Finding
Maximum Height
AND
Maximum Area

To Find Maximum Height:

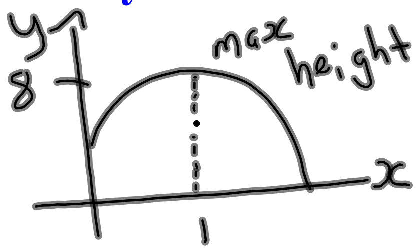
If the equation is given, complete the square and place it in either

Standard $y = a(x - h)^2 + k$ or
Transformational Form $\frac{1}{a}(y - k) = (x - h)^2$

State the vertex (h, k)

The **Maximum Height** will be the **y-value** from the vertex.

$y = 2x^2 - 4x + 10$



$y - 10 = 2(x^2 - 2x)$

$y - 10 + 2 = 2(x^2 - 2x + 1)$

$y - 8 = 2(x - 1)^2$

$y = 2(x - 1)^2 + 8$ stand. form.

$h_{max} = 8$ m

Vertex = (1, 8)

To Find Maximum Area:

If the equation is not given, create the equation using:

P = ?

Let x = width

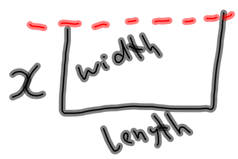
$$\frac{\text{P - \# of widths}}{\text{\# of lengths}} = \text{length}$$

Area = length x width

Once the equation is created, place in general form and complete the square to find the vertex (h, k).

The **Maximum Area** will be the **y-value** from the vertex.

Problem 6 of worksheet



Perimeter = 400m

$$\frac{400-2x}{1} = \text{Length}$$

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

$$\text{Area} = x(400-2x)$$

$$A = 400x - 2x^2$$

$$A = -2x^2 + 400x$$

$$A = -2(x^2 - 200x)$$

$$A - 20000 = -2(x^2 - 200x + 10000)$$

$$A - 20000 = -2(x-100)^2$$

$$A = -2(x-100)^2 + \underbrace{20000}_{\text{max area}}$$

Vertex = (100, 20000)

To Find **TIME** To Reach Maximum Height:

If the equation is given, complete the square and place it in either

Standard $\mathbf{y = a(x - h)^2 + k}$ or
Transformational Form $\mathbf{\frac{1}{a}(y - k) = (x - h)^2}$

State the vertex (h, k)
(x, y)

The **TIME** will be the **x-value** from the vertex.

$$h = -5t^2 + 25t + 10$$

$$h - 10 = -5(t^2 - 5t)$$

$$h - 10 - \frac{125}{4} = -5\left(t^2 - 5t + \frac{25}{4}\right)$$

$$h - \frac{165}{4} = -5(t - 5/2)^2$$

$$h = -5(t - 5/2)^2 + \frac{165}{4}$$

Vertex = (5/2, 165/4)

To Find **TIME** To Reach The **GROUND**:

If the object is hitting the ground that means that the height (y-value) will be 0. There will usually be two points in time (x-values) that the height (y-value) will be 0. One of these x- values may be 0. This would represent the initial time. The other x-value will be the time at which the object makes contact with the ground(or similar surface).

To determine the time it takes for an object to reach the "ground", you need to factor the equation and then set each factor equal to zero. You can then solve for either x or t.

Choose the larger "x" or "t" value.

$y = 4x^2 - 24x$

$y = \text{height}$

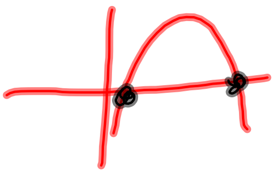
$x = \text{time}$

$0 = 4x^2 - 24x$

$0 = 4x(x-6)$

$0 = 4x$ and $0 = x-6$

$x = 0s$ $\quad$ $x = 6$



$y = x^2 - 8x + 15$

$\underline{-3} + \underline{-5} = -8$

$\underline{-3} \times \underline{-5} = +15$

$y = (x-3)(x-5)$

$0 = x-3$, $0 = x-5$

$x = 3s$ $\quad$ $x = 5s$

To Determine the **HEIGHT** at a Specific Time:

Substitute the specific time into the equation anywhere you see a "t" (or x) and then solve the equation for "h" (or y).

To Determine the INITIAL HEIGHT of an Object.

Substitute **zero** for **"t"** (or x) to represent the time the object was kicked/hit/launched into the air and then solve the equation for "h" (or y).