Projectiles and the Kiddie Pool

The following problem will be approached in phases in multiple assignments. You will need to restrain yourself and only complete the requirements for the current assignment. The sequence of assignments is designed to introduce new MATLAB skills and statements gradually.

Range of a projectile….or can you hit the baby pool

On a hot Saturday afternoon, you and your friends notice an empty baby swimming pool on the lawn of your apartment complex. So, why not see if you can fill it with water from water balloons thrown from your second floor balcony.

Baby pool measurements
Inflated Size: 24" x 6"
Water Capacity (80%): 7 gallons

Now, the pool is far enough away that you will need to lob the balloon up into the air (angle θ). All your buddies want to take a shot at this challenge, so people height is a factor in addition to the height of balcony floor (12').

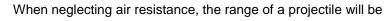### Information about water balloons

Velocity (v) of thrown water balloon: average 15.7 m/s. Range of 0-30 m/s

Diameter inches	Volume gallons	Weight pounds
3	0.1	0.6
5	0.3	2.5
7	0.8	6.5
9	1.7	13.8
11	3.0	25.2
13	5.0	41.5
15	7.6	63.8

Range of a projectile….or can you hit the baby pool

- g: the gravitational acceleration—usually taken to be 32 f/s^2 near the Earth's surface
- θ: the angle at which the projectile (balloon) is launched
- v: the velocity at which the projectile (balloon) is launched
- y_0: the initial height of the projectile (balcony + your height)
- d: the total horizontal distance travelled by the projectile (to the pool)

When neglecting air resistance, the range of a projectile will be

$$d = \frac{v\cos\theta}{g}\left(v\sin\theta + \sqrt{(v\sin\theta)^2 + 2gy_0}\right)$$