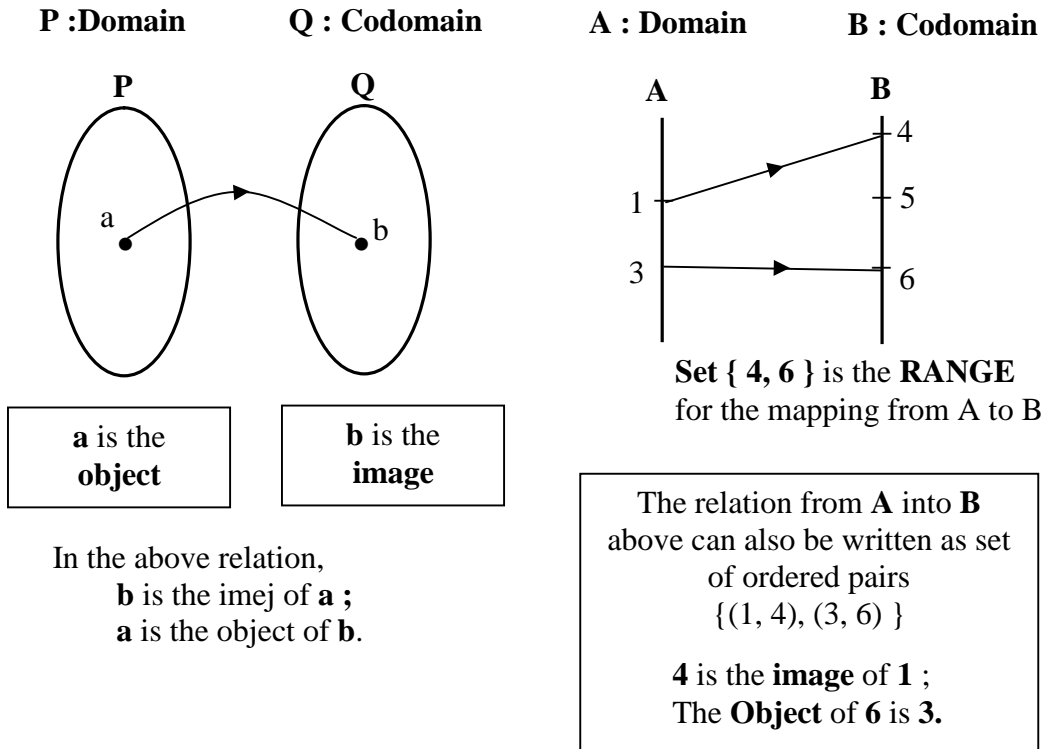


# 1 FUNCTIONS

## 1.0 RELATIONS

Notes :

- (i) Four types of relations : one-to-one, many-to-one, one-to-many and many-to-many.
- (ii) Three ways to represent relations : arrowed diagram, set of ordered pairs and graph.
- (iii) The arrow diagram representation is of the form below :



- (iv) Set of ordered pairs of a relation takes the form of  $\{ (a, b), (c, d), \dots \}$

<b>EXAMPLE</b>	<b>QUESTION</b>																								
<p>1.</p> <div style="border: 1px solid black; padding: 5px; margin: 10px auto; width: fit-content;"> <math>P = \{ 1, 2, 3 \}</math>  <math>Q = \{ 2, 4, 6, 7, 10 \}</math> </div> <p>A relation from P into Q is defined by the set of ordered pairs  <math>\{ (1, 4), (1, 6), (2, 6), (3, 7) \}</math>.</p> <p>State</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 60%;">(a) the image of 1,</td> <td>Ans: 4 and 6</td> </tr> <tr> <td>(b) the object of 4,</td> <td>Ans: 1</td> </tr> <tr> <td>(c) the domain,</td> <td>Ans: <math>\{ 1, 2, 3 \}</math></td> </tr> <tr> <td>(d) the codomain,</td> <td>Ans: <math>\{ 2, 4, 6, 7, 10 \}</math></td> </tr> <tr> <td>(e) the range,</td> <td>Ans: <math>\{ 4, 6, 7 \}</math></td> </tr> <tr> <td>(f) the type of relation</td> <td>Ans: many-to-many</td> </tr> </table>	(a) the image of 1,	Ans: 4 and 6	(b) the object of 4,	Ans: 1	(c) the domain,	Ans: $\{ 1, 2, 3 \}$	(d) the codomain,	Ans: $\{ 2, 4, 6, 7, 10 \}$	(e) the range,	Ans: $\{ 4, 6, 7 \}$	(f) the type of relation	Ans: many-to-many	<p>1.</p> <div style="border: 1px solid black; padding: 5px; margin: 10px auto; width: fit-content;"> <math>P = \{ 2, 4, 6 \}</math>  <math>Q = \{ 2, 3, 6, 7, 10 \}</math> </div> <p>A relation from P into Q is defined by the set of ordered pairs  <math>\{ (2, 2), (4, 2), (6, 7) \}</math>.</p> <p>State</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 60%;">(a) the image of 4,</td> <td>Ans:</td> </tr> <tr> <td>(b) the objects of 2,</td> <td>Ans:</td> </tr> <tr> <td>(c) the domain,</td> <td>Ans:</td> </tr> <tr> <td>(d) the codomain,</td> <td>Ans:</td> </tr> <tr> <td>(e) the range,</td> <td>Ans:</td> </tr> <tr> <td>(f) the type of relation</td> <td>Ans:</td> </tr> </table>	(a) the image of 4,	Ans:	(b) the objects of 2,	Ans:	(c) the domain,	Ans:	(d) the codomain,	Ans:	(e) the range,	Ans:	(f) the type of relation	Ans:
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(c) the domain,	Ans: $\{ 1, 2, 3 \}$																								
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(d) the codomain,	Ans:																								
(e) the range,	Ans:																								
(f) the type of relation	Ans:																								

