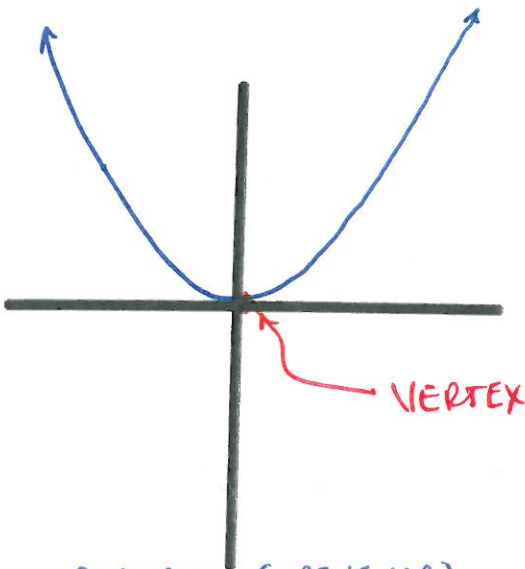


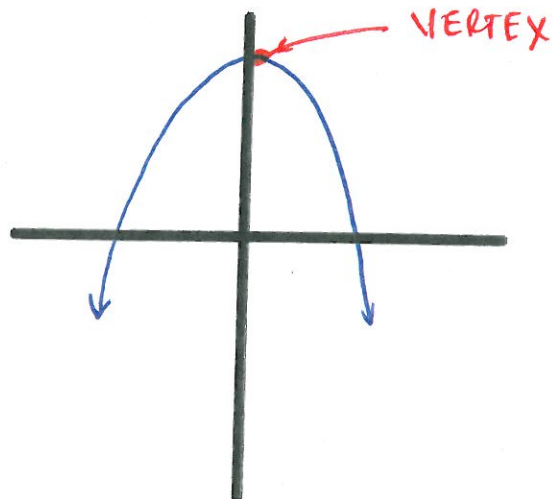
Section 1.5: Quadratic Model Graphs and Equations

A quadratic model is written in standard form: $y = \underline{a}x^{\textcircled{2}} + bx + c$

I. The graphs of quadratic models



PARABOLA (OPENS UP)
(a IS POSITIVE)



PARABOLA (OPENS DOWN)
(a IS NEGATIVE)

II. The concept of a vertex of a parabola

A vertex is a point (x, y) on a parabola where the parabola reaches a maximum or a minimum.

X-coordinate of a vertex:

$$x = -\frac{b}{2a}$$

Y-coordinate of a vertex:

EVALUATE THE MODEL WITH THE X-COORDINATE.

Section 1.5: Quadratic Model Examples

Part I: Algebraic Examples

1. Find the location of the vertex and sketch a graph of the model $y = x^2 - 6x + 4$.

VERTEX LOCATION: $\left(\underline{3}, \underline{-5} \right)$

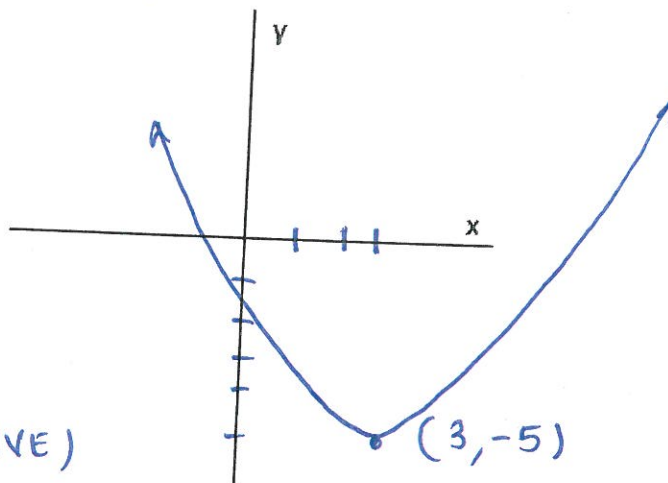
X-COORDINATE: $x = \frac{-b}{2a} = \frac{-(-6)}{2(1)} = \frac{6}{2} = 3$

Y-COORDINATE: $x^2 - 6x + 4$

$$3^2 - 6(3) + 4$$

$$9 - 18 + 4$$

$$y = -5$$



$a = 1$
(POSITIVE)

2. Find the location of the vertex and sketch a graph of the model $y = -4x + x^2$.

$$(2, -4)$$

$$y = ax^2 + bx + c$$
$$y = 1x^2 - 4x + 0$$

$$a = 1$$
$$b = -4$$
$$c = 0$$

X-COORDINATE:

