

# Exponential Functions and their Graphs

## EXAMPLE 5 Transformations of Graphs of Exponential Functions

Each of the following graphs is a transformation of the graph of  $f(x) = 3^x$ .

- Because  $g(x) = 3^{x+1} = f(x+1)$ , the graph of  $g$  can be obtained by shifting the graph of  $f$  one unit to the *left*, as shown in Figure 3.3.
- Because  $h(x) = 3^x - 2 = f(x) - 2$ , the graph of  $h$  can be obtained by shifting the graph of  $f$  down two units, as shown in Figure 3.4.
- Because  $k(x) = -3^x = -f(x)$ , the graph of  $k$  can be obtained by *reflecting* the graph of  $f$  in the  $x$ -axis, as shown in Figure 3.5.
- Because  $j(x) = 3^{-x} = f(-x)$ , the graph of  $j$  can be obtained by *reflecting* the graph of  $f$  in the  $y$ -axis, as shown in Figure 3.6.



Figure 3.3 Horizontal shift

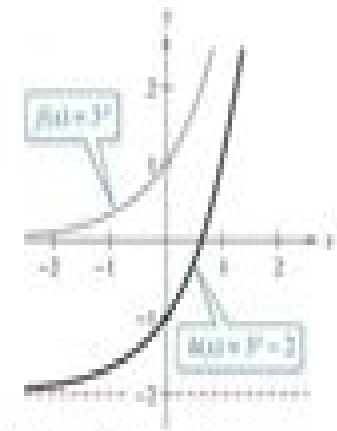


Figure 3.4 Vertical shift



Figure 3.5 Reflection in  $x$ -axis



Figure 3.6 Reflection in  $y$ -axis

# 4 1 Exponential Functions And Their Graphs

**Nels Johann Lennes**



## 4 1 Exponential Functions And Their Graphs:

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