## 1.1 FUNCTION NOTATIONS

Notes:

- (i) A function is usually represented using letters in its lower case :  $f, g, h \dots$
- (ii) Given the function  $f : x \rightarrow 2x+1$ , we usually write it in the form  $f(x) = 2x + 1$  before answering any question.

## 1.2 FINDING THE VALUE OF FUNCTIONS [Mastery Exercise]

- $f(a)$  represent (a) the value of  $f(x)$  when  $x = a$  .
- (b) the image of  $f$  when the object is  $a$

EXAMPLE	QUESTION
<p>1. Given the function <math>f : x \rightarrow 2x+1</math>,</p> <p>find (i) <math>f(3)</math> (ii) <math>f(-4)</math></p> <p>Answer : <math>f(x) = 2x + 1</math></p> <p>(i) <math>f(3) = 2(3) + 1</math>  <math>= 6 + 1</math>  <math>= 7</math></p> <p>(ii) <math>f(-2) = 2(-2) + 1</math>  <math>= -4 + 1</math>  <math>= -3</math></p>	<p>1. Given the function <math>f : x \rightarrow 2x+3</math>,</p> <p>find (i) <math>f(2)</math> (ii) <math>f(-1)</math></p> <p>Answer : <math>f(x) = 2x + 3</math></p> <p>(i) <math>f(2) = 2(\quad) + 3</math>  <math>=</math>  <math>=</math></p> <p>(ii) <math>f(-1) = 2(\quad) + 3</math>  <math>=</math>  <math>=</math></p>
<p>2. Given the function <math>g : x \rightarrow x^2 - 3</math>, find</p> <p>(i) <math>g(0)</math> (ii) <math>g(4)</math></p> <p>Answer : <math>g(x) = x^2 - 3</math></p> <p>(i) <math>g(0) = 0^2 - 3</math>  <math>= 0 - 3</math>  <math>= -3</math></p> <p>(ii) <math>g(4) = 4^2 - 3</math>  <math>= 16 - 3</math>  <math>= 13</math></p>	<p>2. Given the function <math>g : x \rightarrow x^2 - 5</math>, find</p> <p>(i) <math>g(0)</math> (ii) <math>g(2)</math></p> <p>Answer : <math>g(x) = x^2 - 5</math></p> <p>(i) <math>g(0) =</math>  <math>=</math>  <math>=</math></p> <p>(ii) <math>g(2) =</math>  <math>=</math>  <math>=</math></p>
<p>3. Given the function <math>h : x \rightarrow \frac{6}{3x-4}, x \neq \frac{4}{3}</math>,</p> <p>find <math>h(2)</math>.</p> <p>Jawapan : <math>h(x) = \frac{6}{3x-4}</math></p> <p><math>h(2) = \frac{6}{3(2)-4}</math>  <math>= \frac{6}{2}</math>  <math>= 3</math></p>	<p>3. Given the function <math>h : x \rightarrow \frac{9}{2x-3}, x \neq \frac{3}{2}</math>,</p> <p>find <math>h(3)</math>.</p> <p>Jawapan: <math>h(x) =</math></p> <p><math>h(3) =</math></p>

## 1.2 FINDING THE VALUE OF FUNCTIONS [Reinforcement Exercises]

QUESTION	ANSWER
<p>1. Given the function <math>f : x \rightarrow 3x + 1</math>, find</p> <p>(a) <math>f(0)</math></p> <p>(b) <math>f(3)</math></p> <p>(c) <math>f(-2)</math></p> <p>(d) <math>f(4)</math></p> <p>(e) <math>f(-3)</math></p>	<p>1. <math>f(x) = 3x + 1</math></p> <p>(a) <math>f(0) = 3(0) + 1</math> =</p>
<p>2. Given the function <math>g : x \rightarrow x^2 - 3x</math>, find</p> <p>(a) <math>g(0)</math></p> <p>(b) <math>g(2)</math></p> <p>(c) <math>g(4)</math></p> <p>(d) <math>g(-3)</math></p> <p>(e) <math>g(-1)</math></p>	<p>2. <math>g(x) = x^2 - 3x</math></p> <p>(a) <math>g(0) =</math></p>
<p>3. Given the function <math>h : x \rightarrow \frac{6}{3-4x}</math>, find</p> <p>(a) <math>h(0)</math></p> <p>(b) <math>h(1)</math></p> <p>(c) <math>h\left(\frac{1}{2}\right)</math></p> <p>(d) <math>h(-3)</math></p> <p>(e) <math>h\left(\frac{1}{4}\right)</math></p>	

### 1.3 PROBLEM OF FUNCTIONS INVOLVING SIMPLE EQUATIONS. [1]

Note : Questions on functions usually involve solving linear / quadratic equations.

