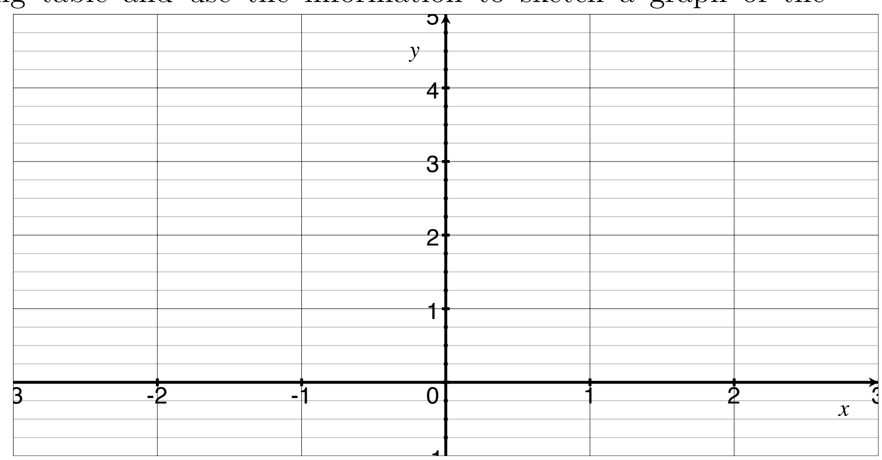
# Transforming Functions

Let $f(x) = x^2$ for the *entirety* of this worksheet.

1. (a) Find $f(2)$ and plot the point $(2, f(2))$ on the graph below.

   (b) Fill out the following table and use the information to sketch a graph of the function $f(x)$.

| $x$ | $f(x)$ |
|---|---|
| $\frac{-3}{2}$ | |
| -1 | |
| $\frac{-1}{2}$ | |
| 0 | |
| 2 | |
| $\frac{3}{2}$ | |




   This graph of a quadratic polynomial is called a *parabola*.

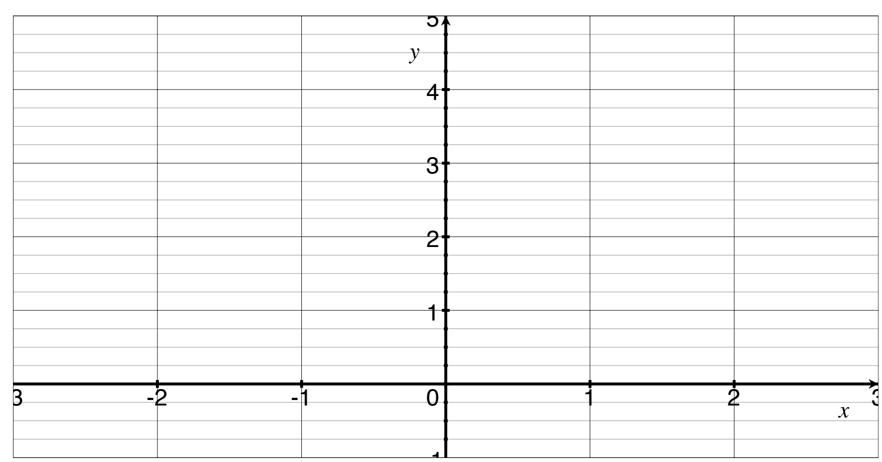
   (c) What is the domain of $f$ in interval notation? The range?

2. Define a new function $g$ to be $g(x) = f(x) + 1$. Since $f$ was defined above, we know $f(x) = x^2$, so we can write *the rule* of $g$ more explicitly as $g(x) = x^2 + 1$.

   (a) Find $g(2)$ and plot the point $(2, g(2))$ on the graph below.

   (b) Fill out the following table and use the information to sketch a graph of the function $g(x)$.

| $x$ | $f(x)$ |
|---|---|
| $\frac{-3}{2}$ | |
| -1 | |
| $\frac{-1}{2}$ | |
| 0 | |
| 2 | |
| $\frac{3}{2}$ | |




   (c) Finish the following sentence:
   The graph of $g$ looks like that of $f$ from # 1. but shifted...

3. Define a new function $k$ to be $k(x) = f(x) + 2$. Without plotting points like we did for Problems 1 and 2, can you say what the graph of $k$ will look like? Either explain what it will look like or draw it on the above graph.

4. Suppose $f$ is a function and $a > 0$. Define functions $g$ and $h$ by

$$g(x) = f(x) + a \quad \text{and} \quad h(x) = f(x) - a.$$

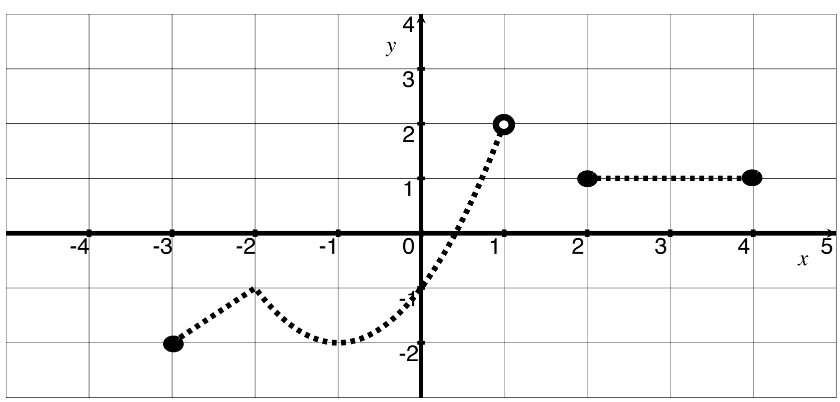
Complete the following sentences:

- The graph of $g$ is obtained by shifting the graph of $f$ ...

- The graph of $h$ is obtained by shifting the graph of $f$...

Verify your answer to Number 4 by looking at the box on page 65 of the textbook.

5. The graph of a piece-wise defined function labeled $g$ is below. To be explicit, all the pieces of the dotted graph below make up the graph of $g$. Note that although the graph of $g$ is disconnected, $g$ passes the vertical line test so it *is* a function.




(a) Find the domain of $g$.

(b) Find the range of $g$.

(c) For what value(s) of $x$ does $g(x) = -1$?

(d) Use your answer from Number 4 and draw the graphs of $m(x) = g(x) + 2$ and $n(x) = g(x) - 1$ on the set of axes.