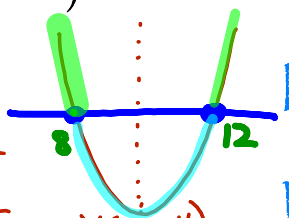
$h(x)=2.75(x-10)^2-11$



V(10, -11)

Dom: $\mathbb{R}$

Ran: $[-11 \quad +\infty[$

Max: None

Min: -11

Positive: $]-\infty, 8] \cup [12, +\infty[$

Negative: $[8, 12]$

$0 = 2.75(x-10)^2 - 11$

$x = 10 \pm \sqrt{\frac{11}{2.75}}$

$x = 10 \pm \sqrt{4}$

$x = 10 \pm 2$

Increasing: $[10, +\infty[$

Decreasing: $]-\infty, 10]$

$x=0$

y-intercept: 264

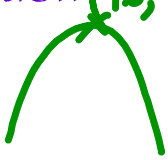
$y=0$

Zero(s): $\{8, 12\}$

Axis of Symmetry: $X = 10$

Example: The elevation of a firework was measured from the time of launch until it exploded. Its trajectory can be described by the function (43,93)

$$h(t) = -5(t-4.3)^2 + 93$$



a) What was the maximum height reached by this firework? 93 m

: k

b) When was the maximum height achieved? 4.3 s

h

c) At what height was the firework launched? ________

d) How many seconds after launch did the the firework explode if its height was 90.55m?

time

$$h(t) = -5(t-4.3)^2 + 93$$

let $y = 90.55$

$$90.55 = -5(t-4.3)^2 + 93$$
$$-93 \qquad -93$$
$$-2.45 = -5(t-4.3)^2$$
$$\div -5 \qquad \div -5$$
$$0.49 = (t-4.3)^2$$
$$\pm\sqrt{0.49} = t-4.3$$
$$\pm 0.7 = t-4.3$$

① $-0.7 + 4.3 = t$

$3.6s = t$

② $0.7 + 4.3 = t$

$5s\ t$

3.6s if before maximum

or 5s if after maximum

OR

$$90.55 = -5(t-4.3)^2 + 93$$
$$0 = -5(t-4.3)^2 + 2.45$$
$$t = 4.3 \pm \sqrt{\frac{-2.45}{-5}}$$
$$t = 4.3 \pm \sqrt{0.49}$$
$$t = 4.3 \pm 0.7$$

Example: A baseball is struck at a height of $1.1m$ above the ground. Three seconds later, it reaches its maximum height of $45.2m$. The height of the ball's trajectory is a second degree function of time.

vertex

x = time
y = height

Determine the rule (equation) that represents this situation.

standard form

$f(x) = a(x-h)^2 + k$

- vertex
- point

$V(3, 45.2)$ $P(0, 1.1)$

We know: 1. Vertex $V(\underset{h}{3}, \underset{k}{45.2})$

2. Point $P(\underset{x}{0}, \underset{y}{1.1})$

Can find: Equation

$$f(x) = a(x-h)^2 + k$$

$$f(x) = a(x-3)^2 + 45.2$$

$$1.1 = a(0-3)^2 + 45.2$$

$$1.1 = a(-3)^2 + 45.2$$

$$1.1 = 9a + 45.2$$

$$\underset{-45.2}{} \qquad \underset{-45.2}{}$$

$$-44.1 = 9a$$

$$\underset{\div 9}{} \qquad \underset{\div 9}{}$$

$$-4.9 = a$$

$$\therefore \boxed{f(x) = -4.9(x-3)^2 + 45.2}$$

$y = ?$ $x = 2$

a) What is the ball's height after 2 seconds?

$$f(x) = -4.9(x-3)^2 + 45.2$$

let $x = 2$

$$f(2) = -4.9(2-3)^2 + 45.2$$

$$f(2) = -4.9(-1)^2 + 45.2$$

$$f(2) = -4.9 + 45.2$$

$$f(2) = 40.3$$

The ball's height is $40.3m$.

$x = ?$ height $= y$

b) At what time would a player catch the ball **2.2m** above the ground ?

$$f(x) = -4.9(x-3)^2 + 45.2$$

let $y = 2.2$

$$2.2 = -4.9(x-3)^2 + 45.2$$
-45.2 -45.2
$$-43 = -4.9(x-3)^2$$
$\div -4.9$ $\div -4.9$
$$8.78 \approx (x-3)^2$$
$$\pm 2.96 \approx x - 3$$

1) $2.96 = x - 3$

$5.96 = x$

2) $-2.96 = x - 3$

$0.04 = x$

Does not seem logical

The player catches the ball after 5.96 seconds.

c) If no one catches the ball, when will it hit the ground?

height $y(y)=0$ the zeros

$$f(x) = -4.9(x-3)^2 + 45.2$$

let $y = 0$

$$0 = -4.9(x-3)^2 + 45.2$$

-45.2 -45.2

$$-45.2 = -4.9(x-3)^2$$

-4.9 $\div -4.9$

$$9.22 \approx (x-3)^2$$

$$\pm 3.04 \approx x - 3 \longrightarrow$$

OR $x = 3 \pm \sqrt{\frac{-45.2}{-4.9}} = 3 \pm \sqrt{9.22}$

$= 3 \pm 3.04$

1) $3.04 = x - 3$

$6.04 = x$

2) $-3.04 = x - 3$

$-0.04 = x$

reject

can't have (-) time

The ball hits the ground after approximately $6.04\ s$.

d) What is the domain and range of this situation?

x (time)

Domain: $[0, 6.04]$ s

y (height)

Range: $[0, 45.2]$ m