Math 3 Honors Unit 1 Day 4 – Transformations

Warm Up

1. $f(x) = x^3+3x^2-2x+1$

D:

R:

Absolute Extrema:

Relative Extrema:

Increasing:

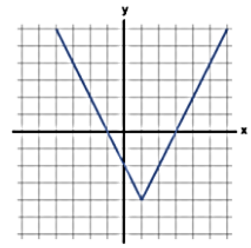
Decreasing:

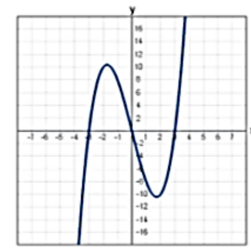
Zeros:

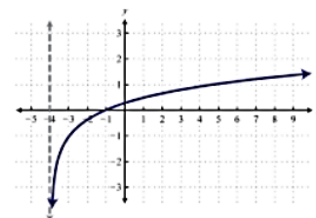
Y-Intercept:

End Behavior:

2. Identify the function







Practice: Sketch the following on the same set of axes in different colors and state the transformation being applied to each function.

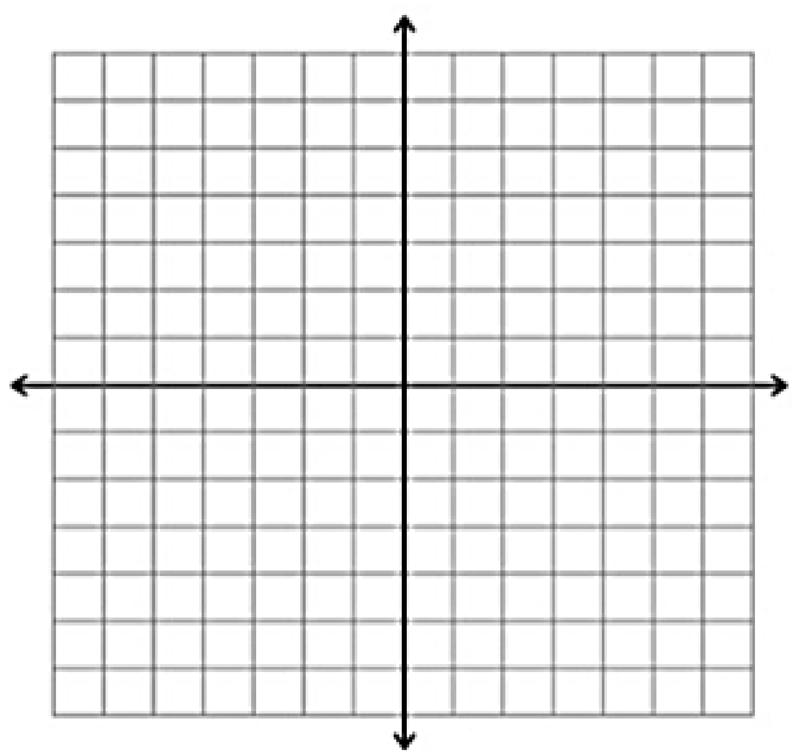
1) $f(x) = |x|$

2) $f(x) = |x + 6|$

3) $f(x) = |x-5|$

4) $f(x) = -|x|$

5) $f(x) = |x + 1|-3$



Expansion and Compression Transformations

Horizontal (x-values): $f(x)=f(bx)$

If $|b|$ is > 1, it is a horizontal compression by a factor of $\frac{1}{b}$

If $|b|$ is < 1, it is a horizontal expansion by a factor of $\frac{1}{b}$

Example: $f(x)=\sqrt{x}$ $g(x)=\sqrt{2x}$ $h(x)=\sqrt{\frac{1}{2}x}$

Vertical (y-values): $f(x)=a(f(x))$

If $|a|$ is > 1, it is a vertical expansion by a factor of **a**

If $|a|$ is < 1, it is a vertical compression by a factor of **a**

Example: $f(x)=\sqrt{x}$ $g(x)=2\sqrt{x}$ $h(x)=\frac{1}{2}\sqrt{x}$

Note: put in standard form first!

-Get the coefficient of x to be a positive 1 !

Given the parent function, $f(x) = x^2$, what transformations were applied in each? What changed from the original function f(x)?

1. a) $f(x) = (.25x)^2$

b) $f(x) = (4x)^2$

2. $f(x) = (x-4)^2$

3. $f(x) = (-x-4)^2$

4. a) $f(x) = 4x^2$

b) $f(x) = \frac{1}{4}x^2$

5. $f(x) = -x^2$

6. $f(x) = x^2 - 4$

General Rules of Transformations:

$$g(x) = \pm af\left(b(x-h)\right)+k$$

(ORDER MATTERS!!!!!)
-b, h,-a, k

Step 1: (-b) If b is negative, reflect the function over the y-axis.

Step 2: (b) Look for a horizontal stretch/shrink.
- If $|b|$ is > 1, it is a horizontal compression by a factor of $\frac{1}{b}$
- If $|b|$ is < 1, it is a horizontal expansion by a factor of $\frac{1}{b}$

Step 3: (h) Look for a horizontal shift.
- For (x - h), horizaontal shift to the **right h**.
- For (x + h), horizontal shift to the **left h**.

NOTE: For horizontal transformations it is the opposite of what you expect

Step 4: (-a) If a is negative, reflect the function over the x-axis.

Step 5: (a) Look for a vertical stretch/shrink.
- If $|a|$ is > 1, it is a vertical expansion by a factor of **a**
- If $|a|$ is < 1, it is a vertical compression by a factor of **a**

Step 6: (k) Look for a vertical shift.
- If k is > 0, we shift up.
- If k is < 0, we shift down.

****b & h** are horizontal transformations, so they are grouped in the parentheses with the x.**

****a & k** are vertical transformations, so they are both outside of the parentheses.**

State the transformations in order!

Remember **-b,h,-a,k**

ex} $h(x) = -|3x| - 5$

$f(x) = 4(-3x - 6)^3 - 1$

b,h,a,K

ex} $f(x) = -6\sqrt{x+4} + 8$

ex} $b(x) = 1/2(4x - 1)^2 + 7$

Now, let's write the function given the transformations:

1) $f(x)=x^2$, vertically stretched by a factor of 7, reflected in the y-axis, translated 5 units to the right and translated 3 units downwards

2) $f(x) = |x|$, horizontally shifted 7 units to the left, horizontally stretched by a factor of 1/2, reflected in the y-axis, vertically stretched by a factor of 9, and shifted down 5 units.