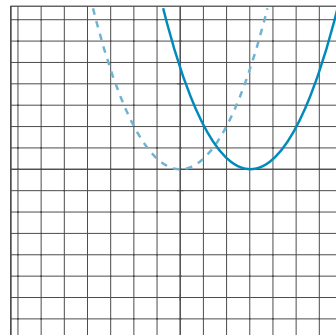
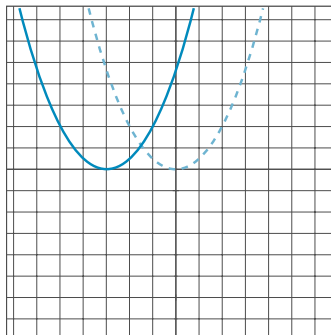
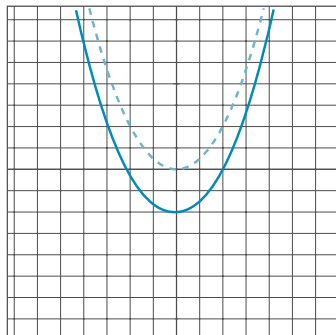
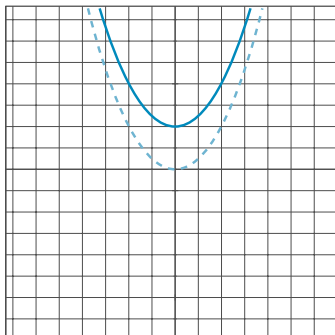


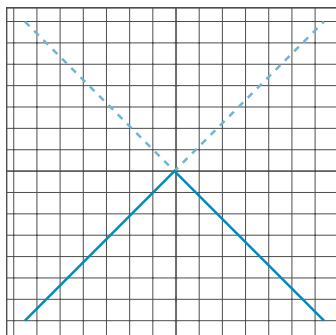
Transformations of Functions

note: $c > 0$

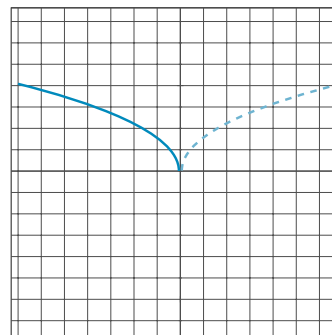


$f(x) + c$ shifts the graph of $f(x)$ up c units
 $f(x) - c$ shifts the graph of $f(x)$ down c units

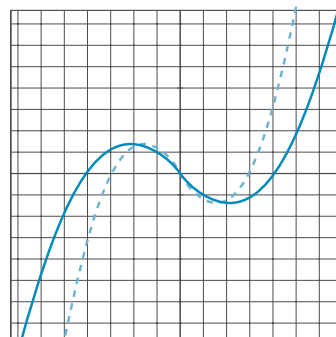
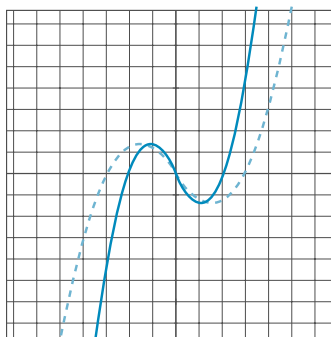
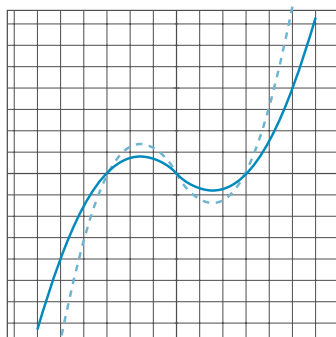
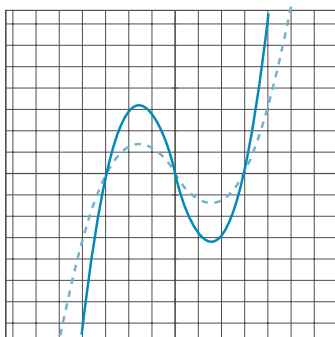
$f(x + c)$ shifts the graph of $f(x)$ left c units
 $f(x - c)$ shifts the graph of $f(x)$ right c units



$-f(x)$ reflects the graph of $f(x)$ about the x -axis



$f(-x)$ reflects the graph of $f(x)$ about the y -axis



$c \cdot f(x)$ $\begin{cases} \text{stretches } f(x) \text{ vertically by } c \text{ if } c > 1 \\ \text{squeezes } f(x) \text{ vertically by } c \text{ if } 0 < c < 1 \end{cases}$

$f(c \cdot x)$ $\begin{cases} \text{squeezes } f(x) \text{ horizontally by } c \text{ if } c > 1 \\ \text{stretches } f(x) \text{ horizontally by } c \text{ if } 0 < c < 1 \end{cases}$