

Example: Suppose you hit a golf ball at an initial velocity of 150 ft/sec. at an angle of 30°.

- a) Write the parametric equations that describe the position of the ball.

$$x = 75\sqrt{3}t$$

$$y = -16t^2 + 75t$$

- b) How long is the golf ball in the air?

$$-16t^2 + 75t = 0$$

$$t(-16t + 75) = 0$$

$$t = 0 \quad -16t + 75 = 0$$

$$t = 4.6875 \text{ sec.}$$

- c) Determine the maximum height of the ball and the time at which the maximum height happened.

$$\frac{4.6875}{2} = 2.34 \text{ sec}$$

$$y = -16(2.34)^2 + 75(2.34) = 87.89 \text{ ft}$$

vertex of vert. component : $x = \frac{-b}{2a} = \frac{-75}{2(-16)} = \frac{-75}{-32} = 2.34 \text{ sec}$

- d) Determine the distance the ball traveled.

$$x = (75\sqrt{3})(4.6875) = 608.92 \text{ ft}$$

Practice

1. A baseball is thrown with an initial velocity of 50 ft/sec. at an angle of 60° and an initial height of 5 ft. Assume that gravity is the only force acting on the baseball.

- a) When will the baseball hit the ground?
 b) How far does the baseball travel in the horizontal direction?
 c) What is the maximum height attained by the ball?

$$x = (50 \cos 60)t \quad y = -\frac{1}{2}(32)t^2 + (50 \sin 60)t + 5$$

$$x = 25t \quad y = -16t^2 + 25\sqrt{3}t + 5$$

a) $-16t^2 + 25\sqrt{3}t + 5 = 0$

$$t = \frac{-25\sqrt{3} \pm \sqrt{(25\sqrt{3})^2 - 4(-16)(5)}}{2(-16)}$$

$$= \frac{-43.3 \pm \sqrt{2195}}{-32}$$

$t = -0.11$
 $t = 2.817$

b) $x = 25(2.817) = 70.425 \text{ ft}$

c) $x = \frac{-25\sqrt{3}}{2(-16)} = 1.35$

$$y = -16(1.35)^2 + 25\sqrt{3}(1.35) + 5$$

$$= 34.297 \text{ ft}$$

2. A golfer hits a ball with an initial velocity of 133 ft/sec and at an angle of 36°

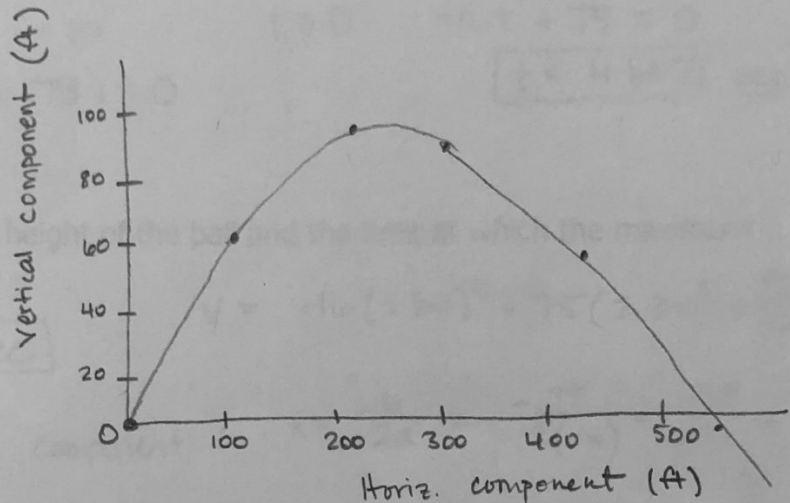
- Write the parametric equations that describe the path of the ball.
- Using the equations from part a, sketch a graph of the path of the ball.
- Find when and where the ball will hit the ground.
- Will the ball clear a fence 9 ft high that is at a distance of 275 ft from the golfer?

a) $x = (133 \cos 36^\circ)t$
 $x = 107.6t$

$y = -\frac{1}{2}(32)t^2 + (133 \sin 36^\circ)t + 0$
 $y = -16t^2 + 78.2t$

b)

t	x	y
0	0	0
1	107.6	62.2
2	215.2	92.4
3	322.8	90.6
4	430.4	56.8
5	538	-9



c) $-16t^2 + 78.2t = 0$
 $t(-16t + 78.2) = 0$
 $t = 0 \quad -16t + 78.2 = 0$
 $t = 4.8875 \text{ sec}$

$x = 107.6(4.8875) = 525.895 \text{ ft}$

The ball will land 525.895 ft away after 4.8875 sec

d) $275 = 107.6t$
 $t = 2.56$

$y = -16(2.56)^2 + 78.2(2.56)$
 $y = 95.33 \text{ ft}$

Yes; when the ball is 275 from the golfer it will have a vertical height of 95.33 ft