will not recieve any points for that part of the problem after 10 attempts.

You do not have to answer all the problems during a single session or in any particular order. To answer a problem simply type the numerical value in the box provided, check the box to the right of the part(s) you want to answer, and then click the submit button. You can freely log in and out of the homework page without losing any submitted information so feel free to take breaks if necessary.

LETS BEGIN!

Problem #1

a) $M = V\rho = \frac{4}{3}\pi R^3 \rho = \frac{4}{3}\pi (6.24\times10^6 m)^3 (3750$

$M = \frac{4}{3}\pi R^3 \rho$ $\boxed{g = \frac{GM}{R^2} = \frac{4}{3}\pi G R \rho}$

We know that a spherical planet of uniform mass density will have a gravitational acceleration of $g = GM/R^2$ at the surface, where $G = 6.674\times10^{-11} Nm^2kg^{-2}$ is the gravitational constant, M is the mass, and R is the radius of the planet. Calculate the gravitational acceleration at the surface of a planet for (a) a planet that has a mass density of $\rho_1 = 3750 kg/m^3$ and a radius of $R_1 = 6.24\times10^6 m$, and (b) a planet that has a mass density of $\rho_2 = 9170 kg/m^3$ and a radius of $R_2 = 7.33\times10^5 m$.

$g = \frac{4}{3}\pi (6.67\times10^{-11})(6.24\times10^6)(3750)$

(a) 6.54 m/s^2 ✓ Answer part (a) $\boxed{g = 6.54 \ m/s^2}$

(b) 1.88 m/s^2 ✓ Answer part (b) $g = \frac{4}{3}\pi (6.67\times10^{-11})(7.33\times10^5)(917$

$\boxed{g = 1.88 \ m/s^2}$

Submit

Attempted part (a) 0 times and part (b) 0 times.

FOR THIS ONE MUST DO VECTORS

There have been no attempts to answer part (a)

There have been no attempts to answer part (b)

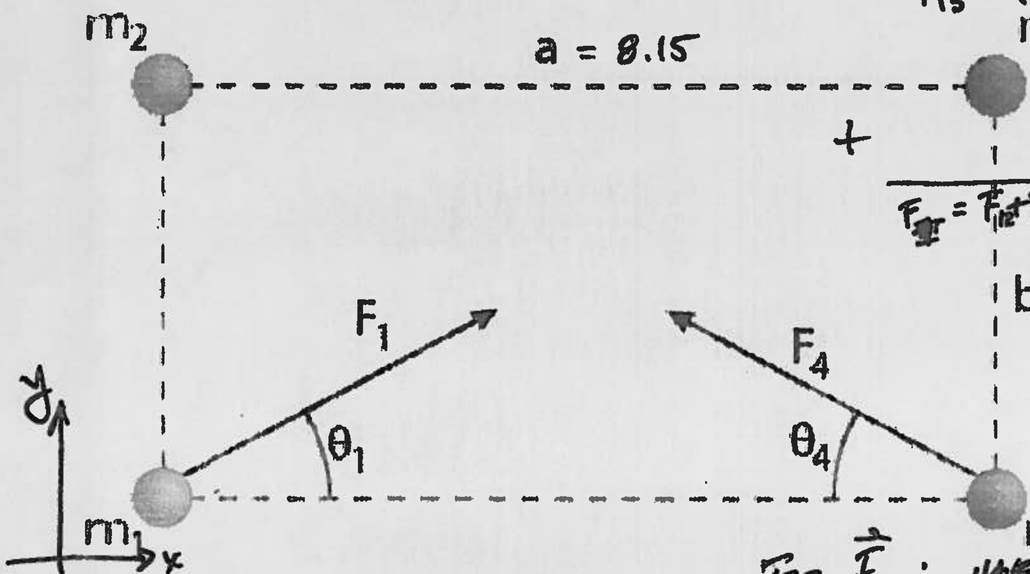
$F = \frac{GMm}{d^2}$

$F_{12} = \left(0, +\frac{GM_1M_2}{b^2}\right) = (0, 4.84)$

$F_{14} = \left(\frac{GM_1M_4}{a^2}, 0\right) = (1.27, 0)$

$F_{13} = (C_{\theta_1}, S_{\theta_1})\underbrace{\frac{GM_1M_3}{b^2+a^2}}_{0.808} = (0.727, 0.35)$

