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Math 4040
Dr. FotherGill - Worksheet

Math Behind Free Throws

- Math is fun!
- Basketball is more fun!

Let's calculate the maximum height of the basketball while shooting a free throw!

Step 1- What is given to us ?

- Release height - 7 feet = c
- Initial velocity - 24 ft/sec = b
- Acceleration of gravity - $-16t^2$ = a

Let's use some math and equations to figure this out.

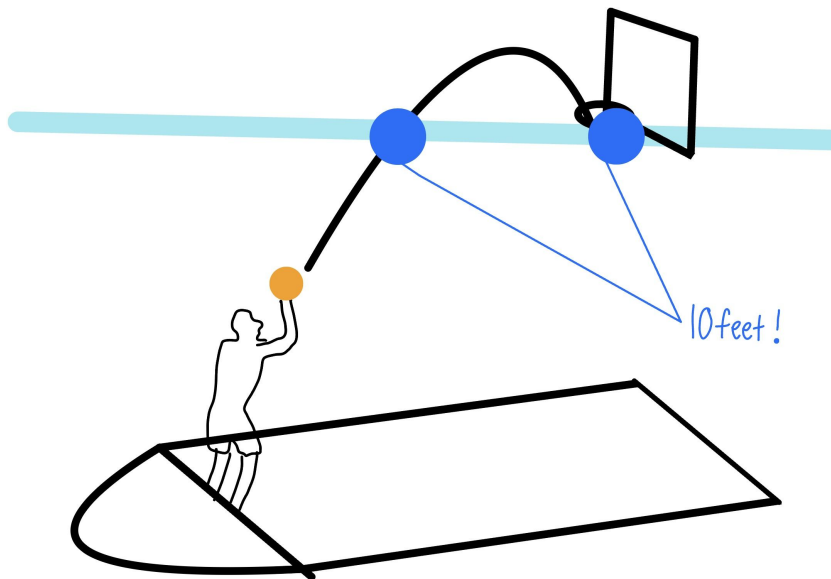
Height of ball at a given time = $h(t)$

^ we are trying to find this!

First we need to find the time when the ball reaches its max height.

Equation used = $h(t) = -16t^2 + 24t + 7$

Step 2- When does the ball reach 10 feet?



Now we need standard form $0 = ax^2 + bx + c$

Plug in 10 for $h(t)$ or 0

$$10 = 16t^2 + 24t + 7$$

$$0 = 16t^2 + 24t + (-3)$$

Step 3- Quad formula

This gives us the output of 0.14 or 1.36

Step 4- How does this help us?

Well since we now know that the ball reaches the height of 10 feet while at .14 seconds in the air and another height of 10 feet when

coming down at 1.36 seconds, we can find the average of the time, which will give us the maximum height of the ball.

Step 5- Mean

$$\text{Easy !} = .14 + 1.36 = 1.5 / 2 = .75$$

Step 6- now that we know when the ball is at its maximum height, the time is .75 seconds.

Let us that as t! And plug into the equation

$$\begin{aligned} H(.75) &= 16(.75)^2 + 24(.75) + 7 \\ &= -9 + 18 + 7 \\ &= 16 \text{ feet.} \end{aligned}$$

The max height of the ball in the air reaches 16 feet. This will give us the perfect free throw. !