EXAMPLE	QUESTION
<p>1. Given that <math>f : x \rightarrow 2x-1</math>, find the value of <math>x</math> if <math>f(x) = 5</math>.</p> <p>Answer : <math>f(x) = 2x - 1</math> <math>2x - 1 = 5</math> <math>2x = 6</math> <math>\therefore x = 3</math></p>	<p>1. Given that <math>f : x \rightarrow 4x-3</math>, find the value of <math>x</math> if <math>f(x) = 17</math>.</p> <p>Answer : <math>f(x) = 4x - 3</math> <math>4x - 3 = 17</math> <math>4x =</math> <math>\therefore x =</math></p>
<p>2. Given that <math>f : x \rightarrow 5x + 3</math>, find the value of <math>x</math> if <math>f(x) = -7</math>.</p> <p>Answer : <math>f(x) = 5x + 3</math> <math>5x + 3 = -7</math> <math>5x = -10</math> <math>\therefore x = -2</math></p>	<p>2. Given that <math>f : x \rightarrow 3x + 7</math>, find the value of <math>x</math> if <math>f(x) = 4</math>.</p> <p>Answer :</p>
<p>3. Given that <math>g : x \rightarrow x + 2</math>, find the value of <math>y</math> if <math>g(y) = 2y - 3</math></p> <p><u>Answer</u> : <math>g(x) = x + 2</math> <math>g(y) = y + 2</math> <math>y + 2 = 2y - 3</math> <math>3 + 2 = 2y - y</math> <math>y = 5</math></p>	<p>3. Given that <math>g : x \rightarrow 3x - 2</math>, find the value of <math>y</math> if <math>g(y) = 2y + 4</math>.</p> <p><u>Answer</u> :</p>
<p>4. Given that <math>f : x \rightarrow 7x - 3</math>, <math>g : x \rightarrow 4x + 15</math>, find the value of <math>p</math> if <math>f(p) = g(p)</math>.</p> <p>Answer : <math>f(x) = 7x - 3</math>, <math>g(x) = 4x + 15</math> <math>f(p) = 7p - 3</math>, <math>g(p) = 4p + 15</math> <math>f(p) = g(p)</math> <math>7p - 3 = 4p + 15</math> <math>3p = 18</math> <math>p = 6</math></p>	<p>4. Given that <math>f : x \rightarrow 2x - 10</math>, <math>g : x \rightarrow 4x + 2</math>, find the value of <math>x</math> if <math>f(x) = g(x)</math>.</p>

**PROBLEMS OF FUNCTIONS INVOLVING SIMPLE EQUATIONS. [2]**

EXAMPLE	QUESTION
<p>5. Given that <math>f : x \rightarrow 2x - 10</math>, <math>g : x \rightarrow x - 7</math>, find the value of <math>x</math> if <math>f(x) = -2g(x)</math></p> <p>A: <math>f(x) = 2x - 10</math>, <math>g(x) = x - 7</math></p> $2x - 10 = -2(x - 7)$ $2x - 10 = -2x + 14$ $4x = 24$ $x = 6$	<p>5. Given <math>f : x \rightarrow 3x - 9</math>, <math>g : x \rightarrow x - 7</math>, find the value of <math>x</math> if <math>f(x) = -3g(x)</math>.</p>
<p>6. Given that <math>f : x \rightarrow 3x + 4</math>, find the values of <math>x</math> if <math>f(x) = x^2</math>.</p> <p>A: <math>f(x) = 3x + 4</math></p> $x^2 = 3x + 4$ $x^2 - 3x - 4 = 0$ $(x + 1)(x - 4) = 0$ $x = -1 \text{ or } x = 4$	<p>6. Given that <math>f : x \rightarrow 2x + 8</math>, find the values of <math>x</math> if <math>f(x) = x^2</math>.</p>
<p>7. Given that <math>g : x \rightarrow 3x^2 - 6</math>, find the values of <math>y</math> if <math>g(y) = 6</math>.</p> <p>A: <math>g(x) = 3x^2 - 6</math></p> $g(y) = 3y^2 - 6$ $3y^2 - 6 = 6$ $3y^2 - 12 = 0$ <p>(<math>\div 3</math>): <math>y^2 - 4 = 0</math></p> $(y + 2)(y - 2) = 0$ $y = -2 \text{ or } y = 2$	<p>7. Given that <math>g : x \rightarrow 2x^2 - 5</math>, find the values of <math>y</math> if <math>g(y) = 45</math>.</p>
<p>8. Given that <math>g : x \rightarrow 3x^2 - 6</math>, find the values of <math>p</math> if <math>g(p) = 7p</math>.</p> <p>A: <math>g(x) = 3x^2 - 6</math></p> $g(p) = 3p^2 - 6$ $3p^2 - 6 = 7p$ $3p^2 - 7p - 6 = 0$ $(3p + 2)(p - 3) = 0$ $p = -\frac{2}{3} \text{ atau } p = 3$	<p>8. Given that <math>g : x \rightarrow 2x^2 - 3</math>, find the values of <math>p</math> if <math>g(p) = -5p</math>.</p>

