Homework Set #3 Solutions (9/15 – 9/19):

Chapter 4: **Questions** 9, 24 **Exercises** 7, 11

Questions:

9. a) Speeding up in a straight line
   b) Speeding up and turning left

24. The independence of the vertical and horizontal motions means that they will hit at the same time.

Exercises:

7. a) $a = \frac{v^2}{r} = \frac{(20 \text{ m/s})^2}{50 \text{ m}} = 8 \text{ m/s}^2$

   b) $F = ma = (120 \text{ kg})(8 \text{ m/s})^2 = 960 \text{ N}$

11. The horizontal speed remains 22 m/s; the vertical speed decreases by 10 m/s to 4 m/s.

Chapter 5: **Questions** 6, 9, 13 **Exercises** 3, 11, 19

Questions:

6. Because the acceleration does not depend on the mass, the acceleration of the apple would be the same as that of the moon.

9. Skip is now twice as far from the center of the planet, which reduces the gravitational force by a factor of 4. Skip weighs 200 newtons on MSU3.

13. Since the acceleration due to gravity is twice as much on an Earth-like planet, the "universal gravitational constant" in this parallel universe must be twice as great.

Exercises:

3. $a = \frac{g}{3^2} = \frac{10 \text{ m/s}^2}{9} = 1.11 \text{ m/s}^2$

11. $r = \sqrt{\frac{GM_1M_2}{F}} = \sqrt{\frac{\left(6.7 \times 10^{-11} \frac{\text{N} \cdot \text{m}^2}{\text{kg}^2}\right)(320 \text{ kg})(5.98 \times 10^{24} \text{kg})}{800 \ N}} = 12{,}660 \text{ km}$

$h = r - r_{earth} = 12{,}660 \text{ km} - 6{,}370 \text{ km} = 6{,}290 \text{ km}$

19. $d = 2\pi r r = 2\ (3.14)(6.6)(6.37 \times 10^6 \text{ m}) = 264{,}000 \text{ km}$

$v = \frac{d}{t} = \frac{264{,}000 \text{ km}}{24 \text{ hrs}}\left[\frac{1 \text{ hr}}{3600 \text{ s}}\right] = 3.06 \text{ km/s} = 3060 \text{ m/s}$