**Functions Workbook**

**Section 1: Understanding Functions**

**1. What is a function?**
a) A relationship where each input has multiple outputs
b) A relationship where each input has exactly one output
c) A process that does not relate inputs to outputs
d) A method of solving equations

**2. Define the domain and range of a function.**

**3. Explain the term "mapping" in the context of functions.**

**Section 2: Function Examples**

**4. Consider the function f(x)=2x+5f(x) = 2x + 5f(x)=2x+5.**
a) Find the output when the input xxx is 3.
b) What is the domain of this function?

**5. A function is defined as g(x)=x2−4g(x) = x^2 - 4g(x)=x2−4.**
a) Calculate g(2)g(2)g(2).
b) Calculate g(−3)g(-3)g(−3).

**6. For the temperature conversion function T(F)=59(F−32)T(F) = \frac{5}{9}(F - 32)T(F)=95​(F−32),**
a) Convert 68°F to Celsius.
b) What is the output when the input is 32°F?

**Section 3: Graphing Functions**

**7. Sketch the graph of the function h(x)=x−2h(x) = x - 2h(x)=x−2.**

**8. Sketch the graph of the function k(x)=x2k(x) = x^2k(x)=x2.**
a) Indicate the x and y-intercepts.
b) Describe the shape of the graph.

**Section 4: Composite Functions**

**9. If f(x)=3xf(x) = 3xf(x)=3x and g(x)=x+1g(x) = x + 1g(x)=x+1, find (f∘g)(x)(f \circ g)(x)(f∘g)(x).**

**10. For the functions p(x)=x−4p(x) = x - 4p(x)=x−4 and q(x)=2x+1q(x) = 2x + 1q(x)=2x+1, find (p∘q)(x)(p \circ q)(x)(p∘q)(x).**

**Answers**

**1. b) A relationship where each input has exactly one output**

**2.**

* **Domain:** The set of all possible inputs for the function.
* **Range:** The set of all possible outputs of the function.

**3.**

* **Mapping:** The process of pairing each input with its corresponding output in a function.

**4.**
a) For f(x)=2x+5f(x) = 2x + 5f(x)=2x+5, if x=3x = 3x=3:
f(3)=2(3)+5=6+5=11f(3) = 2(3) + 5 = 6 + 5 = 11f(3)=2(3)+5=6+5=11
b) The domain of f(x)=2x+5f(x) = 2x + 5f(x)=2x+5 is all real numbers (R\mathbb{R}R) because you can input any real number.

**5.**
a) For g(x)=x2−4g(x) = x^2 - 4g(x)=x2−4, if x=2x = 2x=2:
g(2)=22−4=4−4=0g(2) = 2^2 - 4 = 4 - 4 = 0g(2)=22−4=4−4=0
b) For x=−3x = -3x=−3:
g(−3)=(−3)2−4=9−4=5g(-3) = (-3)^2 - 4 = 9 - 4 = 5g(−3)=(−3)2−4=9−4=5

**6.**
a) For T(F)=59(F−32)T(F) = \frac{5}{9}(F - 32)T(F)=95​(F−32), if F=68F = 68F=68:
T(68)=59(68−32)=59×36=20°CT(68) = \frac{5}{9}(68 - 32) = \frac{5}{9} \times 36 = 20 \text{°C}T(68)=95​(68−32)=95​×36=20°C
b) For F=32F = 32F=32:
T(32)=59(32−32)=59×0=0°CT(32) = \frac{5}{9}(32 - 32) = \frac{5}{9} \times 0 = 0 \text{°C}T(32)=95​(32−32)=95​×0=0°C

**7.**
Graph of h(x)=x−2h(x) = x - 2h(x)=x−2: A straight line with a slope of 1 and a y-intercept at -2.

**8.**
Graph of k(x)=x2k(x) = x^2k(x)=x2: A parabola that opens upwards with the vertex at (0, 0).
a) The x-intercept is at (0, 0) and the y-intercept is also at (0, 0).
b) The graph is a U-shaped curve.

**9.**
For f(x)=3xf(x) = 3xf(x)=3x and g(x)=x+1g(x) = x + 1g(x)=x+1:
(f∘g)(x)=f(g(x))=f(x+1)=3(x+1)=3x+3(f \circ g)(x) = f(g(x)) = f(x + 1) = 3(x + 1) = 3x + 3(f∘g)(x)=f(g(x))=f(x+1)=3(x+1)=3x+3

**10.**
For p(x)=x−4p(x) = x - 4p(x)=x−4 and q(x)=2x+1q(x) = 2x + 1q(x)=2x+1:
(p∘q)(x)=p(q(x))=p(2x+1)=(2x+1)−4=2x−3(p \circ q)(x) = p(q(x)) = p(2x + 1) = (2x + 1) - 4 = 2x - 3(p∘q)(x)=p(q(x))=p(2x+1)=(2x+1)−4=2x−3