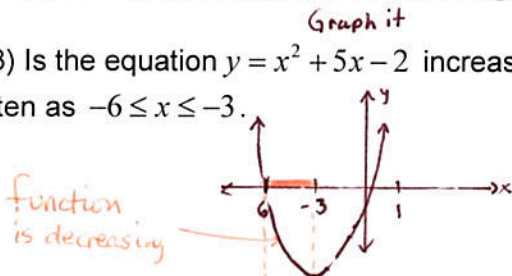## 5B – Graphs of Quadratics and Exponentials Continued

▶ Video - "Increasing and Decreasing Intervals - Example" - MathontheWeb (5:07)
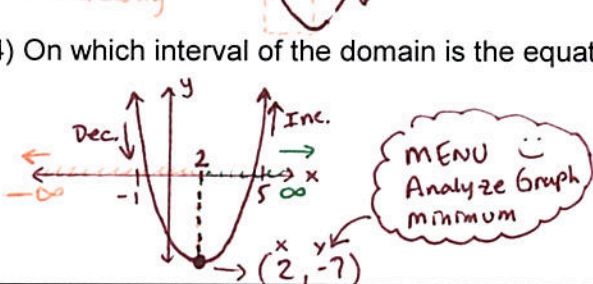
(-5, 3)
-5 < x < 3   ☺

Graph it

EX3) Is the equation $y = x^2 + 5x - 2$ increasing or decreasing on the interval $[-6, -3]$ of the domain, also written as $-6 \le x \le -3$.

function is decreasing

On the interval [-6, -3], the function is decreasing.

Graph it

EX4) On which interval of the domain is the equation $y = x^2 - 4x - 3$ increasing? Which is it decreasing?
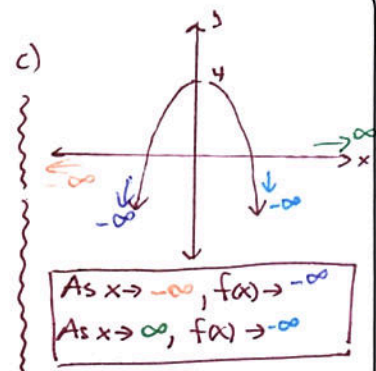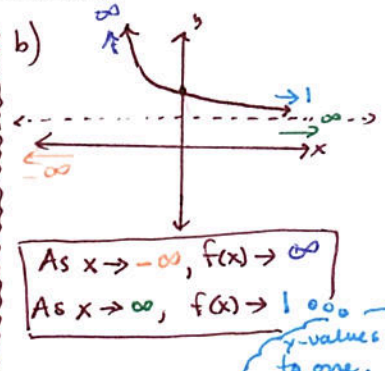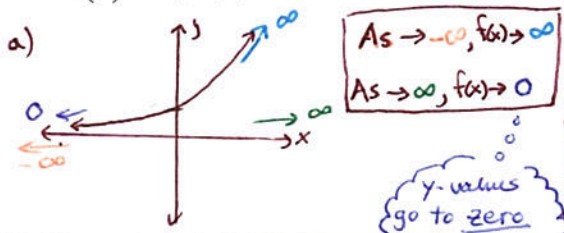
Dec.   *Inc.*

MENU ☺
Analyze Graph
minimum

Decreasing: $(-\infty, 2]$
Increasing: $[2, \infty)$

$(2, -7)$

▶ Video - "End Behavior - Example" - MathontheWeb (6:02)

EX5) Describe the end behavior of the following functions:

a. $f(x) = 2^x$
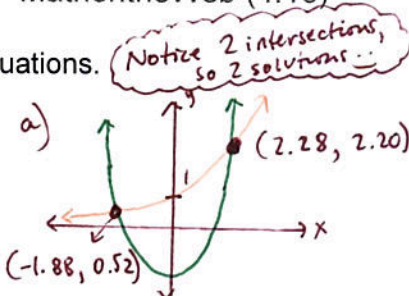
b. $g(x) = 3^{-x} + 1$ *Graph*

c. $h(x) = -x^2 + 4$

a)

As $\to -\infty$, f(x) $\to \infty$
As $\to \infty$, f(x) $\to 0$

b)

As $x \to -\infty$, $f(x) \to \infty$
As $x \to \infty$, $f(x) \to 1$ ooo

c)

As $x \to -\infty$, f(x) $\to -\infty$
As $x \to \infty$, f(x) $\to -\infty$

y-values go to zero

y-values go to one.

▶ Video - "Systems of Equations - Example" - MathontheWeb (4:13)

EX6) Determine the solution(s) to the system of equations. *Notice 2 intersections, so 2 solutions ☺*

a. $\begin{cases} y = 2^{0.5x} \\ y = x^2 - 3 \end{cases}$ *Graph in same window and ☺ MENU, Analyze Graph Intersection*
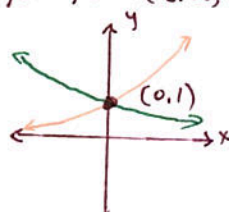
b. $\begin{cases} y = 2^x \\ y = (0.5)^x \end{cases}$ *same as above*

