

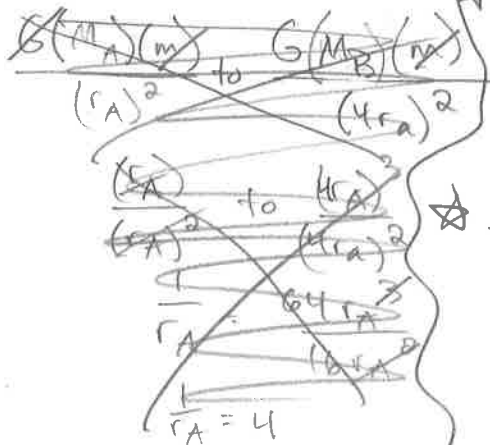
1. Planet A and Planet B are made of the same substance: same as earth. However, the radius of Planet B is 4 times the radius of Planet A. That is  $r_B = 4r_A$

a) I stand on a scale on each of the planets' surfaces. Find the ratio of the two readings: weight on planet B compared to my weight on planet A (show your work if you want full credit).

$w_B = 4 w_A$

$\frac{4}{3}\pi r^3$  to  $\frac{4}{3}\pi(4r)^3$   
1 to 64 for Mass

Weight =  $\frac{G(M)(m)}{r^2}$        $M = (\frac{4}{3}\pi r^3)(\text{density})$



$M_B = 64M_A$   
 $\frac{GMm}{r^2}$  to  $\frac{64Mm}{(4r)^2}$   
1 to  $\frac{64}{16} = 1$  to 4  
 $\frac{GMm}{r}$  to  $\frac{(64M)(m)}{4r}$   
1 to  $\frac{64}{4} = 16$   
1 to 16

b) I need to get away from each of these planets to get back to earth... very very far away, What is the ratio of the gravitational potentials that I'll need to climb out of in order to get back to earth? That is

$PE_B = 16 PE_A$

c) I'll need to attain escape velocity. Is the escape velocity the same for each planet? If not, what is the ratio of the escape velocities for each planet?

