Math 1090 ~ Business Algebra

Section 3.6 Transformations of Graphs

Objectives:

- Differentiate between outside and inside the function.
- Describe shifts, stretches and reflections of a parent function.
- Sketch a graph using shifts, stretches and reflections of the parent function.
Transformations to a graph of $f(x)$.

<table>
<thead>
<tr>
<th>shift</th>
<th>reflection</th>
<th>stretch/shrink</th>
</tr>
</thead>
<tbody>
<tr>
<td>$f(x)+h$</td>
<td>$-f(x)$</td>
<td>$cf(x)$</td>
</tr>
<tr>
<td>$h&gt;0$</td>
<td>$h&lt;0$</td>
<td>$c&gt;0$</td>
</tr>
<tr>
<td>up</td>
<td>down</td>
<td>constant</td>
</tr>
<tr>
<td>$f(x-h)$</td>
<td>$f(-x)$</td>
<td>$c&gt;1$, shrink</td>
</tr>
<tr>
<td>$h&gt;0$</td>
<td>$h&lt;0$</td>
<td>$c&lt;1$, shrink</td>
</tr>
<tr>
<td>right</td>
<td>left</td>
<td></td>
</tr>
</tbody>
</table>

Vertical changes: outside the fn

Horizontal changes: inside the fn

Ex 1: Describe the transformation of $f(x) = -(x-2)^2 + 3$ compared to the base graph of $y = x^2$. Sketch the graph of $f(x)$.

Base graphs

- $y = x^2$
- $y = |x|$
- $y = x^3$
- $y = \sqrt{x}$
Ex 2: Describe the transformations and sketch the graph.

a) \( q(x) = -2|x-3| + 1 \)

**base graph:** \( y = 1 \times 1 \)

\[ q(x) = -2|x-3| + 1 \]

vert. reflectn

vert. stretch factor of 2

shift R 3

shift up 1

b) \( h(x) = -\sqrt{-x} + 3 \)

**parent**

\[ h(x) = -\sqrt{-x} + 3 \]

vert. ref

hor. ref.

\begin{align*}
\begin{array}{|c|c|c|c|}
\hline
y = \sqrt{x} & -\sqrt{x} & -\sqrt{-x} & -\sqrt{-x} + 3 \\
\hline
(0,0) & (0,0) & (0,0) & (0,3) \\
(1,1) & (1,-1) & (-1,-1) & (-1,2) \\
(4,2) & (4,-2) & (-4,-2) & (-4,1) \\
\hline
\end{array}
\end{align*}

+shift up 3

vert. ref and stretch
Ex 3: Given this graph of $f(x)$, sketch the indicated transformed graph.

$f(x)$

$\sqrt{\text{horiz. ref.}}$

$f(-x) + 1$

vert. shift up 1

$\text{vert. ref.}

-f(x) + 1$

vert. shift up 1