**PROBLEM OF FUNCTIONS INVOLVING SIMPLE EQUATIONS [Reinforcement Exercises]**

QUESTION	ANSWER
<p>1. Given the functions <math>f : x \rightarrow 2x - 5</math> and <math>g : x \rightarrow x + 2</math>, find</p> <p>(a) the value of <math>x</math> if <math>f(x) = 7</math></p> <p>(b) the value of <math>y</math> if <math>g(y) = 2y - 3</math></p> <p>(c) the value of <math>p</math> if <math>f(p) = g(p)</math></p> <p>(d) the value of <math>x</math> if <math>f(x) = -g(x)</math></p>	<p>1. <math>f(x) = 2x - 5</math>, <math>g(x) = x + 2</math></p> <p>(a) <math>f(x) = 7</math>  <math>2x - 5 = 7</math>  <math>2x =</math>  <math>x =</math></p>
<p>2. Given the functions <math>f : x \rightarrow 3x + 4</math> and <math>g : x \rightarrow 2x</math>, find</p> <p>(a) the value of <math>p</math> if <math>f(p) = -5</math></p> <p>(b) the value of <math>k</math> if <math>g(k) = 3k - 4</math></p> <p>(c) the value of <math>x</math> if <math>2f(x) = g(x)</math></p> <p>(d) the values of <math>y</math> jika <math>f(y) = y^2</math></p>	<p>2. <math>f(x) =</math>, <math>g(x) =</math></p> <p>(a) <math>f(p) = -5</math>  <math>3p + 4 = -5</math></p>
<p>3. Given the function <math>f : x \rightarrow 3x^2 - 12</math>,</p> <p>(a) evaluate <math>f^2(-2)</math>.</p> <p>(b) solve the equation <math>f(x) = 0</math>.</p> <p>(c) find the values of <math>p</math> if <math>f(p) = 3p + 6</math>.</p>	<p>3. <math>f(x) =</math></p> <p>(a) <math>f^2(-2) = f f(-2)</math>  <math>= f( )</math>  <math>=</math></p> <div style="border: 1px solid black; border-radius: 50%; padding: 10px; width: fit-content; margin-left: 200px;"> <math>f(-2) = 3(-2)^2 - 12</math>  <math>=</math> </div>
<p>4. Given the functions <math>f : x \rightarrow x^2</math> and <math>g : x \rightarrow 12 - 4x</math>, find</p> <p>(a) the image of 3 that is mapped by <math>f</math>.</p> <p>(b) the values of <math>x</math> if <math>f(x) = x</math>,</p> <p>(c) the values of <math>y</math> if <math>f(y) = g(y)</math>.</p>	<p>4. <math>f(x) =</math>, <math>g(x) =</math></p>

## 1.4 FINDING THE VALUE OF COMPOSITE FUNCTIONS [Mastery Exercises]

Notes : To find the value of  $fg(a)$  given the functions  $f$  and  $g$ , we can first find  $fg(x)$  and then substitute  $x = a$ .

We can also follow the EXAMPLES below.

<p><b>EXAMPLE 1 :</b></p> <p>Given that <math>f : x \rightarrow 3x - 4</math> and <math>g : x \rightarrow 2x</math>, find <math>fg(3)</math>.</p> <p>Answer : <math>f(x) = 3x - 4</math>, <math>g(x) = 2x</math></p> $g(3) = 2(3)$ $= 6$ $fg(3) = f [ g(3) ]$ $= f ( 6 )$ $= 3 ( 6 ) - 4$ $= 14$	<p><b>EXAMPLE 2 :</b></p> <p>Given that <math>f : x \rightarrow 3 - 2x</math> and <math>g : x \rightarrow x^2</math>, find <math>gf(4)</math>.</p> <p>Answer : <math>f(x) = 3 - 2x</math>, <math>g(x) = x^2</math>.</p> $f(4) = 3 - 2(4)$ $= 3 - 8$ $= -5$ $gf(4) = g (-5)$ $= (-5)^2$ $= 25$
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### EXERCISES