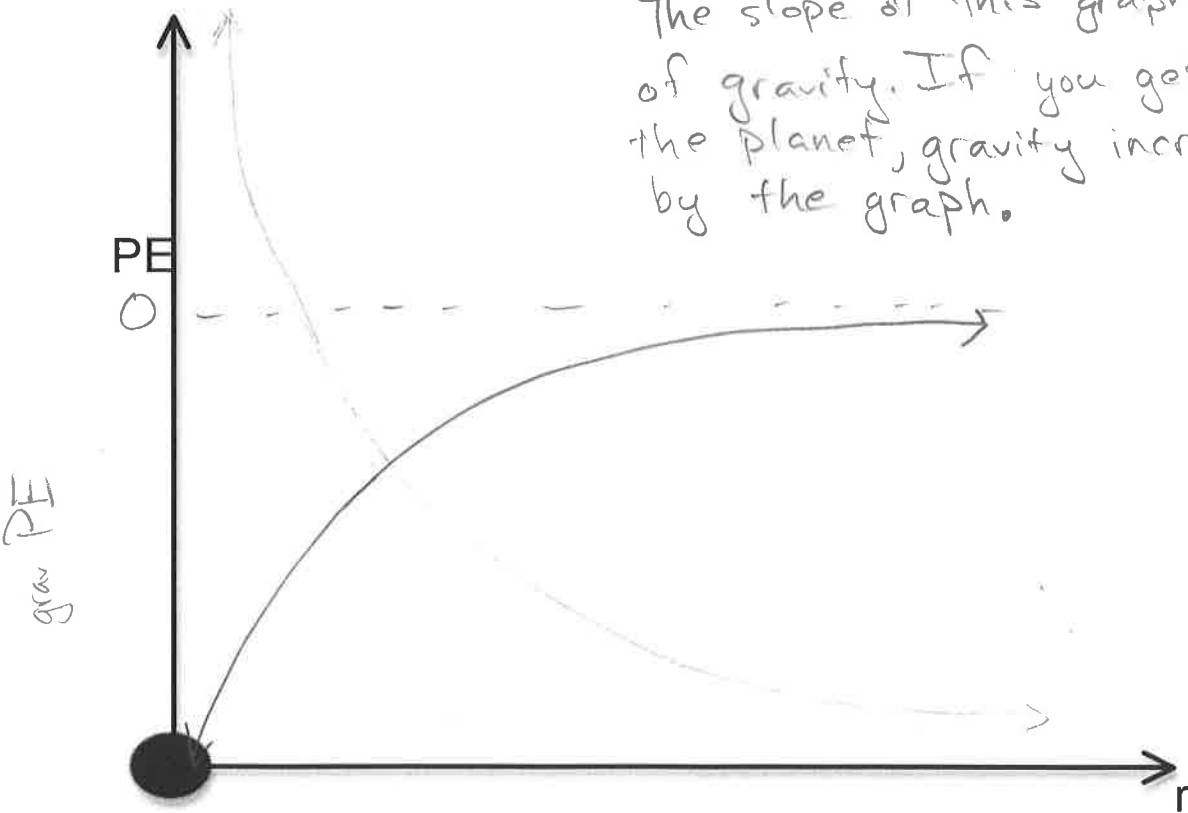
$v_B = 4 v_A$

$KE = \frac{GMm}{r}$   
 $\frac{1}{2}mv^2 = \frac{GMm}{r}$        $\frac{1}{2}mv^2 = 1$        $\frac{1}{2}mv^2 = 16$   
 $v = \sqrt{2}$        $v = \sqrt{32}$   
= 1 to 4



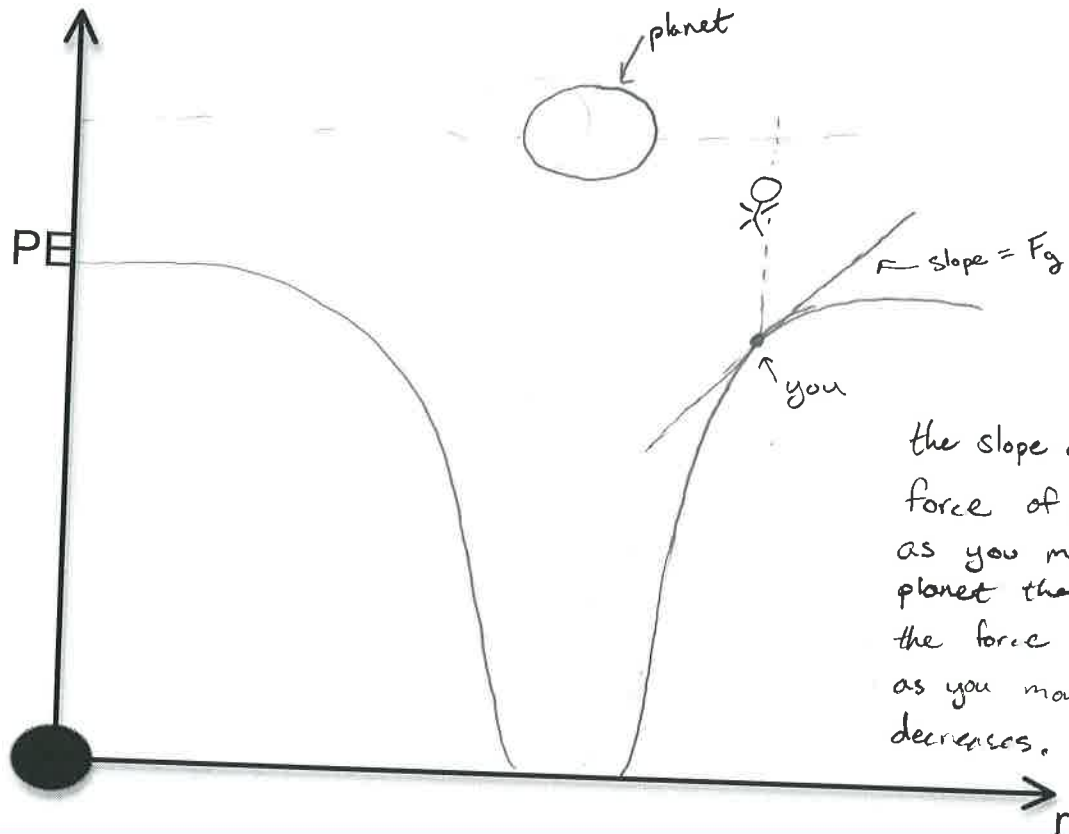
2. Make a potential energy diagram of the gravitational potential above versus the distance from the planet, and state how your graph shows that the force of gravity increases as you get closer to the planet. Use back of paper if you like.

The slope of this graph is the force of gravity. If you get closer to the planet, gravity increases <sup>(negatively)</sup> as shown by the graph.



Distance from Planet (m)

2. Make a potential energy diagram of the gravitational potential above versus the distance from the planet, and state how your graph shows that the force of gravity increases as you get closer to the planet. Use back of paper if you like.



lovely!  
+1 extra credit!

the slope of the line is the force of gravity on you. So as you move closer to the planet the slope increases meaning the force of gravity increases and as you move further away the  $F_g$  decreases.