PreCalculus 11 Date _____

Unit 2: Quadratic Functions
2.3 Quadratic Functions in Standard Form

Vertex form quadratic: $f(x) = a(x-p)^2 + q$ where $a, p, q \in \mathbb{R}; a \neq 0$

Standard form quadratic: $f(x) = ax^2 + bx + c$ where $a, b, c \in \mathbb{R}; a \neq 0$

- *a* determines the shape of the parabola & the direction of opening
  & influences the horizontal & vertical translations
- *b* influences the horizontal & vertical translations
- *c* represents the y-intercept of the parabola
  & influences the vertical translation

* note: $p = \frac{-b}{2a}$

ex. graph the parabola $f(x) = 2x^2 - 3x - 5$ on a calculator and state:

a) vertex $(0.75, -6.125)$

b) axis of Symmetry $x = 0.75$

c) direction of opening up

d) y-intercept $y = -5$

e) x-intercepts $x = -1$ & $x = 2.5$

f) domain $\{x \mid x \in \mathbb{R}\}$

g) range $\{y \mid y \geq -6.125, y \in \mathbb{R}\}$

ex. graph the parabola $f(x) = -\frac{1}{2}x^2 - 5x + 10$ on a calculator and state:

a) vertex $(-5, 22.5)$

b) axis of Symmetry $x = -5$

c) direction of opening down

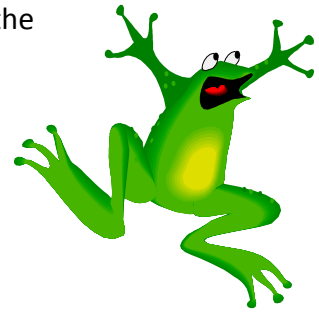
d) y-intercept $y = 10$

e) x-intercepts $x = -11.71$ & $x = 1.71$

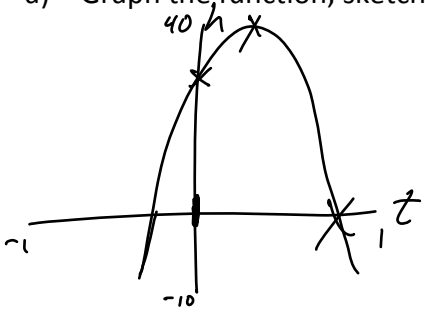
f) domain $\{x \mid x \in \mathbb{R}\}$

g) range $\{y \mid y \leq 22.5, y \in \mathbb{R}\}$

ex. A frog sitting on a rock jumps into a pond. The height, *h*, in centimeters of the frog above the surface of the water as a function of time, *t*, in seconds, since it jumped can be modeled by the function $h(t) = -490t^2 + 150t + 25$. Where appropriate, answer the following questions to the nearest tenth.



a) Graph the function, sketch.



b) What is the y-intercept? What does it represent in this situation?

$y = 25$ at $t = 0$s the frog is 25 cm above the pond

c) What maximum height does the frog reach? When does it reach that height?

vertex (0.2, 36.5)

max height 36.5 cm
at time 0.2 s

d) When does the frog hit the surface of the water?

$h(t) = 0$
ie. x-intercept $t = 0.4$ s

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

$D: \{t \mid 0 \le t \le 0.4, t \in \mathbb{R}\}$

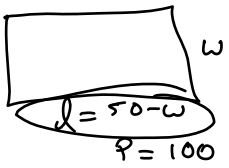
$R: \{h \mid 0 \le h \le 36.5, h \in \mathbb{R}\}$

f) How high is the frog 0.25 seconds after it jumps?

$h(0.25) =$ 31.9 cm

ex. A rancher has 100 m of fencing available to build a rectangular corral. Answer the following questions **without** the aid of the graphing features of a graphing calculator.

a) Write a quadratic function in standard form to represent the area of the corral.



$A = l \times w$

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

$A(w) = 50w - w^2$

$A(w) = -w^2 + 50w$

$2l + 2w = 100$

$2l = 100 - 2w \therefore l = 50 - w$

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

(p, q)

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

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

$= 25$

$q = A(25)$

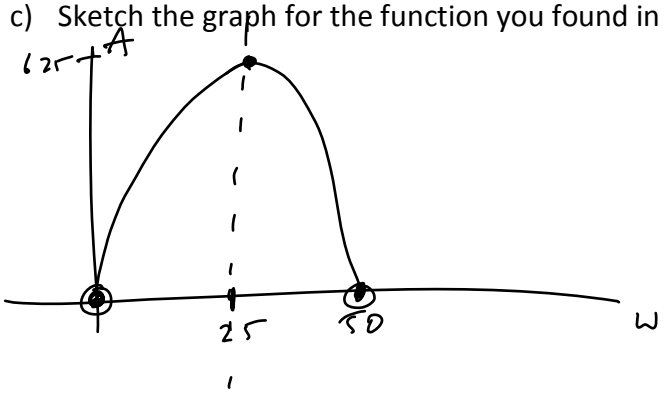
$= -(25)^2 + 50(25)$

$= 625$

vertex (25, 625)

max area of $625\ m^2$ when the width is 25 m

c) Sketch the graph for the function you found in a).



d) Determine the domain and range.

$D: \{w \mid 0 < w < 50, w \in \mathbb{R}\}$

$R: \{A \mid 0 < A \leq 625, A \in \mathbb{R}\}$

e) Identify any assumptions you made in modeling this situation mathematically.

- using all the fencing
- all dimensions are possible

Practice: pg. 174/ # 2ab, 3, 5ab, 6ab, 7, 8, 10 – 12, 14, 16, 17, 18, 23