

Horizontal Translation (Shift)

$$y = f(x) \rightarrow f(x-h)$$

Horizontal Shift by  $h$  units

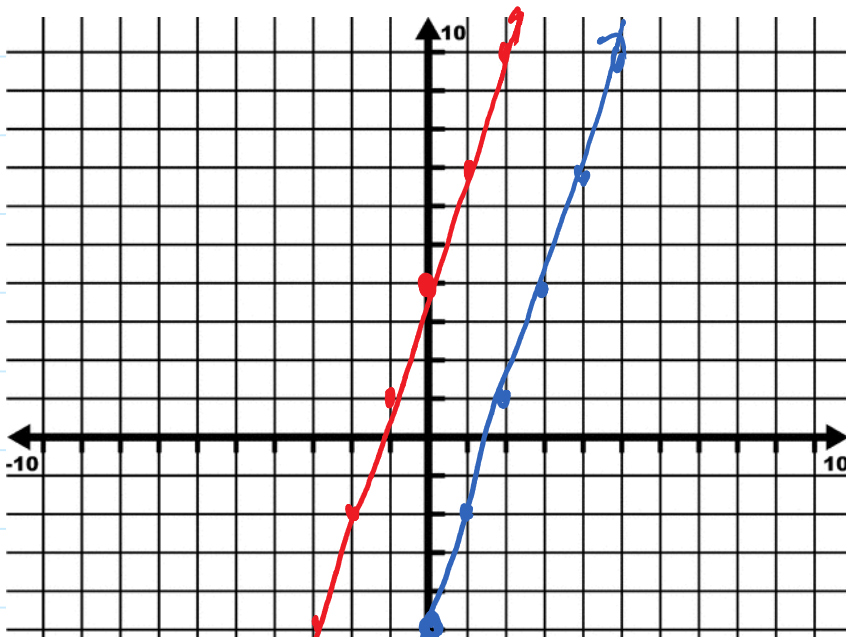
$+h \rightarrow$

$-h \leftarrow$

$f(x) = 3x - 5$       Translation 3 units  
 $h = -3$

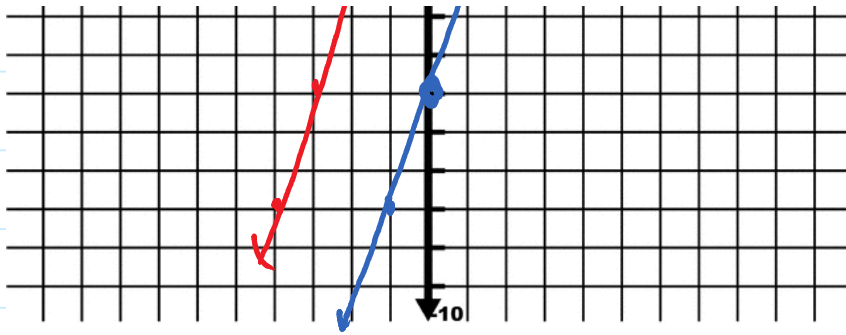
$$g(x) = f(x+3) = 3(x+3) - 5$$
$$= 3x + 9 - 5$$

$$g(x) = 3x + 4$$



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

$$g(x) = 3x + 4$$



$$f(x) = \frac{2}{3}x + 2$$

Translation 3 right  
 $h = +3$

$$g(x) = f(x-3) = \frac{2}{3}(x-3) + 2$$

$$= \frac{2}{3}x - 2 + 2$$

$$g(x) = \frac{2}{3}x$$

Vertical Translation

$$y = f(x) = f(x) + k$$

Vertical Translation (shift) of  $k$  units

$+k \uparrow$

$-k \downarrow$

$$f(x) = x \quad \text{Translate 3 units up}$$

$$k = +3$$

$$g(x) = f(x) + 3 = x + 3$$

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$$f(x) = 3x - 5 \quad \text{Translate Down 4}$$

$$k = -4$$

$$g(x) = f(x) - 4 = 3x - 5 - 4 = 3x - 9$$

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$$f(x) = 2x - 3$$

LEFT 2, followed by Down 3

$$h = -2$$

$$k = -3$$

$$1) \quad f(x) \rightarrow f(x+2) = 2(x+2) - 3$$

$$= 2x + 4 - 3 = 2x + 1$$

$$2) \quad g(x) = f(x) - 3 = 2x + 1 - 3 = 2x - 2$$