Problem #2



$\tan\theta = b/a \Rightarrow \theta = 25.85°$

$+$

$F_{TOT} = F_{12} + F_{14} + F_{13} = (1.997, 5.19)$

b=3.95 $|\vec{F}_1| = \sqrt{(1.997)^2 + (5.19)^2}$
$= \boxed{5.561\ N}$

$\theta_1 = \arctan\left(\frac{5.19}{1.997}\right) = \boxed{68.95°}$

FOR $\vec{F}_4$: HAVE F_{41} $(= -F_{14})$, F_{42}, F_{43}

Four compact and dense masses are in deep space and form the corners of a rectangle with sides a = 8.15km and b = 3.95km as shown in the above diagram. They have masses $m_1 = 1.02 \times 10^9$kg, $m_2 = 1.11 \times 10^9$kg, $m_3 = 9.74 \times 10^8$kg, and $m_4 = 1.24 \times 10^9$kg. Calculate (a) $|F_1|$, (b) θ_1, (c) $|F_4|$, and (d) θ_4.

(a) 5.561 N Answer part (a)

(b) 68.95 ° Answer part (b)

(c) 6.093 N Answer part (c)

(d) ° Answer part (d)

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$\vec{F}_{41} = (-1.27, 0)$

$\vec{F}_{42} = \frac{GM_4M_2}{a^2+b^2}(-C_{25.85}, +S_{25.85})$
$= (-1.0072, +0.488)$

$+ \quad \vec{F}_{43} = (0, 5.163)$

$\vec{F}_{41} + \vec{F}_{42} + \vec{F}_{43} = \vec{F}_{4\,TOTAL} = (-2.277, 5.651)$

So $|\vec{F}_4| = \sqrt{(2.277)^2 + (5.651)^2} = \boxed{6.093}$

Attempted part (a) 0 times, part (b) 0 times, part (c) 0 times, and part (d) 0 times.

& $\tan\theta_4 = \frac{5.651}{2.277} \Rightarrow \boxed{\theta_4 = 68°}$

There have been no attempts to answer part (a)

There have been no attempts to answer part (b)

There have been no attempts to answer part (c)

BUT $M = \frac{4}{3}\pi R^3 \rho$

There have been no attempts to answer part (d)

Problem #3

a) ESCAPE VELOCITY $V = \sqrt{\frac{2GM}{R}} = \sqrt{\frac{8\pi}{3} G R^2 \rho}$

$V = \sqrt{\frac{8\pi}{3}(6.67\times10^{-11})(8.52\times10^{7})^2(5550)} = 150$ km/s

Some space invaders build a giant gun on the surface of their planet. After wandering the planet, they find that the planet has a radius of 8.52×10^7m, and after a simple freefall experiment, they calculate the mean mass density to be 5550kg/m^3. (a) What must the muzzle velocity for the projectile to escape the planet's gravitation when fired perpendicular to the horizon? (b) What is the speed of the projectile after it has traveled a distance of 9.35×10^6m?

(a) 150 km/s Answer part (a)

(b) 142.4 km/s Answer part (b)

Submit

b) USE ENERGY:

$U_f = \frac{1}{2} m V^2 + -\frac{GMm}{R} = 0$ FOR ESCAPE TRAJ

$U_f = 0 \Rightarrow V^2 = \frac{2GM}{R}$

$V^2 = \frac{2(6.67\times10^{-11})(1.438\times10^{28})}{(9.35\times10^{6} + 8.52\times10^{7})}$

$M = \frac{4}{3}\pi R_e^3 \rho = \frac{4}{3}\pi(8.52\times10^7)^3(5550)$

$M = 1.438\times10^{28}$ kg

Attempted part (a) 0 times and part (b) 0 times.

