**1-2: Transformations Sheet f(x) =**

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| |a| | Vertical Stretch:  Vertical Compression:  **4f(x):** | If a > 1, then vertical stretch by factor of **a**  If 0 < a < 1, then vertical compression by factor of **a**  y-coordinates stay the same, affects the x-coordinates  **Point notation:**  **(x, y) (x, ay) OR (x, f(x)) (x, af(x))** |
| -a | Reflection across x-axis  **-f(x):** | x-coordinates stay the same, affects y-coordinates  **(x, y) (x, -y) OR (x, f(x)) (x, -f(x))** |
| |b| | Horizontal Stretch:  Horizontal Compression:  **f(4x):** | If 0 < b < 1, then horizontal stretch by factor of **1/b**  If b > 1, then horizontal compression by factor of **1/b**  y-coordinates stay the same, affects the x-coordinates  **(x, y) OR (x, f(x))** |
| -b | Reflection across y-axis  **f(-x):** | y-coordinates stay the same, affects x-coordinates  **(x, y) (-x, y) OR (x, f(x)) (-x, f(-x))** |
| h | Horizontal Translation  **f(x-3):** | y-coordinates stay the same, affects x-coordinates  f(x + h):  -graph moves left  -subtract h from the x-coordinates  **(x, y) (x – h, y) OR (x, f(x)) (x – h, f(x + h))**  f(x – h):  -graph moves right  -add h to the x-coordinates  **(x, y) OR (x, f(x)) (x + h, f(x – h))** |
| k | Vertical Translation  **f(x)-3:** | x-coordinates stay the same, affects y-coordinates  f(x) + k:  -graph moves up  -add k to the y-coordinates  **(x, y) (x, y + k) OR (x, f(x)) (x, f(x) + k)**  f(x) – k:  -graphs moves down  -subtract k from the y-coordinates  **(x, y) (x, y – k) OR (x, f(x)) (x, f(x) – k)** |