# Honors Calculus, Math 1451- HW 2. Due Thursday 18th February.

**Dr Matthew Nicol, PGH 665**

(1) Questions in 13.4:
16, 18, 24, 40, 42.

(2) In class we showed that under a central force $F = -f(|r|)\hat{r}$, angular momentum $\hat{h} = \hat{r} \times \dot{\hat{r}}$ is conserved and that the motion lies in a plane orthogonal to the angular momentum vector $\hat{h}$. In particular this shows that under Newton's law of gravitation each planet moves in a plane about the sun. We can choose polar coordinates $(r, \theta)$ in the plane and describe the motion of a planet in coordinates $\hat{r} = r\cos(\theta)\hat{i} + r\sin(\theta)\hat{j}$ where the sun is at the origin $(0,0)$. Show that the quantity $r^2 \frac{d\theta}{dt}$ is conserved under the planets motion around the sun. This implies Kepler's second law, that a line joining the planet to the sun sweeps out equal areas in equal times.

(3) Questions in Section 14.1:
30 (a,b, c, f), 48, 56, 58, 60.

(4) Questions in 14.2:
6, 8, 12, 30, 32, 36.

(5) Questions in 14.3:
6, 8, 16, 18, 20, 28, 37, 38, 46, 48.