# Composition of Functions

1. If $f(x) = 3x + 1$ and $g(x) = 2x + 5$ find $f(g(x))$ and $g(f(x))$.
   Hence find i) $f(g(2))$ ii) $g(f(-3))$ iii) $f(g(-1))$ iv) $g(f(5))$

2. If $f(x) = 1 - 3x$ and $g(x) = 4x$ find formulas for $f(g(x)$ and $g(f)x))$.
   Use these formulas to find i) $f(g(2))$ ii) $g(f(-1))$ iii) $f(g((1/2))$

3. If $f(x) = 6x + 1$ , $g(x) = 2x$ and $h(x) = 1 - x$ find formulas for
   a) $f(g(x))$ b) $g(h(x))$ c) $h(f(x))$

4. If $f(x) = x^2$ , $g(x) = 1 + x$ and $h(x) = 2x$ find formulas for
   a) $f(g(x))$ b) $h(g(x))$ c) $h(f(x))$

5. For each of the following, find $f(g(x))$ and $g(f(x))$
   a) $f(x) = 8x + 3$ , $g(x) = 1 - 2x$
   b) $f(x) = x^3$ , $g(x) = 5x + 4$
   c) $f(x) = x - 8$ , $g(x) = 3x + 2$
   d) $f(x) = x^2 + 1$ , $g(x) = 2x + 3$

# Solutions.

1. $f(g(x)) = 6x + 6$ $g(f(x)) = 6x + 7$ i)28 ii) - 11 iii) 10 iv) 37
2. $f(g(x)) = 1 - 12x$ $g(f(x)) = 4 - 12x$ i) - 23 ii) 16 iii) - 5
3. a) $f(g(x)) = 12x + 1$ b) $g(h(x)) = 2 - 2x$ c) $h(f(x)) = - 6x$
4. a) $f(g(x)) = (1 + x^2)$ b) $h(g(x)) = 2 + 2x$ c) $h(f(x)) = 2x^2$

5.

| | a) | b) | c) | d) |
|---|---|---|---|---|
| $f(g(x))$ | $11 - 6x$ | $(5x + 4)^3$ | $3x - 6$ | $4x^2 + 12x + 10$ |
| $g(f(x))$ | $- 5 - 16x$ | $5x^3 + 4$ | $3x - 22$ | $2x^2 + 5$ |