

Practices on Shiftings, Compressions and Expansions, and Reflections.

1. Let  $f(x) = x^2$ .
  - a. Find the function  $g$  (write down the function) so that  $y = g(x)$  is a reflection of  $y = f(x)$  with respect to the  $x$ -axis;
  - b. Find the function  $h$  (write down the function) so that  $y = h(x)$  is a shifting of  $y = f(x)$  left 30 units and down 30 units.
  - c. Find the function  $k$  (write down the function) so that  $y = k(x)$  is a shifting of  $y = g(x)$  left 30 units and down 30 units.
  - d. If  $l(x) = -\frac{1}{2}x^2$ , sketch  $y = f(x)$  and  $y = l(x)$  together.
2. If  $f(x) = -(x-1)(x-3)$ 
  - a. Describe the relationship between  $y = f(x)$  and  $y = -f(x)$ . Sketch the graph of  $y = -f(x)$ .
  - b. Describe the relationship between  $y = f(x)$  and  $y = f(-x)$ . Sketch the graph of  $y = f(-x)$ .
  - c. Describe the relationship between  $y = f(x)$  and  $y = f(x+3)$ . Sketch the graph of  $y = f(x+3)$ .
  - d. Describe the relationship between  $y = f(x)$  and  $y = f(x)+3$ . Sketch the graph of  $y = f(x)+3$ .
3. If  $f(x) = -\sqrt{x-1}$ 
  - a. Describe the relationship between  $y = f(x)$  and  $y = -f(x)$ . Sketch the graph of  $y = -f(x)$ .
  - b. Describe the relationship between  $y = f(x)$  and  $y = f(-x)$ . Sketch the graph of  $y = f(-x)$ .
  - c. Describe the relationship between  $y = f(x)$  and  $y = f(x-3)$ . Sketch the graph of  $y = f(x-3)$ .
  - d. Describe the relationship between  $y = f(x)$  and  $y = f(x)-3$ . Sketch the graph of  $y = f(x)-3$ .
  - e. Describe the relationship between  $y = f(x)$  and  $y = 2f(x)$ . Sketch the graph of  $y = 2f(x)$ .