$\boxed{V = 142.4 \text{ km/s}}$

There have been no attempts to answer part (a)

There have been no attempts to answer part (b)

Problem #4

THIS PRACTICES KEPLER III $V_{circ} = \sqrt{\frac{GM}{R}}$ $T = \frac{2\pi R}{V}$

$T = \frac{2\pi R^{3/2}}{\sqrt{GM}}$ SOLVE FOR M: $M = \frac{4\pi^2}{GT^2}R^3$

In a galaxy far far away, an imperial probe is characterizing distant planets. The first planet has the probe orbiting with a period of 2.65days while orbiting the planet with an orbital radius of 1.05×10^8m. (a) What is the mass of this planet? The next planet takes the probe 5.92 days to orbit at an orbital radius of 2.25×10^8m. (b) What is the mass of this planet?

a) $M = \frac{4\pi^2(1.05\times10^8)^3}{(6.67\times10^{-11})[(2.65)(24)(3600)]^2}$ SECONDS

(a) 1.31 $\times10^{25}$kg Answer part (a)

$\boxed{M = 1.31\times10^{25} \text{ kg}}$

(b) 2.577 $\times10^{25}$kg Answer part (b) b) DO IT AGAIN!

$M = \frac{4\pi^2(2.25\times10^8)^3}{(6.67\times10^{-11})[5.92(24)(3600)]^2} = 2.577\times10^{25}$ kg

Submit

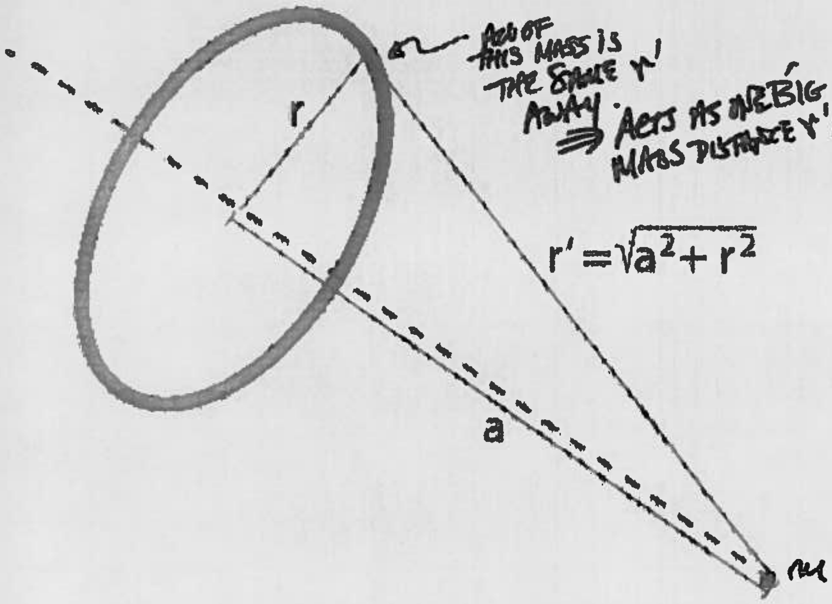
Attempted part (a) 0 times and part (b) 0 times.

There have been no attempts to answer part (a)

There have been no attempts to answer part (b)

Problem #5

$$U = \frac{-GMm}{r'} = -\frac{(6.67\times10^{-11})(2.15\times10^{19})(3.2)}{\sqrt{(2.8\times10^{7})^2 + (1.22\times10^{7})^2}}$$



ALL OF THIS MASS IS THE SAME r' AWAY.
⇒ ACTS AS ONE BIG MASS DISTANCE r' AWAY

$$\boxed{U = -150.2\ \text{J}}$$

The ring in the above diagram has a uniform mass of $M = 2.15\times10^{19}$kg and a radius of $r = 1.22\times10^{7}$m. What is the gravitational potential energy of an object with a mass of $m = 3.2$kg located along the axis of the ring and a distance $a = 2.8\times10^{7}$m away from the center of the ring?

-150.2 J ☑ Answer the question

Submit

Attempted the problem 0 times.

