



Basketball Game

Mini Project 6: Toss the Ball

In this sixth mini-project, you'll import the code from the fifth project. You'll learn the math to model the basketball's path. You will draw the path of the ball when the user presses the enter key.

Objectives:

- add the NET code
- add the GAUGE code
- add the ARC code
- use getKey to change velocity and angle

Basketball Game Project Overview:

After completing a series of 8 mini-projects, you will have a basketball game similar to the one on the right. The code for projects mini-projects1 -4 will be imported into project 5. Projects 6-8 will build upon project 5.

Mini-Project Order:

1. Draw the Background
2. Draw the Net
3. Power Gauge
4. Angle Gauge
5. Compile the Projects and Code the Arrow Key
- 6. Toss the Ball**
7. The Game
8. Win the Trophy (and fireworks!)



1. Create a program named TOSS.

You could extend the code in BB instead of creating a new file. However, it is a good idea to keep a backup of your code in case you need to start over.

The first two lines of code will create variables to keep track of your shots made and the total number of shots attempted. Use the variable H for hits and T for Tosses.

```
:0 →H
```

```
:0 →T
```

Import the BB code

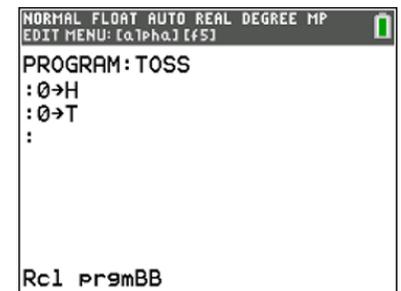
```
rcl ( 2nd sto→ )
```

```
prgm
```

```
EXEC
```

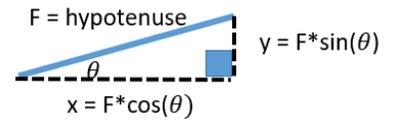
Select NET

Press the enter key





2. When a ball is tossed, it has both a vertical and horizontal component as it travels. When the ball leaves the player's hand, the velocity force (F) on the ball is split between the horizontal and vertical components.



Once the ball leaves your hand, nothing acts on it horizontally, so the equation is

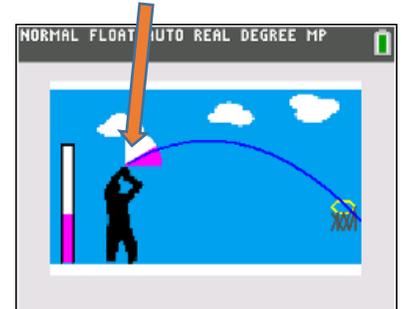
$$x = X1 + F*\cos(\theta)*t$$

where X1 is the starting x value of the ball and t is time

The vertical component has gravity pulling it down so it has an additional component $-\frac{1}{2} * \text{gravity} * \text{time}^2 = -4.9*t^2$. Time starts when the ball leaves the hand. On earth, gravity acceleration has the value 9.8m/s^2 , thus $\frac{1}{2}*\text{gravity} = 4.9$. The final equation is

$$y = Y1 + F*\sin(\theta)*t - 4.9*t^2$$

where Y1 is the starting y value of the ball and t is time



3. $x = X1 + F*\cos(\theta)*t$

$$y = Y1 + F*\sin(\theta)*t - 4.9*t^2$$

In the demo code the values for X1 and Y1 are 65 and 95 respectively.

Therefore,

$$x = 65 + F*\cos(\theta)*t$$

$$y = 95 + F*\sin(\theta)*t - 4.9*t^2$$

Can you solve for t in the x equation?



$$4. \quad x = 65 + F \cdot \cos(\theta) \cdot t \qquad y = 95 + F \cdot \sin(\theta) \cdot t - 4.9 \cdot t^2$$

$$t = \frac{x - 65}{F \cdot \cos(\theta)}$$

You can combine these two equations into one with a little substitution.

$$y = 95 + F \cdot \sin(\theta) \cdot \frac{x-65}{F \cdot \cos(\theta)} - 4.9 \cdot \left(\frac{x-65}{F \cdot \cos(\theta)} \right)^2$$

$$y = 95 + \sin(\theta) \cdot \frac{x-65}{\cos(\theta)} - 4.9 \cdot \left(\frac{x-65}{F \cdot \cos(\theta)} \right)^2$$

$$y = 95 + \tan(\theta) \cdot (x - 65) - 4.9 \cdot \left(\frac{x-65}{F \cdot \cos(\theta)} \right)^2$$

If your starting X1 and Y1 values are different make sure you use those values instead of 65 and 95 on the next step.

- Delete the last End statement at the end of your code.
This ends the While statement used to get a key pressed.
You will insert an IF statement that will execute if the enter key is pressed.

Write the following lines of code

```
:"SHOOT BASKET
:If K = 105
:Then
```

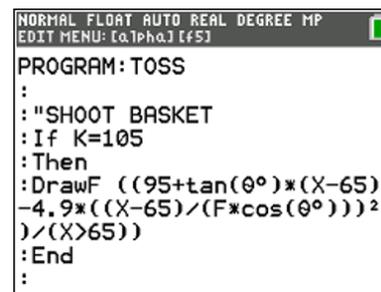
- You could simply DrawF ([2nd][[DRAW]) with the equation you found in step 4. However, that will draw the entire parabola. We only want the part when X > 65. (Your x value may be different. Use your starting X value.) Therefore, we will add a small conditional statement to the equation.

$$y = 95 + \tan(\theta) \cdot (x - 65) - 4.9 \cdot \left(\frac{x-65}{F \cdot \cos(\theta)} \right)^2$$

Add the two new lines

```
:"SHOOT BASKET
:If K = 104
:Then
:DrawF ((95 + tan(θ°)*(X-65) - 4.9*((X-65)/(F*cos(θ°)))2)/(X>65))
:End
```

Add one more End to complete the While loop.





10 MOC: Beyond Basics

TI-84 PLUS CE TECHNOLOGY

- Execute your code. Make sure it runs. Try several games. Use the arrow keys to change the velocity and the angle.

BASKETBALL GAME: MINI-PROJECT 6

STUDENT ACTIVITY

