1. Is the relationship $\{(3,2),(-1,3),(2,0),(4,2)\}$ a function? If yes, state its domain and range. If no, explain why not.

Ans: Yes. Domain $= \{3,-1,2,4\}$, Range $= \{2,3,0\}$

2. Is the relationship $\{(0,2),(2,0),(1,5)\}$ a function? If yes, state its domain and range. If no, explain why not.

Ans: Yes. Domain $= \{0,2,1\}$, Range $= \{2,0,5\}$

3. Is the relationship $\{(-1,5),(3,5),(10,5),(13,5),(17,5)\}$ a function? If yes, state its domain and range. If no, explain why not.

Ans: Yes. Domain $= \{-1,3,10,13,17\}$, Range $= \{5\}$

4. Is the relationship $\{(1,3),(2,6),(1,7),(-7,0)\}$ a function? If yes, state its domain and range. If no, explain why not.

Ans: No. Since the input 1 produced more than one output, namely 3 and 7.

5. For the given function f and g, evaluate $f(1)$, $f(x+1)$, $f(g(x))$, and $g(f(x))$:

a. $f(x) = 2x+3, \quad g(x) = x^2$

Ans: $f(1) = 5$, $f(x+1) = 2x+5$, $f(g(x)) = 2x^2+3$, $g(f(x)) = (2x+3)^2$

b. $f(x) = \dfrac{2}{x}, \quad g(x) = x-1$

Ans: $f(1) = 2$, $f(x+1) = \dfrac{2}{x+1}$, $f(g(x)) = \dfrac{2}{x-1}$, $g(f(x)) = \dfrac{2}{x} - 1$

c. $f(x) = x^3 - 2, \quad g(x) = \sqrt[3]{x+2}$

Ans: $f(1) = -1$, $f(x+1) = (x+1)^3 - 2$, $f(g(x)) = x$, $g(f(x)) = x$

6. Is the function $f(x) = x^4$ a one-to-one function? Explain.

Ans: No. $f(-1) = 1 = f(1)$

7. What is the domain and range of the function $f(x) = 4x - 3$?

Ans: Domain of f = All Real Numbers.

8. What is the domain and range of the function $f(x) = \sqrt{x+1}$?

Ans: Domain of $f = [-1, \infty)$

9. If f is the function defined by:

$$
\begin{array}{ccc}
 & f: & \\
5 & \rightarrow & 5 \\
2 & \rightarrow & -3 \\
-1 & \rightarrow & 10 \\
4 & \rightarrow & 6 \\
0 & \rightarrow & 8
\end{array}
$$

Find the/an inverse of f. Does the inverse of f that you defined completely recovers all the values in the domain of f? Can you define more than one inverse of f?

Ans:

$$
\begin{array}{ccc}
 & f^{-1}: & \\
5 & \rightarrow & 5 \\
-3 & \rightarrow & 2 \\
10 & \rightarrow & -1 \\
6 & \rightarrow & 4 \\
8 & \rightarrow & 0
\end{array}
$$

f^{-1} is unique. It completely recovers all values in the domain of f.

10. If f is the function defined by:

$$
\begin{array}{ccc}
 & f: & \\
1 & \rightarrow & 1 \\
-2 & \rightarrow & 12 \\
3 & \rightarrow & 1 \\
11 & \rightarrow & -5 \\
6 & \rightarrow & 0 \\
7 & \rightarrow & 1 \\
8 & \rightarrow & -2
\end{array}
$$

Find the/an inverse of f. Does the inverse of f that you defined completely recovers all the values in the domain of f? Can you define more than one inverse of f?

f^{-1} is **not** unique. One possible choice:

$$
\begin{array}{ccc}
 & f^{-1}: & \\
1 & \rightarrow & 1 \\
12 & \rightarrow & -2 \\
-5 & \rightarrow & 11 \\
0 & \rightarrow & 6 \\
-2 & \rightarrow & 8
\end{array}
$$

The above f^{-1} cannot recover the numbers 3 and 7 in the domain of f. It is possible to define another f^{-1}.

11. Find the inverse of the given function:

a. $f(x) = \sqrt{x-1}$

Ans: $f^{-1}(x) = x^2 + 1,\ x \geq 0$

b. $f(x) = 3x - 1$

Ans: $f^{-1}(x) = \dfrac{x+1}{3}$

c. $f(x) = x^3 + 2$

Ans: $f^{-1}(x) = \sqrt[3]{x-2}$

d. $f(x) = \frac{x-1}{x+2}$

Ans: $f^{-1}(x) = \dfrac{1+2x}{1-x}$

e. $f(x) = e^{3x} - 4$

Ans: $f^{-1}(x) = \dfrac{\ln(x+4)}{3}$

f. $f(x) = \ln(5x+1) - 2$

Ans: $f^{-1}(x) = \dfrac{e^{y+2} - 1}{5}$