PHYSICS 117 – HOMEWORK SET 4

Q 5 The satellite exerts the same force on the earth, according to Newton.

Q 12 Skip's distance has increased by two, so the $1/r^2$ force would decrease by four times; however, the mass of the planet has increased by eight, so the overall force increases by two. Skip's weight doubles to 1600 newtons.

Q 21 Since you and the scale are both falling at the same rate, you do not press down on it anymore, and it reads zero. The force of gravity acting on you is still the same, however.

Q 17 The acceleration due to gravity in the other universe is twice that in ours. All other things being equal, you might guess that G has doubled.

Q 23 The plane follows the same trajectory that the passengers would follow if they were falling freely. That means that they are effectively falling freely.

Q 31 Presumably, the $1/r^2$ formula is more precise, but near the surface of the earth, when r does not change so much compared to inter-planetary distances, mg happens to be adequately accurate.

E 2 $a = \frac{v^2}{r} = .0026$ m/s^2

E 5 If the distance were tripled, the $1/r^2$ force would decrease by a factor of nine. Then, the force would be 60 N.

E 9 $\left(\frac{R_{earth}}{R_{shuttle}}\right)^2 = .89$, so the force decreases by a factor of .89.

E 11 $r = \sqrt{\frac{GM_1M_2}{F}} = 7750$ km, $h = 7750 - 6400 = 1350$ km.

E 17 Near the surface of a planet, $g \approx \frac{GM}{R^2}$, so $g_{mars} \approx g_{earth}\frac{m_{mars}r_{earth}^2}{m_{earth}r_{mars}^2} = 3.9$ m/s^2.

E 20 $F = ma = 44.8$ N, $M_{planet} = F\frac{r^2}{GM_{sat}} = 1.34 \times 10^{23}$ kg.