COEN 45
Winter Quarter, 2011
Homework #8
Due Thurs. Mar. 10

Note on `trapz`: The proper way to do integration with `trapz` is *not* what I showed in class, but rather `y=trapz(x,f)` where x is your vector of independent variables and f is the corresponding vector of function values. Thus to do

$$\int_0^{2\pi} \cos^2 x \, dx$$

do

```
x = linspace(0,2*pi,100);
y = trapz(x,cos(x).^2)
```

and the answer is $y = \pi$

1. Problem 27, p. 318 (3rd. ed: prob. 18, p. 310): orbit of Pluto. Use `trapz` to do the integration, or any MATLAB method of your choice.

2. Problem 33, p. 320 (3rd. ed: prob. 23, p. 311): the well-known von Bertalanffy fish growth model. Use `ode45`:

   ```
   [t,N] = ode45(@bertalanffy,t,N0,[],a,b);
   ```

3. Newton's law of gravitation says that the attractive force between two masses falls off as the square of the distance between them. The gravitational acceleration experienced by a body at altitude h above the earth is

   $$g = g_0 \frac{R^2}{(R+h)^2}$$

   where g_0 is the surface acceleration, 9.81 m/sec^2, and R is the radius of the earth, 6371 km.

   (a) An astronaut who ascends into an orbit at altitude of 800 km loses what fraction of his weight?

   (b) If this fraction is not very large, why are astronauts and other objects in orbit said to be weightless?

   (c) The amount of gravitational potential energy gained by the astronaut by ascending into an orbit of altitude a is

   $$U = \int_0^a m \, g(h) \, dh$$

   Calculate this energy in MJ for an astronaut weighing 125 kg (including gear) and an 800-km orbit. (Answer: 871.6)