Gr. 11 Pre-cal
Mrs. Piché

3.2 QUADRATIC FUNCTIONS IN STANDARD FORM

The standard form for a quadratic function is: $f(x)=ax^2+bx+c$, where a, b, and c are real numbers and $a \neq 0$.

Sometimes equations of a quadratic function may not be given to you in standard form.

Practice writing these quadratic functions in standard form:

a) $f(x)=(x-3)(3x+7)$

$f(x) = 3x^2+7x-9x-21$

$\boxed{f(x) = 3x^2-2x-21}$

$a=3 \quad b=-2 \quad c=-21$

b) $f(x)=x(3x+7)+2x^2$

$f(x) = 3x^2+7x+2x^2$

$\boxed{f(x) = 5x^2+7x}$

$a=5 \quad b=7 \quad c=0$

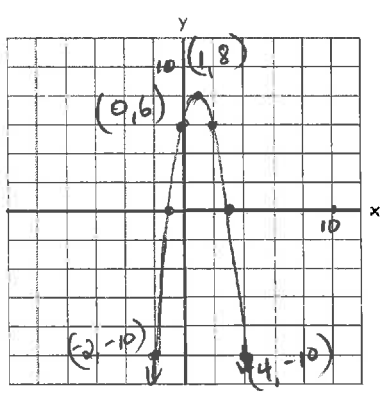
The graph of every quadratic function (polynomial of degree 2) is a curve called a <u>parabola.</u>

Identify the characteristics of a graph of a quadratic function, including:

- Vertex
- Domain and range
- Direction of opening
- Axis of symmetry
- X- and y-intercepts
- Maximum or minimum value

$y=-2x^2+4x+6$ Use these values of x: $-2,-1,0,1,2,3,4$ to sketch a graph.

x	y
-2	-10
-1	0
0	6
1	8
2	6
3	0
4	-10



V: (1,8)
domain: $(-\infty,\infty)$
range: $(-\infty,8]$
opens down
A.S. $x=1$
x-int: -1, 3 (by inspection)
y-int: 6
Max. value: 8

Note: By writing the equation $y = a(x-p)^2 + q$ in standard form ($y = ax^2 + bx + c$), you will see that p (the x-coord of the vertex), is equivalent to $\frac{-b}{2a}$, when the equation is in standard form. **Try to show why this is so.

Thus, given: $y = 3x^2 - 6x + 4$, the x-coord of the vertex is : $\frac{-(-6)}{2(3)} = 1$

To find the y-coord of the vertex, substitute for x and solve.

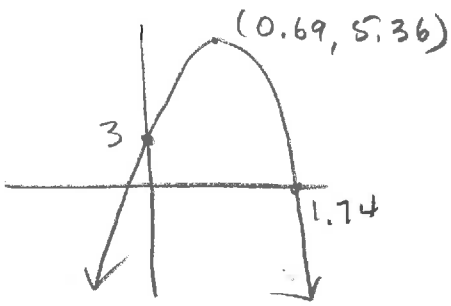
$y = 3(1)^2 - 6(1) + 4 = 1$

Therefore the vertex is: $(p, q) = (1, 1)$

$a > 0$, parabola opens up, min. value is 1.

Suppose a diver jumps from a 3-m 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 modelled by the function $h(t) = -4.9t^2 + 6.8t + 3$.

a) Graph the function using technology. (zoom std.)



Calc. max : 5.36

Calc. x-int : 1.74

b) What does the y-intercept represent?

height at time $t = 0$

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

max. height is 5.36 m at time $t = 0.69$ s.

d) How long does it take before the diver hits the water?

(ht is zero) time = 1.74 s.

e) What domain and range are appropriate in this situation?

domain : $0 \le x \le 1.74$ range : $0 \le y \le 5.36$

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

$h(0.6) = -4.9(0.6)^2 + 6.8(0.6) + 3$

$= 5.32$ m

or use graph & calc. value at $x = 0.6$

Suppose that at a children's music festival, the organizers are roping off a rectangular area for stroller parking. There is 160 m of rope available to create the perimeter.

a) Write a quadratic function in standard form to represent the area for the stroller parking.

$A = L \cdot W$ $\quad P = 2L + 2W$

$160 = 2L + 2W$

$80 = L + W$ $\quad W = 80 - L$

$A = L(80 - L)$

$= 80L - L^2$

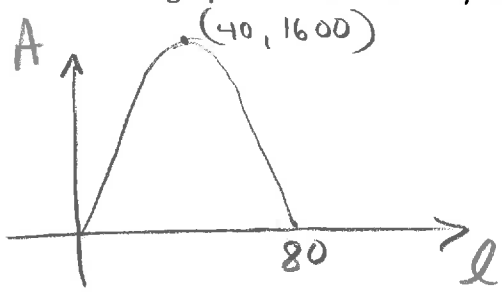
$$\boxed{A = -L^2 + 80L}$$

b) What are the coordinates of the vertex? What does the vertex represent in this situation?

graph on calc. + adjust window : (0,80) by (0, 3000) guess

V : (40, 1600) – means the max area of 1600 m² occurs when the length is 40 m

c) Sketch the graph for the function you determined in part a).



d) Determine the domain and range for this situation.

domain : $0 < L < 80$

range : $0 < A \leq 1600$

e) Identify any assumptions you made.

area > 0 $(\neq 0)$

no obstacles

Assignment: 3.2 p.174 #1, 3, 4a,b, 5d, 6-8, 10a,b, 15

(#15: Graph using x-intercepts and axis of symmetry to find the maximum.)