MA104 - Differential Calculus
Lesson 40 - Worksheet Answer Key

1. Shot put problem
   (a) The shot lands on the ground, about 64.092 feet away. (This happens at a time of about 2.11 seconds.)
   (b) The maximum height is about 21.4 feet. (This happens at a time of about 0.95 seconds.)
   (c) Impact occurs at about 2.11 seconds, and the speed at impact is about 47.93 ft/sec.
2. Fenway park problem: The initial speed of the ball is about 108.82 ft/sec.
3. Gun with unknown angles: The two angles are about 0.173 radians (9.92 degrees) and 1.397 radians (80.05 degrees)
4. Gun with 30 degree angle: The muzzle speed is about 198 m/s.

Block III Review - Worksheet Answer Key

1. Problems on vectors
   (a) $\langle 10, 1\rangle$
   (b) $\sqrt{73}$
   (c) 4
   (d) 5
   (e) $\langle 3, 8, 1\rangle$
2. $\mathbf{r}(2) = \langle e^4, -1, \ln 7\rangle$; $\mathbf{v}(2) = \langle 4e^4, 0, \frac{3}{7}\rangle$; Speed after 2 seconds is about 218.4 m/sec; $\mathbf{a}(2) = \langle 18e^4, \frac{\pi^2}{4}, -\frac{9}{49}\rangle$.
3. (Let's assume time is measured in seconds, since the problem does not say.) There is a collision at (1,2,0), after 1 second. There is an intersection at (29,14,8) after the fly has traveled for 3 seconds and the model rocket has traveled for 5 seconds.
4. Lines and Planes
   (a) A point on the line and a direction vector (i.e. a vector that is parallel to the line)
   (b) A point in the plane and a normal vector to the plane
5. Equation of a line
   (a) $\mathbf{r} = \langle 4, -1, 2\rangle + t\langle -3, 2, 3\rangle$
   (b) $x = 4 - 3t$, $y = -1 + 2t$, $z = 2 + 3t$
6. $5(x-2) - 6(y-1) + 3z = 0$
7. The chamber needs to be about 0.839 meters long and 0.136 meters high.