p 031, q14

Extend

14. Consider the function $f(x) = (x + 4)(x - 3)$. Without graphing, determine the zeros of the function after each transformation.

a) $y = 4f(x)$

b) $y = f(-x)$

c) $y = f\left(\frac{1}{2}x\right)$

d) $y = f(2x)$

The zeros of the parent base function are

$(x+4)=0 \Rightarrow x_1 = -4 \Rightarrow (-4,0)$

$(x-3)=0 \Rightarrow x_2 = 3 \Rightarrow (3,0)$

a) $y = 4f(x)$

a vertical stretch: $(x,y) \rightarrow (x,4y)$

has no effect on $y=0$.

$\therefore$ the zeros stay the same

$(-4,0) \rightarrow (-4, 4\times 0) = (-4,0)$

$(3,0) \rightarrow (3, 4\times 0) = (3,0)$

the new zeros stayed the same: $(-4,0)$ & $(3,0)$.

b) $y = f(-x) \Rightarrow (x,y) \rightarrow (-x,y)$

Horiz. Refl. into the y-axis & will change all x-coordinates that are $\neq 0$.

while our "zeros" aka roots are like

x-coordinates that are $\neq 0$.
which our "zeroes", a.k.a. roots are like

$$(-4,0) \to (-(-4),0) = (4,0)$$

$$(3,0) \to (-3,0)$$

The new zeros are: $(4,0)$ & $(-3,0)$

c) $y = f(\frac{1}{2}x)$

$\uparrow$

this is a Horiz. stretch by a factor of

$$\frac{1}{\frac{1}{2}} = 1 \times \frac{2}{1} = 2$$

$\therefore \quad (x,y) \to (2x, y)$

$$(-4,0) \to (-4 \times 2, 0) = (-8,0)$$
$$(3,0) \to (3 \times 2, 0) = (6,0)$$

The new zeros are $(-8,0)$ & $(6,0)$.

d) $y = f(2x)$

$\uparrow$

this is a Horiz. stretch by a factor of

$$\frac{1}{2}$$

$\therefore \quad (x, y) \rightarrow \left(\frac{1}{2}x, y\right)$

$(-4, 0) \rightarrow \left(-4 \times \frac{1}{2}, 0\right) = (-2, 0)$

$(3, 0) \rightarrow \left(3 \times \frac{1}{2}, 0\right) = (1.5, 0)$

The new zeros are $(-2, 0)$ & $(1.5, 0)$.