U3:L2 Quadratics in Standard Form

The standard form of a quadratic is...

$$\boxed{f(x) = ax^2 + bx + c}$$

Where a, b, c are real numbers and $a \neq 0$.

A	-shape of the parabola -open UP/DOWN think "m" in $y=mx+b$
B	-position of parabola on graph
C	-y intercept of graph think "b" of $y=mx+b$

The two forms are related to each other...

$f(x) = a\boxed{(x-p)^2} + q$

Factoring perfect square binomial

$f(x) = a(x^2 - 2xp + p^2) + q$

$f(x) = ax^2 - 2axp + ap^2 + q$

$f(x) = ax^2 - \underline{(2ap)}x + \underline{(ap^2 + q)}$

$f(x) = ax^2 + \underline{(-2ap)}x + (ap^2 + q)$

$f(x) = ax^2 + bx + c$

$\therefore b =$ $-2ap$

$\therefore p =$ $\frac{b}{-2a}$

$\therefore c =$ $ap^2 + q$

$\therefore q =$ $c - ap^2$

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

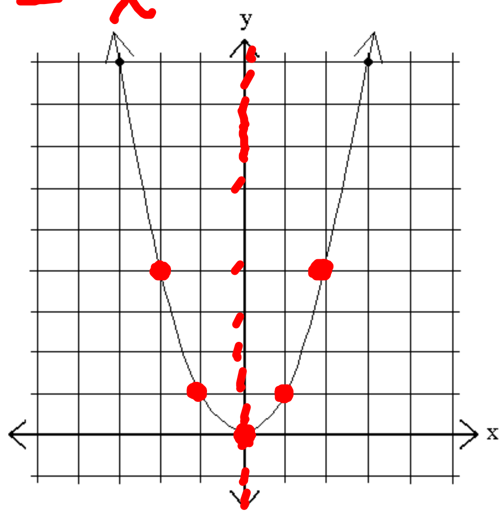
To find the x-coordinate of the vertex, use $x = p$

Find x of vertex

Plug x in to find y

$f(x) = x^2$

$c = 0$



DIRECTION OF OPENING: UP

COORDINATES OF VERTEX: $(0,0)$

MAXIMUM OR MINIMUM VALUE: min $y=0$

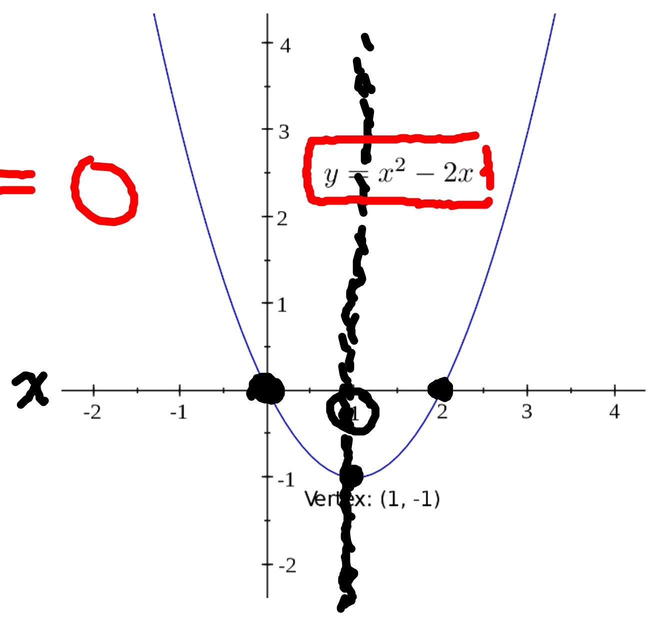
EQUATION OF AXIS OF SYMMETRY: ~~$y=0$~~ $x=0$

