Projectile Motion Worksheet
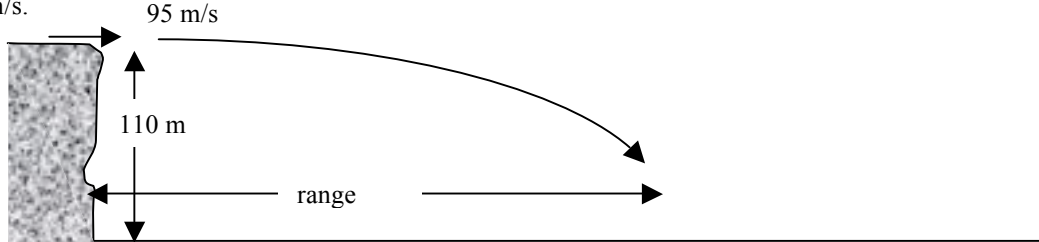
52 marks

1. A rugby ball is kicked at 22 m/s over level ground Find the range of this projectile if the launch angle was:
    a. 30^0 b. 45^0 c. 75^0 *(6 marks)*

2. Find the maximum height of the football for each angle in question #1.   *(6 marks)*

3. An arrow is fired horizontally off a 110 m high cliff on the **Moon** ($g = -1.63$ m/s^2) at a speed of 95 m/s.


    95 m/s

    110 m

    range

    a. How much time will elapse before the arrow hits the lunar ground?   *(2 marks)*
    b. What is the range of this projectile?   *(2 marks)*
    c. Explain how the arrows flight would have different if shot from the same height on Earth.   *(2 marks)*

4. A hunter is trying to hit a semi-intelligent monkey hanging from a tree limb. The hunter is aiming directly at the monkey's heart. The monkey (having taken but not passed Physics 11) thinks he will be able to save himself by dropping from the tree limb as soon as the hunter shoots his arrow. Explain whether the monkey is hit or missed by the hunter.   *(2 marks)*

5. A baseball pitcher throws a fastball at 140 km/h (38.9 m/s) towards home plate that is 18.4 m away. Find how far the ball drops due to gravity by the time it reaches home plate. *(4 marks)*

    Drop distance

    38.9 m/s

    18.4 m
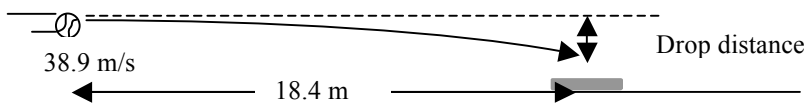
6. A projectile is fired with an initial velocity of 50.0 m/s at 60^0 above the horizontal, over level ground.
    a. What is the velocity of the projectile when it reaches its highest point? *(1 mark)*
    b. What is the projectiles acceleration at its highest point?   *(1 mark)*
    c. What is the velocity in the horizontal direction just before it hits the ground?   *(1 mark)*

7. A cannon fires a 12 kg cannon ball (what else?) with a muzzle velocity of 220 m/s at an angle 35^0 over level ground. The cannon fires a second ball at the same speed but an angle of 55^0. In both cases neglect air friction.

    a. Calculate the range of each projectile.   *(4 marks)*
    b. Calculate the height of each projectile.   *(4 marks)*
    c. How do the ranges and heights for the two projectiles compare?   *(2 marks)*
    d. The two angles chosen are complimentary angles (i.e. they add up to 90^0). Do you think the pattern that you observe holds true for any set of complimentary angles?   *(1 marks)*
    e. Discuss why each complimentary angle may have an advantage in warfare. *(2 marks)*

8. A projectile is fired into the air from the top of a 210 m high cliff at a velocity of 60.0 m/s at angle of 50^0 above the horizontal. What is the range for this projectile is you neglect air friction?

(5 marks)

$v_0 = 60.0$ m/s

50^0

210 m

range
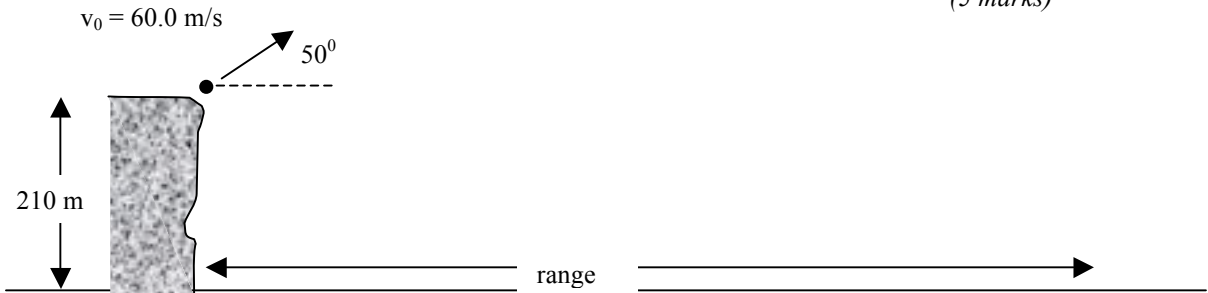
9. A motorbike needs to clear 7.0 m wide ditch. A ramp with an angle of 11^0 has been built to the edge of the ditch. How fast must the motorbike be travelling to clear the ditch and continue on its way?

(3 marks)

10. A very large boulder was resting on a 380 m high cliff above a small village. An earthquake causes the boulder to fall off the cliff with an initial speed of 50.0 m/s at an angle of 30^0 **below** the horizontal. There is a small 400 m wide pond between the cliff and the village. Where does the boulder hit the ground (or water)? *Prove with calculations.*

(4 marks)

30^0

50.0 m/s

380 m

400 m