EXAMLE USING METHOD 1.

PART 1

Stage 1:

State your group's horizontal distance from the hoop. Your distance from the hoop for the shot is equal to ***twice the average*** *of the heights of your group members. Specify the units of measurement used (feet or meters). Make sure your chosen units match those used for the initial velocity.*

Distance from hoop: 15 ft

Height of shooter (Y_i): 10 feet

Height of hoop (Y_f): 10 feet / 3.048 meters

For Part 1, you will assume that the shooter is the same height as the basketball hoop (10 feet tall).

Next choose an initial angle of elevation and find the initial velocity of the basketball. To do this you may use either method below.

used for this example

METHOD 1:

1. Choose an angle for the shot (i.e. 45 degrees).
2. Compute the total time (t_f) that the basketball travels until it gets to the hoop.
   For this calculation, use Equation 8 where X_f is the distance to the hoop and $(Y_f\text{-}Y_i)$ is the difference between the hoop height and the shooter height.
3. Compute initial velocity (V_i) required when using the chosen angle and your group's distance from hoop.
   For this calculation, use Equation 9 where X_f is the distance to the hoop and t_f is the time found in Step 2.

METHOD 2: (Note that this method is much less accurate than Method 1)

1. Use the applet at the following website: http://www.fearofphysics.com/Proj/proj.html
2. Choose an angle for the shot (i.e. 45 degrees).
3. Then choose an Initial Velocity (V_i) to test (10 mph = 14.4 ft/sec = 4.4 m/sec).
   Make sure that you velocity units/second match the distance units that you used.
4. Then try your shot and see if it goes in. If it goes in, you have your angle and initial velocity. If not, then choose a different V_i and try the shot again.

Your goal for Stage 1 is to find the exact initial velocity that must be used with your chosen angle in order for your shot to reach the hoop.

WORK: $t_f = \sqrt{\dfrac{15 \cdot \sin(45) - (0-0) \cdot \cos 45}{-\frac{1}{2}(-32) \cdot \cos(45)}} = \sqrt{\dfrac{10.6066}{11.3137}} = \boxed{0.9682 \text{ sec}}$

$V_i = \dfrac{15}{(\cos 45) \cdot (0.9682)} = \boxed{21.9099 \text{ ft/sec}}$

θ (chosen angle of elevation): 45°

V_i (initial velocity): 21.9099 ft/sec

Stage 2

Using three different times (i.e. $t = 0, t = 1, t = 2$) and the equations for X and Y, find three points (X, Y) such that each point lies on the parabola created by the basketball in flight.

WORK:

③ $X = \frac{1}{2}a_x t^2 + V_{ix} t + X_i = \frac{1}{2}(0)t^2 + 15.4926\,t + 0 = 15.4926\,t$

④ $Y = \frac{1}{2}a_y t^2 + V_{iy} t + Y_i = \frac{1}{2}(-32)t^2 + 15.4926\,t + 0 = -16t^2 + 15.4926\,t$

⑤ Find X and Y for different times (i.e. $t = \frac{1}{2}, t = 2$, etc.)

$X(\frac{1}{2}) = 15.4926(\frac{1}{2}) = \boxed{7.7463}$

$Y(\frac{1}{2}) = -16(\frac{1}{2})^2 + 15.4926(\frac{1}{2}) = \boxed{3.7463}$

① V_{ix}: $V_i \cdot \cos(\theta) = 21.9099(\cos 45) \approx 15.4926$

② V_{iy}: $V_i \cdot \sin(\theta) = 21.9099(\sin 45) \approx 15.4926$

} Keep at least 4 decimal places precision.

Point 1: (0, 0)

Point 2: (7.7, 3.7) ← from Step 5

Point 3: (15, 0)

Stage 3:

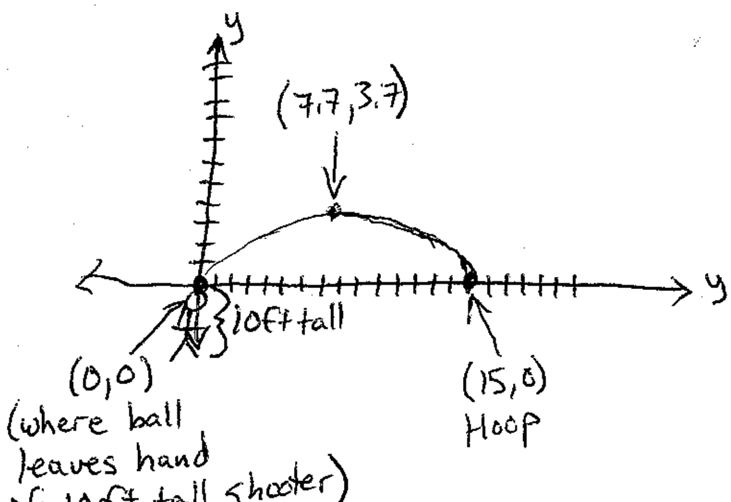
Do a quadratic regression using the three points above in order to find the equation of the parabolic trajectory of the basketball.

① Enter the three points found in Stage 2 into Stat table (Stat → Edit) (enter x values in L_1, enter y values in L_2)

② Do a quadratic regression with these lists L_1, L_2 (Stat → Calc Menu → QuadReg) (set XList to L_1 and YList to L_2) OR enter QuadReg L_1, L_2

③ Equation: $\boxed{-0.0658x^2 + 0.9874x + 0}$

Draw and label an illustration of the shot showing the trajectory and any other key information found.



Graph should include the 3 points, the height of the shooter, and the distance to the hoop.

Also draw in the approximate parabola that represents the path of the ball.