<p>1. Given that <math>f : x \rightarrow 2x + 1</math> and <math>g : x \rightarrow 3x</math>, find <math>f g(1)</math>.</p>	<p>2. Given that <math>f : x \rightarrow 2x - 9</math> and <math>g : x \rightarrow 1 + 3x</math>, find <math>gf(3)</math>.</p>
<p>3. Given the functions <math>f : x \rightarrow x + 3</math> and <math>g : x \rightarrow 4x - 1</math>, find</p> <p>(a) <math>f g(1)</math>                      (b) <math>gf(1)</math></p>	<p>4. Given the functions <math>f : x \rightarrow 3x - 7</math> and <math>g : x \rightarrow 4 - 2x</math>, find</p> <p>(a) <math>f g(0)</math>                      (b) <math>gf(0)</math></p>

**FINDING THE VALUE OF COMPOSITE FUNCTIONS [Reinforcement Exercises]**

1. Given that $f : x \rightarrow 2x+3$ and $g : x \rightarrow 4x$ , find $fg(2)$ .	2. Given that $f : x \rightarrow 2x-5$ and $g : x \rightarrow 5x$ , find $gf(7)$ .
3. Given that $f : x \rightarrow x+4$ and $g : x \rightarrow 2x-1$ , find (a) $fg(1)$ (b) $gf(1)$	4. Given that $f : x \rightarrow 3x+4$ and $g : x \rightarrow 5-2x$ , find (a) $fg(0)$ (b) $gf(0)$
5. Given the functions $f : x \rightarrow 3x^2-1$ and $g : x \rightarrow 2-x$ , find (a) $fg(-1)$ (b) $gf(-1)$	6. Given that $f : x \rightarrow 3x$ and $g : x \rightarrow 2-x^2$ , find (a) $fg(-2)$ (b) $gf(-2)$
7. Given the functions $f : x \rightarrow x+2$ and $g : x \rightarrow 2-3x+x^2$ , find (a) $fg(1)$ (b) $gf(1)$	8. Given the functions $f : x \rightarrow 2-x$ and $g : x \rightarrow 1-4x+3x^2$ , find (a) $fg(-1)$ (b) $gf(-1)$

## 1.5 FINDING THE VALUE OF COMPOSITE FUNCTIONS $f^2$ , $g^2$

Notes :  $f^2(a) = ff(a) = f[f(a)]$

<p><b>EXAMPLE 1 :</b></p> <p>Given that <math>f : x \rightarrow 3x - 2</math>, find <math>f^2(2)</math>.</p> <p>Answer : <math>f(x) = 3x - 2</math></p> $f(2) = 3(2) - 2 = 4$ $f^2(2) = f[f(2)]$ $= f(4)$ $= 3(4) - 2$ $= 10$	<p><b>EXAMPLE 2 :</b></p> <p>Given that <math>g : x \rightarrow 3 - 4x</math>, evaluate <math>gg(1)</math>.</p> <p>Answer : <math>g(x) = 3 - 4x</math></p> $g(1) = 3 - 4(1) = -1$ $gg(1) = g[g(1)]$ $= g(-1)$ $= 3 - 4(-1)$ $= 3 + 4$ $= 7$
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### EXERCISES

1. Given that $f : x \rightarrow 2x + 3$ , find $f^2(2)$ .	2. Given that $g : x \rightarrow x - 5$ , evaluate $gg(3)$ .
3. Given that $g : x \rightarrow 2x - 1$ , evaluate $g^2(3)$ .	4. Given that $f : x \rightarrow 3x + 4$ , find $ff(0)$ .
5. Given that $g : x \rightarrow 2 - 5x$ , find $g^2(1)$ .	6. Given that $f : x \rightarrow 3x^2 - 1$ , find $ff(1)$ .
7. Given that $g : x \rightarrow 4x$ , evaluate $gg(-2)$ .	8. Diberi $f : x \rightarrow 2x^2 - 4x + 3$ . Nilaikan $f^2(0)$ .

## 1.6 BASIC EXERCISES BEFORE FINDING THE COMPOSITE FUNCTIONS [ 1 ]

<p><b>EXAMPLE 1 :</b></p> <p>Given <math>f : x \rightarrow 3x+1,</math>  <math>f(x) = 3x + 1</math></p> <p>thus (a) <math>f(2) = 3(2) + 1</math>  <math>= 7</math></p> <p>(b) <math>f(a) = 3a + 1</math></p> <p>(c) <math>f(p) = 3p + 1</math></p> <p>(d) <math>f(2k) = 3(2k) + 1 = 6k + 1</math></p> <p>(e) <math>f(2x) = 3(2x) + 1 = 6x + 1</math></p> <p>(f) <math>f(x^2) = 3x^2 + 1</math></p>	<p><b>EXAMPLE 2 :</b></p> <p>Given <math>g : x \rightarrow 5 - 4x,</math> .  <math>g(x) = 5 - 4x</math></p> <p>thus (a) <math>g(2) = 5 - 4(2) = 5 - 8 = -3</math></p> <p>(b) <math>g(a) = 5 - 4a</math></p> <p>(c) <math>g(p) = 5 - 4p</math></p> <p>(d) <math>g(3k) = 5 - 4(3k) = 5 - 12k</math></p> <p>(e) <math>g(x^2) = 5 - 4x^2</math></p> <p>(f) <math>g(3+2x) = 5 - 4(3+2x)</math>  <math>= 5 - 12 - 8x</math>  <math>= -7 - 8x</math></p>
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### EXERCISES

