

1.1
1.2

VERTICAL

HORIZONTAL

TRANSLATION

• EQUATION $y = f(x) \xrightarrow[\substack{\uparrow \text{if } k > 0 \\ \downarrow \text{if } k < 0}]{\text{translation } k \text{ units}} y = f(x) + k$

• MAPPING $(x, y) \longrightarrow (x, y + k)$

• NO INVARIANT POINT!

• Example $f(x) = x^2 + x - 6 \xrightarrow[4 \uparrow]{\text{translate}} \begin{cases} y = x^2 + x - 6 + 4 \\ y = x^2 + x - 2 \end{cases}$

• EQUATION $y = f(x) \xrightarrow[\substack{\rightarrow \text{if } h > 0 \\ \leftarrow \text{if } h < 0}]{\text{translation } h \text{ units}} y = f(x - h)$

• MAPPING $(x, y) \longrightarrow (x + h, y)$

• NO INVARIANT POINT!

• Example $f(x) = x^2 + x - 6 \xrightarrow[4 \leftarrow]{\text{translate}} y = (x + 4)^2 + (x + 4) - 6$

STRETCH

• EQUATION $y = f(x) \xrightarrow[\text{factor } a \leftarrow \Delta \oplus]{\text{vertical stretch}} y = af(x)$

• MAPPING $(x, y) \longrightarrow (x, ay)$

• INVARIANT POINTS: All the points on the x-axis

• Example $f(x) = x^2 + x - 6 \xrightarrow[\text{factor } 2]{\text{v. stretch}} y = 2(x^2 + x - 6)$

• EQUATION $y = f(x) \xrightarrow[\text{factor } \frac{1}{b} \leftarrow \oplus]{\text{horizontal stretch}} y = f(bx)$

• MAPPING $(x, y) \longrightarrow (\frac{1}{b}x, y)$

• INVARIANT POINTS: All the points on the y-axis.

• Example $f(x) = x^2 + x - 6 \xrightarrow[\text{factor } 3]{\text{h. stretch}} y = (\frac{1}{3}x)^2 + (\frac{1}{3}x) - 6$

REFLECTION

• EQUATION $y = f(x) \longrightarrow y = -f(x)$

• MAPPING $(x, y) \longrightarrow (x, -y)$

• INVARIANT POINTS: All the points on the x-axis

• Example $f(x) = x^2 + x - 6 \longrightarrow \begin{cases} y = -(x^2 + x - 6) \\ y = -x^2 - x + 6 \end{cases}$

⚠ vertical reflection = around the x-axis!

• EQUATION $y = f(x) \longrightarrow y = f(-x)$

• MAPPING $(x, y) \longrightarrow (-x, y)$

• INVARIANT POINTS: All the points on the y-axis

• Example $f(x) = x^2 + x - 6 \longrightarrow \begin{cases} y = (-x)^2 + (-x) - 6 \\ y = x^2 - x - 6 \end{cases}$

⚠ horizontal reflection = around the y-axis!