X-INTERCEPTS: $(0,0)$

Y-INTERCEPT: $(0,0)$

DOMAIN AND RANGE: $\{x \in \mathbb{R}\}$ $\{y \geq 0, y \in \mathbb{R}\}$

$c = 0$



DIRECTION OF OPENING: UP

COORDINATES OF VERTEX: $(1,-1)$

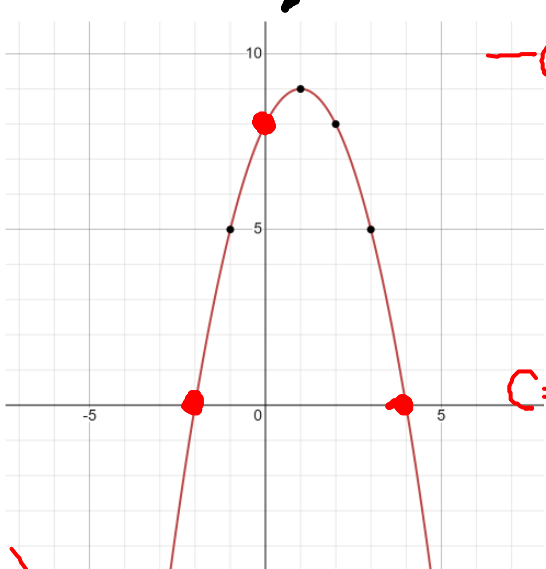
MAXIMUM OR MINIMUM VALUE: min $y=-1$

EQUATION OF AXIS OF SYMMETRY: @1

X-INTERCEPTS: $(0,0)$ $(2,0)$

Y-INTERCEPT: $(0,0)$

DOMAIN AND RANGE: $\{x \in \mathbb{R}\}$ $\{y \geq -1, y \in \mathbb{R}\}$



$-a$ DIRECTION OF OPENING: Down

COORDINATES OF VERTEX: $(1,9)$

MAXIMUM OR MINIMUM VALUE: max $y=9$

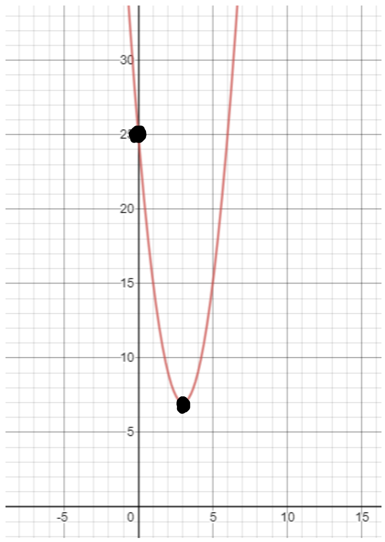
EQUATION OF AXIS OF SYMMETRY: $x=1$

X-INTERCEPTS: $(4,0)$ $(-2,0)$

$C=$ Y-INTERCEPT: $(0,8)$

DOMAIN AND RANGE: $\{x \in \mathbb{R}\}$ $\{y \leq 9, y \in \mathbb{R}\}$

$f(x) = -x^2 + 2x + 8$



+a DIRECTION OF OPENING: UP

COORDINATES OF VERTEX: (3,7)

MAXIMUM OR MINIMUM VALUE: min y=7

EQUATION OF AXIS OF SYMMETRY: x=3

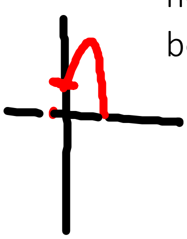
X-INTERCEPTS: NONE

c Y-INTERCEPT: y=25

DOMAIN AND RANGE: {x ∈ ℝ}
{y<7, y ∈ ℝ}

*DESMOS APP

A diver jumps from a 3m springboard with an initial vertical velocity of 6.8 m/s. Her height (h in meters) above the water, t seconds, after leaving the diving board can be represented by the function:



$$h(t) = -4.9t^2 + 6.8t + 3$$

a) Graph the function. $y=-4.9x^2+6.8x+3$

b) What does the y-intercept represent?

$y=3=C$ where she starts on springboard

c) What is the maximum height of the diver? When does she reach that height?

(0.694, 5.359) 5.4 m Vertex

d) How long is the diver in the air?

(1.74, 0) x intercept 1.74 seconds

e) What is the height of the diver 0.6 seconds after leaving the board?

(0.6, 5.316) 5.316m

Joe Bob is making an ice rink in his yard. He has 100m of boards to use as perimeter.

a) Write a quadratic function in standard form to represent the area of the rink:

$\boxed{A = lw}$ (l, w)

$P = 2l + 2w$

$100 = 2l + 2w$

$\frac{100 - 2w}{2} = \frac{2l}{2}$

$50 - w = l$

$A = l \times w$

$A = (50 - w) \times w$

$A = 50w - w^2$

$\boxed{A = -w^2 + 50w}$

b) What are the coordinates of the vertex? What does the vertex represent?

$x = p$

★ $x = \frac{-b}{2a}$

$x = \frac{-50}{2(-1)}$

$\boxed{x = 25}$

$y = ax^2 + bx + c$

$A = -w^2 + 50w + 0$

$y = -x^2 + 50x + 0$

$y = -1x^2 + 50x + 0$

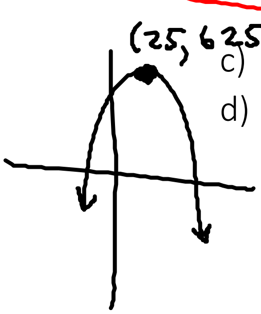
$y = -1(25)^2 + 50(25) + 0$

$y = -625 + 1250$

$\boxed{y = 625}$

$(25, 625)$

c) Sketch the graph.



d) Determine the domain and range.

x y

$\{x \in \mathbb{R}\}$

$\{y \mid y \leq 625, y \in \mathbb{R}\}$

(−) do not work

e) Identify any assumptions you made to solve this.

★ He uses ALL the fencing

★ He has unlimited perfect space for a perfect rectangle rink

Practice: Pages 174 – 179 Qs: 1, 3, 4, 6