<p>1. Given <math>f : x \rightarrow 2x + 3,</math>  <math>f(x) = 2x + 3</math></p> <p>thus (a) <math>f(2) = 2(2) + 3 =</math></p> <p>(b) <math>f(a) =</math></p> <p>(c) <math>f(p) =</math></p> <p>(d) <math>f(2k) =</math></p> <p>(e) <math>f(x^2) =</math></p> <p>(f) <math>f(-x^2) =</math></p> <p>(g) <math>f(-3x) =</math></p>	<p>2 Given <math>g : x \rightarrow 2 - 4x .</math>  <math>g(x) =</math></p> <p>thus (a) <math>g(2) =</math></p> <p>(b) <math>g(a) =</math></p> <p>(c) <math>g(s) =</math></p> <p>(d) <math>g(3x) =</math></p> <p>(e) <math>g(x^2) =</math></p> <p>(f) <math>g(3+2x) =</math></p> <p>(g) <math>g(2 - 4x) =</math></p>
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**BASIC EXERCISES BEFORE FINDING THE COMPOSITE FUNCTIONS [ 2 ]**

<p>1. Given <math>f : x \rightarrow 4 - 2x</math> ,  <math>f(x) = 4 - 2x</math></p> <p>thus (a) <math>f(3) = 4 - 2(3) =</math></p> <p>(b) <math>f(-x) =</math></p> <p>(c) <math>f(2+x) =</math></p> <p>(d) <math>f(3 - x) =</math></p> <p>(e) <math>f(x^2) =</math></p> <p>(f) <math>f(-x^2 + 2) =</math></p>	<p>2 Given <math>g : x \rightarrow -2x + 1</math> .  <math>g(x) =</math></p> <p>thus (a) <math>g(-1) =</math></p> <p>(b) <math>g(2x) =</math></p> <p>(c) <math>g(x-2) =</math></p> <p>(d) <math>g(-3x) =</math></p> <p>(e) <math>g(x^2) =</math></p> <p>(f) <math>g(1-2x) =</math></p>
<p>3. Given <math>f : x \rightarrow 1 - x</math> ,  <math>f(x) =</math></p> <p>thus (a) <math>f(10) =</math></p> <p>(b) <math>f(3x) =</math></p> <p>(c) <math>f(2 - x) =</math></p> <p>(d) <math>f(4+x) =</math></p> <p>(e) <math>f(2x- 3) =</math></p> <p>(f) <math>f(x^2) =</math></p>	<p>4 Given <math>g : x \rightarrow 2(x + 2)</math> , .  <math>g(x) =</math></p> <p>thus (a) <math>g(-1) =</math></p> <p>(b) <math>g(2x) =</math></p> <p>(c) <math>g(x-1) =</math></p> <p>(d) <math>g(-x) =</math></p> <p>(e) <math>g(x^2) =</math></p> <p>(f) <math>g(1+2x) =</math></p>

## 1.7 FINDING COMPOSITE FUNCTIONS

### EXAMPLE 1 :

Given that  $f : x \rightarrow 3x - 4$  and  $g : x \rightarrow 2x$ , find  $fg(x)$ .

Answer :  $f(x) = 3x - 4$ ,  $g(x) = 2x$

$$fg(x) = f [ g(x) ]$$

$$= f ( 2x )$$

$$= 3 ( 2x ) - 4$$

$$= 6x - 4$$

OR

$$fg(x) = f [ g(x) ]$$

$$= 3 [g(x)] - 4$$

$$= 3 ( 2x ) - 4$$

$$= 6x - 4$$

### EXAMPLE 2 :

Given that  $f : x \rightarrow 3 - 2x$  and  $g : x \rightarrow x^2$ , find the composite function  $gf$ .