There have been no attempts to answer the problem

Problem #6

$a = \frac{GM}{R^2}$

Calculate the magnitude of the acceleration of gravity for an object that is (a) 0m, (b) 7370m, (c) 6.15×10^5m, and (d) 7.37×10^6m above the surface of the Earth. Take the radius of a spherical Earth to be $R_E = 6.37\times10^6$m and the mass of Earth to be $M_E = 5.97\times10^{24}$kg.

(a) 9.813 m/s² Answer part (a)

(b) 9.791 m/s² Answer part (b)

(c) 8.16 m/s² Answer part (c)

(d) 7.11 m/s² Answer part (d)

Submit

a) $a = \frac{(6.67\times10^{-11})(5.97\times10^{24})}{(6.37\times10^6 + 0)^2}$

$\boxed{a = 9.813\ m/s^2}$ AS EXPECTED

b) $a = \frac{(6.67\times10^{-11})(5.97\times10^{24})}{(6.37\times10^6 + 7370)^2}$

$\boxed{a = 9.791\ m/s^2}$ A LITTLE SMALLER...

c) $a = \frac{(6.67\times10^{-11})(5.97\times10^{24})}{(6.37\times10^6 + 6.15\times10^5)^2}$

$\boxed{a = 8.16\ m/s^2}$ SMALLER YET

d) $a = \frac{(6.67\times10^{-11})(5.97\times10^{24})}{(6.37\times10^6 + 7.37\times10^6)^2}$

$\boxed{a = 2.11\ m/s^2}$ MUCH SMALLER! 'CAUSE YOUR FURTHER AWAY...

Attempted part (a) 0 times, part (b) 0 times, part (c) 0 times, and part (d) 0 times.

There have been no attempts to answer part (a)

There have been no attempts to answer part (b)

There have been no attempts to answer part (c)

There have been no attempts to answer part (d)

Problem #7

$T_1^2 = kR_1^3$
$T_2^2 = kR_2^3$
$\Rightarrow \left(\frac{T_2}{T_1}\right)^2 = \left(\frac{R_2}{R_1}\right)^3 \Rightarrow \left(\frac{T_2}{T_1}\right) = \left(\frac{R_2}{R_1}\right)^{3/2}$

A distant solar system has two planets that circularly orbit one star. The first planet orbits with a radius of $r_1 = 2.96\times10^{10}$m and the second planet has an orbital radius of $r_2 = 6.04\times10^{10}$m. Calculate the fraction T_2/T_1, where T_1 and T_2 are the respective orbital periods of the first planet and second planet.

2.915 Answer the question

$\frac{T_2}{T_1} = \left(\frac{6.04}{2.96}\right)^{3/2} = \boxed{2.915}$

Submit

Attempted the problem 0 times.

There have been no attempts to answer the problem

Problem #8

For the known values of the Earth such that $R_E = 6.37\times10^6$m and $M_E = 5.97\times10^{24}$kg, determine (a) the height that the satellite is orbiting above the surface, and (b) tangential velocity of a satellite while in a geosynchronous orbit. Take a sidereal day to be 23 hours and 56 minutes. $\Rightarrow T = 86{,}160$ sec

(a) 35,780 km ☑ Answer part (a)

(b) 3.073 km/s ☑ Answer part (b)

Submit

Attempted part (a) 0 times and part (b) 0 times.

There have been no attempts to answer part (a)

There have been no attempts to answer part (b)

a) $T^2 = \frac{4\pi^2}{GM} R^3 \quad R = \left(\frac{GMT^2}{4\pi^2}\right)^{1/3}$

$\Rightarrow R = 42{,}150$ KM

$- R_e = 6\,370$ KM

$h = R - R_e = 35{,}780$ KM

b) Find orbital velocity:

$V = \sqrt{\frac{GM}{R}}$

$V = \sqrt{\frac{(6.67\times10^{-11})(5.97\times10^{24})}{42.150\times10^6\ m}}$

$V = 3{,}073$ m/s $= \boxed{3.073 \text{ km/s}}$