c. $\begin{cases} y = 3^{-x} \\ y = -x^2 - 1 \end{cases}$ *same as above*

a) $(2.28, 2.20)$

$(-1.88, 0.52)$

* Solutions: $(-1.88, 0.52)$ and $(2.28, 2.20)$

b) $(0, 1)$

Notice 1 intersection, so 1 solution ☺
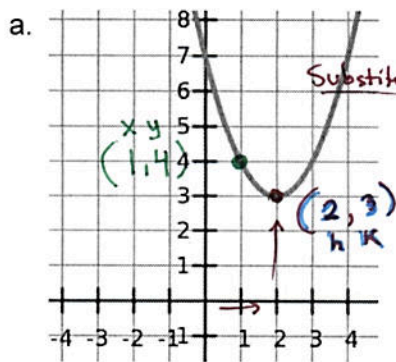
c)
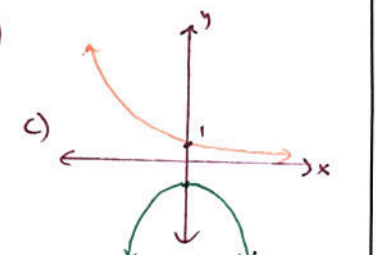
* Notice NO intersection, so NO solution ☺

* Solution: $(0, 1)$

opens up or down: $y = a(x-h)^2 + K$, vertex (h, K)

▶ Video - "Vertex Form of a Quadratic - Example" - MathontheWeb (7:23)

EX7) Determine an equation of a parabola in vertex form that can match the given graph:

a.

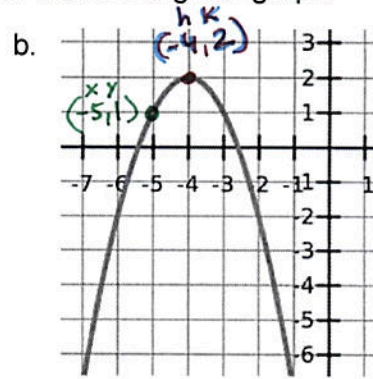$y = a(x-h)^2 + K$
Substitute: $4 = a(1-2)^2 + 3$
$4 = a(-1)^2 + 3$
$4 = a \cdot 1 + 3$
$4 = a + 3$
$\underline{-3 \qquad -3}$
$\boxed{1 = a}$

$(1, 4)$ ← x y
$(2, 3)$
h K

$\boxed{y = 1(x-2)^2 + 3}$

* Don't substitute x and y, just h and K. ⌣

b.

$(-4, 2)$ ← h K
$(-5, 1)$ ← x y

$y = a(x-h)^2 + K$
$1 = a(-5 - -4)^2 + 2$
$1 = a(-5+4)^2 + 2$
$1 = a(-1)^2 + 2$
$1 = a \cdot 1 + 2$
$1 = a + 2$
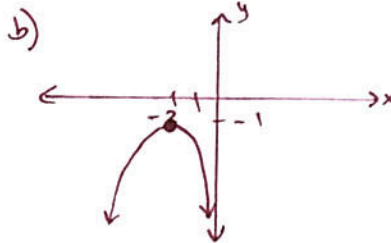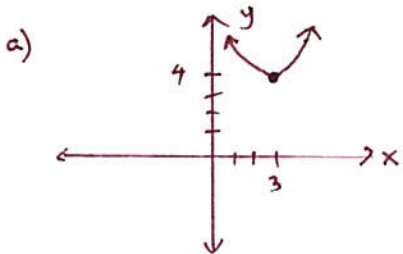$\underline{-2 \qquad -2}$
$\boxed{-1 = a}$

$y = -1(x - -4)^2 + 2$
$\boxed{y = -1(x+4)^2 + 2}$

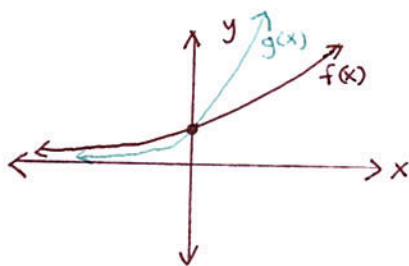EX8) Graph the quadratic function without the use of a calculator. ⌣

a. $y = 1(x-3)^2 + 4$ → Vertex $(3, 4)$, opens up since $\boxed{a=1}$ is positive

b. $y = -1(x+2)^2 - 1$ → Vertex $(-2, -1)$, opens down since $\boxed{a=-1}$ is negative

a)

b)

▶ Video - "Comparing Exponential Functions - Example" - MathontheWeb (3:59)

EX9) Alex graphed the function $f(x) = 2^x$. He decides to add another one and graphs $g(x) = 6^x$. Describe the change from $f(x)$ to $g(x)$.

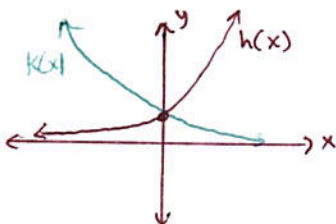Change: $g(x)$ increases faster than $f(x)$; that is to say the y-values of $g(x)$ grow faster than y-values of $f(x)$.

* Both functions are exponential growth functions.

EX10) Gabby graphed the function $h(x) = 5^x$. She decides to add another one and graphs $k(x) = (0.75)^x$. Describe the change from $h(x)$ to $k(x)$.

Change: $k(x)$ decreases while $h(x)$ increases.
So the y-values of $h(x)$ increase (grow large) and the y-values of $k(x)$ get smaller and smaller, very close to 0. ⌣

* $k(x)$ is an exponential decay function.