Transforming and Analyzing Absolute Value	The state of the s
Functions	

Absol	ute	Va	lυϵ
Funct	ions		

- * For an Absolute Value Value function, the general form is f(x) = a|bx-c|+d, where a, b, c, and d are real numbers.
- The Absolute Value parent function is f(x) = |x|
- The full family of Absolute Value functions is generated by applying transformations to the Absolute Value parent function
- Transformations are applied using parameters that are multiplied or added to the independent variable in the functional relationship

Changes in a

- \bullet The parameter a influences the vertical stretch or compression of the graph of the parabola.
- If |a| > 1, then the y-values are multiplied by a factor of a to vertically stretch the graph
- · If o < |a| < 1, then the y-values are multiplied by a factor of a to vertically compress the graph
- If a < 0, then the graph will be reflected across the x-axis

Changes in <i>b</i> - The parameter <i>b</i> influences the horizontal stretch or compression of the graph of the parabola. - If $b < 0$, then the x-values are multiplied by a factor of $\frac{1}{ b }$ to horizontally stretch the graph - If $b < 0$, then the graph will be reflected across the y-axis. - The parameter <i>c</i> , like <i>b</i> , influences the horizontal translation of the graph of the parabola. - Note that is the general form, the sign in front of the <i>c</i> is negative. This could list the graph of the parabola subject to the list. - If $c < 0$, then the graph will translate f_0^c to the list. - The parameter dinfluences the vertical translation of the graph of the parabola. - If $c < 0$, then the graph will translate f_0^c to the list. - The parameter dinfluences the vertical translation of the graph of the parabola. - If $c < 0$, then the graph of the parabola will translate $[d]$ units up. - If $d < 0$, then the graph of the parabola will translate $[d]$ units up. - If $d < 0$, then the graph of the parabola will translate $[d]$ units up. - If $d < 0$, then the graph of the parabola will translate $[d]$ units up.		
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Vertex	• The vertex of a parabola is a maximum or minimum value. • If the parabola opens up, then the vertex is a minimum value. If the parabola opens down, then the vertex is a maximum value. • The location of the vertex is $ \cdot \binom{c}{b}, d)$
Domain and Range	• A Absolute Value function involves squaring a number. Since every real number can be squared, there are no domain restrictions. Therefore, the domain will always be <i>all real numbers</i> , or $\{x \mid x \in \mathbb{R}\}$ • The range does have restrictions. The range is affected by parameters a and d. If a > 0, then d sets the y-coordinate of the vertex at a minimum value. The range becomes $y \ge d$ or $\{f(x) \mid f(x) \ge d\}$ • If a < 0, then d sets the y-coordinate of the vertex at a maximum value. The range becomes $y \le d$ or $\{f(x) \mid f(x) \le d\}$
X- and Y- intercepts	• A Absolute Value function has as many as two x-intercepts, also called zeroes. The x-intercepts are located at: $\cdot \left(\frac{c+\frac{d}{a}}{b}\right)0)$ • If the is in the general form, y = a bx - c + d then we find the y-intercept by substituting x = 0: $\cdot \text{ the y-intercept becomes (o, a c +d)}$

Examples	• What transformations of the absolute value parent function, $f(x) = x $, will result in the graph of the absolute value function $g(x) = -\frac{1}{2} 2x+1 -3$?
Examples	• Step 1: Rewrite the equation of $g(x)$ in general form to determine the values of the parameters $a,b,c,$ and d . • $g(x)=a(bx-c)^2+d$ • $g(x)=\frac{1}{3}(x-1)^3-4$ • $g(x)=\frac{1}{3}(x-1)^2+(-4)$ • So, $a=\frac{1}{3^2},b=1,c=1,$ and $d=-4$
Examples	 Step 2: Use the values of the parameters to describe the transformations of the Absolute Value parent function f(x) that are necessary to produce g(x). a = ¹/₃₇ so a > 1, then the y-values are multiplied by a factor of ¹/₃ to vertically compress the graph b = 1, there is no affect to the graph c = 1, so c < 0, then the graph will translate 1 = 1 to the right d = -4, so d < 0, then the graph of the parabola will translate 4 units down

Examples	• Identify the key attributes of $f(x) = \frac{5}{4} x + 2 \left -1 \right $, including domain, range, vertex, x- and y-intercepts. Write the domain and range as intervals and in set builder notation. Determine whether the vertex is a maximum or a minimum value of the function.	
Examples	• Step 1: Determine the domain and range of $f(x) = \frac{5}{4} x+2 - 1$. The domain is always <i>all real numbers</i> • $(-\infty, \infty)$ • $\{x x \in \mathbb{R}\}$ • Since $a > 0$, the graph will open up. So the range will be numbers $f(x) > -1$ • $(-1, \infty)$ • $\{f(x) \mid f(x) \ge -1\}$	
]
Examples	• Step 2: Determine the vertex of the parabola. • The vertex is $\binom{c}{b}$, d) • $\binom{-2}{1}$, -1) = $(-2$, -2) • Since a > o, this value is a minimum	

Examples	$ \text{Step 3: Determine the x-intercepts.} $ $ \text{The x-intercepts are located at } \frac{c \pm \frac{d}{a}}{b}, \text{ o)} $ $ \text{$\cdot \left(\frac{-2 \pm \frac{1}{125}}{125}, \text{ o}\right)$} $ $ \text{$\cdot \left(\frac{-2 \pm \frac{4}{5}}{125}, \text{ o}\right)$} $ $ \text{$\cdot \left(-2 \pm \frac{4}{5}, \text{ o}\right)$} $ $ \text{$\cdot \left(-1.2, \text{ o}\right)$} $ $ \text{$\cdot \left(-1.2, \text{ o}\right)$} $	
Examples	• Step 4: Determine the y-intercepts • The y-intercept occurs where $x = 0$ • $f(x) = \frac{5}{4} x+2 - 1$ • $f(x) = \frac{5}{4} 0+2 - 1$ • $f(x) = \frac{5}{4} 2 - 1$ • $f(x) = \frac{10}{4} - 1$ • $f(x) = \frac{6}{4} = 1.5$ • $(0, 1.5)$	