Answer:  $f(x) = 3 - 2x$ ,  $g(x) = x^2$ .

$$gf(x) = g[f(x)]$$

$$= g ( 3 - 2x )$$

$$= ( 3 - 2x )^2$$

OR

$$gf(x) = g[f(x)]$$

$$= [f(x)]^2$$

$$= ( 3 - 2x )^2$$

thus  $gf : x \rightarrow ( 3 - 2x )^2$

### EXERCISES

1. Given that  $f : x \rightarrow 2x + 3$  and  $g : x \rightarrow 4x$ , find  $fg(x)$ .

2. Given that  $f : x \rightarrow 2x - 5$  and  $g : x \rightarrow 5x$ , find the composite function  $gf$ .

3. Given the functions  $f : x \rightarrow x + 4$  and  $g : x \rightarrow 2x - 1$ , find

(a)  $fg(x)$

(b)  $gf(x)$

4. Given that  $f : x \rightarrow 3x + 4$  and  $g : x \rightarrow 5 - 2x$ ,

find

(b)  $f g$

(b)  $gf$

## REINFORCEMENT EXERCISES FOR FINDING COMPOSITE FUNCTIONS

<p>1. Given the functions <math>f : x \rightarrow 3x + 2</math> and <math>g : x \rightarrow 2 - 2x</math>, find</p> <p>(a) <math>fg(x)</math>                      (b) <math>gf(x)</math></p>	<p>2. Given that <math>f : x \rightarrow 3x</math> and <math>g : x \rightarrow 2 - x^2</math>, find the composite functions</p> <p>(a) <math>fg</math>                      (b) <math>gf</math></p>
<p>3. Given the functions <math>f : x \rightarrow x + 4</math> and <math>g : x \rightarrow 1 - 3x</math>, find</p> <p>(a) <math>fg(x)</math>                      (b) <math>gf(x)</math></p>	<p>4. Given that <math>f : x \rightarrow 3 - x</math> and <math>g : x \rightarrow -4x + 3</math>, find the composite functions</p> <p>(a) <math>f g</math>                      (b) <math>gf</math></p>
<p>5. Given the functions <math>f : x \rightarrow x + 2</math> and <math>g : x \rightarrow 5 + 2x</math>, find</p> <p>(a) <math>fg(x)</math>                      (b) <math>gf(x)</math></p>	<p>6. Given that <math>f : x \rightarrow 2 - 5x</math> and <math>g : x \rightarrow 1 + x^2</math>, find the composite function gubahan</p> <p>(a) <math>fg</math>                      (b) <math>gf</math></p>

**REINFORCEMENT EXERCISES FOR FINDING COMPOSITE FUNCTIONS [  $f^2$  and  $g^2$  ]**

<p>1. Given that <math>f : x \rightarrow 3x + 2</math>, find <math>f^2(x)</math>.</p> $f(x) = 3x + 2$ $f^2(x) = f[f(x)]$ $= f(3x + 2) \quad \text{or} \quad 3f(x) + 2$ $= 3(3x+2) + 2$ $=$	<p>2. Given that <math>f : x \rightarrow 3x</math>, find the function <math>f^2</math>.</p>
<p>3. Given that <math>g : x \rightarrow 1 - 3x</math>, find <math>gg(x)</math></p>	<p>4. Given that <math>g : x \rightarrow -4x + 3</math>, find the function <math>g^2</math>.</p>
<p>5. Given that <math>f : x \rightarrow x + 2</math>, find <math>ff(x)</math>.</p>	<p>6. Given that <math>f : x \rightarrow 2 - 5x</math>, find the function <math>f^2</math>.</p>
<p>7. Given that <math>f : x \rightarrow 3 + 4x</math>, find <math>f^2(x)</math>.</p>	<p>8. Given that <math>f : x \rightarrow 5x</math>, find the function <math>f^2</math>.</p>
<p>9. Given that <math>g : x \rightarrow \frac{1}{2}x</math>, find <math>g^2(x)</math>.</p>	<p>10. Given that <math>h : x \rightarrow \frac{2}{x-2}</math>, find the function <math>f^2</math>.</p>

## 1.8 INVERSE FUNCTIONS

Notes : 1. Students must be skillful in changing the subject of a formula !

2. If  $f(x) = y$ , then  $x = f^{-1}(y)$  OR if  $f^{-1}(x) = y$ , then  $x = f(y)$

EXAMPLE 1. Given that $f(x) = 2x - 3$ , find $f^{-1}(x)$ .	
METHOD 1	METHOD 2
<p>Given <math>f(x) = 2x - 3</math>,</p> <p>then <math>f^{-1}(2x - 3) = x</math>.</p> <p><math>f^{-1}(y) = x</math> when <math>y = 2x - 3</math></p> $y + 3 = 2x$ $x = \frac{y + 3}{2}$ <p><math>f^{-1}(y) = \frac{y + 3}{2}</math></p> <p><math>\therefore f^{-1}(x) = \frac{x + 3}{2}</math></p>	<p>Given <math>f(x) = 2x - 3</math></p> <p>then <math>f(y) = 2y - 3</math></p> <p><math>f^{-1}(2y - 3) = y</math></p> <p><math>f^{-1}(x) = y</math> when <math>x = 2y - 3</math></p> $x + 3 = 2y$ $y = \frac{x + 3}{2}$ <p><math>\therefore f^{-1}(x) = \frac{x + 3}{2}</math></p>
Students are advised to master only one of the methods !	

