Outcome 1 – Type 1 'f(g(x))'

Bronze examples

Examples...

Two functions are defined as $f(x) = x^2 + 3$ and $g(x) = 5x - 4$.

Calculate...

(a) $f(g(2)) = f(6) = 36 + 3 = 39$ where $g(2) = 10 - 4 = 6$

(b) $g(f(-1)) = g(4) = 20 - 4 = 16$ where $f(-1) = 1 + 3 = 4$

Bronze questions

Two functions are defined as $f(x) = x^2 - 8$ and $g(x) = 6x + 1$. Calculate...

1. $f(g(4))$
2. $g(f(-1))$

Two functions are defined as $h(x) = 5x^2 + 8$ and $k(x) = 4x + 1$. Calculate...

3. $h(k(-2))$
4. $k(h(1))$

Two functions are defined as $f(a) = a^2 + 2$ and $g(a) = 4a - 1$. Calculate...

5. $f(g(\frac{1}{2}))$
6. $g(f(\frac{1}{8}))$

Outcome 2 – Type 2 'f(g(number))'

Silver examples

Examples...

Two functions are defined as $f(x) = x^2 + 4$ and $g(x) = 5x + 1$.

Calculate...

1. Square 1st term
2. Times and double
3. Square last term

(a) $f(g(x)) = (5x + 1)^2 + 4$

$= 25x^2 + 10x + 1 + 4$

$= 25x^2 + 10x + 5$

(b) $g(f(x)) = 5(x^2 + 4) + 1$

$= 5x^2 + 20 + 1 = 5x^2 + 21$

Silver questions

Two functions are defined as $f(x) = x^2 - 7$ and $g(x) = 2x - 3$. Calculate...

1. $f(g(x))$
2. $g(f(x))$

Two functions are defined as $h(x) = x^2 + 1$ and $k(x) = 8x - 5$. Calculate...

3. $h(k(x))$
4. $k(h(x))$

Two functions are defined as $f(a) = a^2 + 3a$ and $g(a) = 9a - 1$. Calculate...

5. $g(g(a))$
6. $f(g(a))$

Outcome 3 – Working backwards (finding 'x')

Gold example

Example...

Two functions are defined as $f(g(x)) = x^2 + 2$ and $g(f(x)) = 8 - x$.

For what value(s) of x does $f(g(x)) = g(f(x))$?

1. Set them equal
2. Set equal to 0
3. Factorise

$x^2 + 2 = 8 - x$

$+x \quad -8 \quad -8 \quad +x$

$x^2 + x - 6 = 0$

$(x - 2)(x + 3) = 0$

$x = 2 \quad x = -3$

Gold questions

1. Two functions are defined as $f(g(x)) = 4x - 5$ and $g(f(x)) = x + 19$.

   For what value(s) of x does $f(g(x)) = g(f(x))$?

2. Two functions are defined as $h(k(x)) = x^2 + 10$ and $k(h(x)) = 7x + 40$.

   For what value(s) of x does $h(k(x)) = k(h(x))$?

3. Two functions are defined as $f(g(a)) = 2a^2 + 9a$ and $g(f(a)) = 1 + 5a - 3a^2$.

   For what value(s) of x does $f(g(a)) = g(f(a))$?

Bronze Answers

1. 617
2. -41
3. 253
4. 53
5. 3
6. 113/16

Silver Answers

1. $4x^2 - 12x + 2$
2. $2x^2 - 17$
3. $64x^2 - 80x + 26$
4. $8x^2 + 3$
5. $81a - 10$
6. $81a^2 + 9a - 2$

Gold Answers

1. $x = 8$
2. $x = 10, x = -3$
3. $a = 1/5, a = -1$