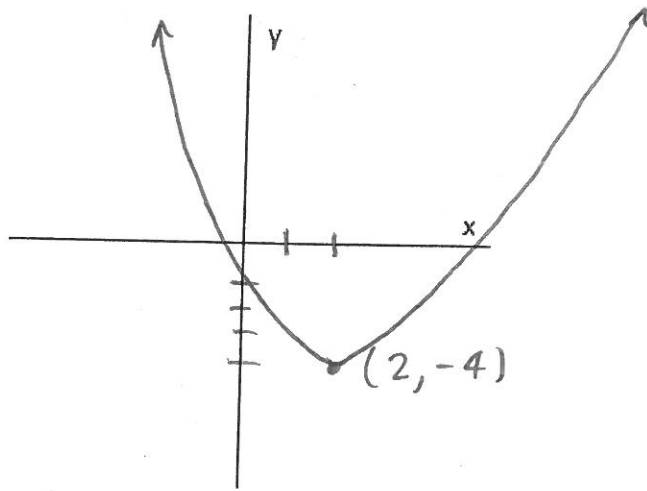
$$x = \frac{-b}{2a} = \frac{-(-4)}{2(1)} = \frac{4}{2} = 2$$

Y-COORDINATE: $-4x + x^2$

$$= -4(2) + 2^2$$

$$= -8 + 4$$

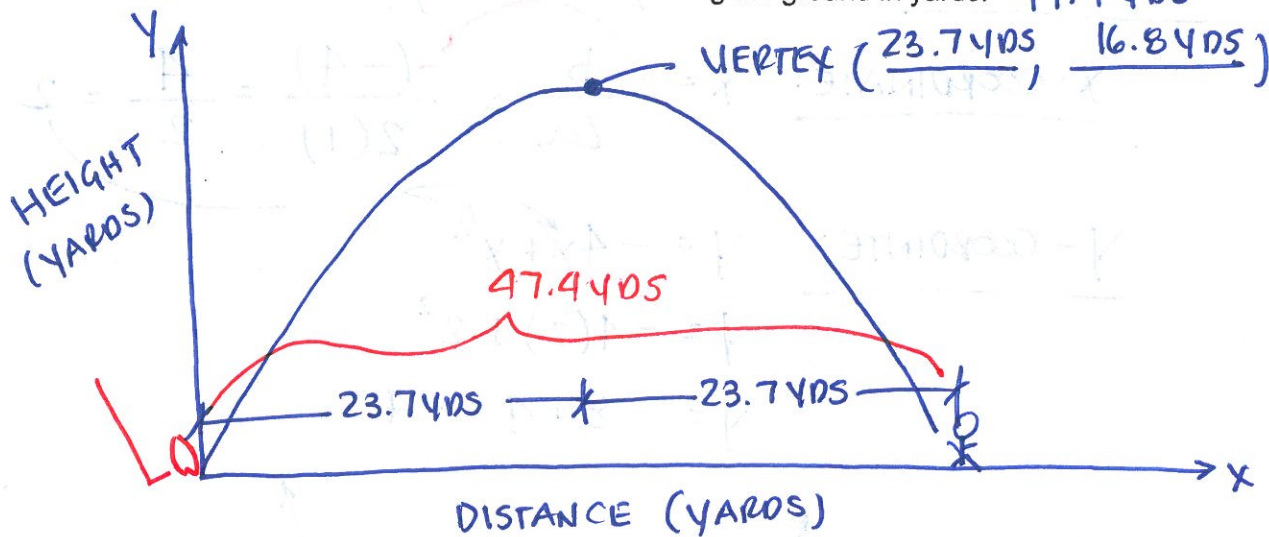
$$= -4$$



Part IV: Quadratic Model Example (Application - Projectile Motion Problem)

A football is kicked and follows the model $y = -0.03x^2 + 1.42x$ where y is the height of the ball in yards and x is the distance the ball travels along the ground, both distances in yards.

- ✓ Sketch a graph of the flight of the football.
- ✓ Find the maximum height the football reaches in the air in yards. 16.8 YARDS (y-coor)
- ✓ Find the distance the ball travels along the ground in yards. 47.4 YDS



VERTEX LOCATION : $(\frac{23.7 \text{ YDS}}{\quad} , \frac{16.8 \text{ YDS}}{\quad})$

X-COORDINATE: $x = -\frac{b}{2a} = \frac{-1.42}{2(-0.03)} = \frac{-1.42}{-0.06} = 23.7 \text{ YARDS}$

Y-COORDINATE: $y = -0.03x^2 + 1.42x$

$$y = -0.03(23.7)^2 + 1.42(23.7)$$

$$y = -0.03(561.7) + 33.7$$

$$y = -16.9 + 33.7$$

$$y = 16.8 \text{ YARDS}$$