

**3.1 Composite Functions ( Numerical Questions )**

We have got used to the idea of substituting a number into a function, and the function 'doing stuff' to the number. Typically, a different number then comes out.

We're now going to take that output number and feed it back around to the input again. Alternatively we could use it as the input to another, completely different, function.

**3.2 A numerical example**

Let  $p$  and  $q$  be the functions;

$$p(x) = 8x - 20 \quad x \in \mathbb{R}$$

$$q(x) = 3x - 7 \quad x \in \mathbb{R}$$

Watch the teaching Video : [http://www.NumberWonder.co.uk/Video/v9002\(3\).mp4](http://www.NumberWonder.co.uk/Video/v9002(3).mp4)



Evaluate each of the following;

( i )  $p(6)$

( ii )  $q(6)$

[ 1, 1 marks ]

( iii )  $p q(3)$

[ 2 marks ]

( iv )  $q p(3)$

[ 2 marks ]

### 3.3 Exercise

Marks Available : 54

#### Question 1

Let  $f$  and  $g$  be the functions;

$$f(x) = 5x - 12 \quad x \in \mathbb{R}$$

$$g(x) = 4x + 3 \quad x \in \mathbb{R}$$

Evaluate each of the following;

(i)  $f(3)$                       (ii)  $g(6)$                       (iii)  $f(10)$

(iv)  $g(16)$                       (v)  $ff(4)$                       (vi)  $gg(5)$

(vii)  $fg(1)$                       (viii)  $fg(0)$                       (ix)  $gf(0)$

[ 9 marks ]

**Question 2**

Let  $m$  and  $n$  be the functions;

$$m(x) = x^2 - 75 \quad x \in \mathbb{R}$$

$$n(x) = \frac{4x}{5} \quad x \in \mathbb{R}$$

Evaluate each of the following;

(i)  $m(1)$

(ii)  $n(15)$

(iii)  $m(-1)$

(iv)  $n(-15)$

(v)  $m(m(9))$

(vi)  $n(n(50))$

(vii)  $m(n(0))$

(viii)  $m(n(10))$

(ix)  $m(n(m(10)))$

[ 9 marks ]

**Question 3**

Let  $s$  and  $t$  be the functions;

$$s(x) = 6x + 1 \quad x \in \mathbb{R}$$

$$t(x) = (x + 1)^2 \quad x \in \mathbb{R}$$

Evaluate each of the following;

(i)  $s(8)$                       (ii)  $t(6)$                       (iii)  $s(9)$

(iv)  $t(-4)$                       (v)  $s s(1)$                       (vi)  $t t(2)$

(vii)  $s t(9)$                       (viii)  $s t(2)$                       (ix)  $t s(-1)$

[ 9 marks ]

**Question 4**

Let two functions,  $m$  and  $n$ , be;

$$m(x) = 10x - 8 \quad x \in \mathbb{R}$$

$$n(x) = 100 - x^2 \quad x \in \mathbb{R}$$

Find each of the following;

(i)  $m(3)$

(ii)  $n(7)$

(iii)  $n(-6)$

(iv)  $m \circ n(8)$

(v)  $m \circ m(4)$

(vi)  $n \circ m(2)$

[ 9 marks ]

**Question 5**

Let two functions,  $s$  and  $t$ , be;

$$s(x) = x^2 + x \quad x \in \mathbb{R}$$

$$t(x) = 3x - 2 \quad x \in \mathbb{R}$$

Find each of the following;

(i)  $s(5)$                       (ii)  $s \circ s(1)$                       (iii)  $t \circ t \circ t(1)$

(iv)  $t \circ s(10)$                       (v)  $s \circ t(3)$                       (vi)  $t \circ s(-1)$

[ 9 marks ]

**Question 6**

If  $f(x) = \sqrt{2x + 11}$ ,  $x \in \mathbb{R}$ ,  $x \geq -\frac{11}{2}$

and  $g(x) = 5x$ ,  $x \in \mathbb{R}$

what is;

(i)  $f(7)$                       (ii)  $gf(19)$                       (iii)  $fg(11)$

(iv)  $fg(-0.2)$                       (v)  $gf\left(-\frac{11}{2}\right)$                       (vi)  $fg(x)$

**[ 9 marks ]**

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Teachers may obtain detailed worked solutions to the exercises by email from [mhh@shrewsbury.org.uk](mailto:mhh@shrewsbury.org.uk)