### DRILLING PRACTICES ON CHANGING SUBJECT OF A FORMULA [ 1 ]

<p>1. If <math>y = 3x - 2</math>, then <math>x =</math></p> $3x - 2 = y$ $3x = y + 2$ $x = \frac{y + 2}{3}$	<p>2. If <math>y = 4x - 2</math>, then <math>x =</math></p> $4x - 2 = y$ $4x =$ $x =$
<p>3. If <math>y = 3 - 6x</math>, then <math>x =</math></p>	<p>4. If <math>y = 4 - 5x</math>, then <math>x =</math></p>
<p>5. If <math>y = 3 + 5x</math>, then <math>x =</math></p>	<p>6. If <math>y = 10x - 4</math>, then <math>x =</math></p>

**DRILLING PRACTICES ON CHANGING SUBJECT OF A FORMULA [ 2 ]**

<p>1. If <math>y = \frac{2x-5}{4}</math>, then <math>x =</math></p> $\frac{2x-5}{4} = y$ $2x-5 = 4y$ $2x =$ $x =$	<p>2. If <math>y = \frac{3x-2}{5}</math>, then <math>x =</math></p>
<p>3. If <math>y = 5 + 6x</math>, then <math>x =</math></p>	<p>4. If <math>y = 4 - \frac{1}{2}x</math>, then <math>x =</math></p>
<p>5. If <math>y = 6 + \frac{3}{2}x</math>, then <math>x =</math></p>	<p>6. If <math>y = 6x - 9</math>, then <math>x =</math></p>
<p>7. If <math>y = \frac{1}{3x-2}</math>, then <math>x =</math></p>	<p>8. If <math>y = \frac{2}{4-x}</math>, then <math>x =</math></p>
<p>9. If <math>y = \frac{x+1}{4x-2}</math>, then <math>x =</math></p>	<p>10. If <math>y = \frac{2x}{3-x}</math>, then <math>x =</math></p>

**DETERMINING THE INVERSE FUNCTION FROM A FUNCTION OF THE TYPE ONE-TO-ONE CORRESPONDENCE**

<p><b>EXAMPLE 1 :</b> Given that <math>f(x) = 4x - 6</math>, find <math>f^{-1}(x)</math>.</p>	<p><b>EXAMPLE 2 :</b> Given that <math>f : x \rightarrow \frac{2x+1}{2-x}</math>, <math>x \neq 2</math>, find <math>f^{-1}(x)</math>.</p>
<p style="text-align: center;">Answer :</p> <p>Given <math>f(x) = 4x - 6</math> so <math>f(y) = 4y - 6</math> then <math>f^{-1}(4y - 6) = y</math>.</p> <p style="padding-left: 40px;"><math>f^{-1}(x) = y</math> when <math>x = 4y - 6</math> <math>x + 6 = 4y</math> <math>y = \frac{x+6}{4}</math></p> <p><math>\therefore f^{-1}(x) = \frac{x+6}{4}</math></p>	<p>Given <math>f(x) = \frac{2x+1}{2-x}</math> so <math>f(y) = \frac{2y+1}{2-y}</math> then <math>f^{-1}\left(\frac{2y+1}{2-y}\right) = y</math></p> <p style="padding-left: 40px;"><math>f^{-1}(x) = y</math> when <math>x = \frac{2y+1}{2-y}</math></p> <p style="padding-left: 80px;"><math>x(2-y) = 2y+1</math> <math>2x - xy = 2y+1</math> <math>2x - 1 = 2y + xy</math> <math>2x - 1 = y(2+x)</math> <math>y = \frac{2x-1}{2+x}</math></p> <p><math>\therefore f^{-1}(x) = \frac{2x-1}{x+2}</math>, <math>x \neq -2</math>.</p>

**EXERCISES**

<p>1. Given that <math>f : x \rightarrow 4 + 8x</math>, find <math>f^{-1}</math>.</p>	<p>2. Given that <math>g : x \rightarrow 10 - 2x</math>, find <math>g^{-1}</math>.</p>
<p>3. Given that <math>f : x \rightarrow 4 - 3x</math>, find <math>f^{-1}</math>.</p>	<p>4. Given that <math>g : x \rightarrow 15 + 6x</math>, find <math>g^{-1}</math>.</p>

**MASTERY EXERCISES ON FINDING THE INVERSE OF A FUNCTION**

1. Given that $f: x \rightarrow 10 - 8x$ , find $f^{-1}$ .	2. Given that $g: x \rightarrow 3 - \frac{1}{2}x$ , find $g^{-1}$ .
3. Given that $f: x \rightarrow 5 + 2x$ , find $f^{-1}$ .	4. Given that $g: x \rightarrow 3 - x$ , find $g^{-1}$ .
5. Given that $f(x) = \frac{2x-5}{4}$ , find $f^{-1}(x)$ .	6. Given that $g(x) = \frac{3x-2}{6}$ , find $g^{-1}(x)$ .
7. Given that $f: x \rightarrow 6x - 15$ , find $f^{-1}$ .	8. Given that $g: x \rightarrow 3 - \frac{3}{4}x$ , find $g^{-1}$ .
9. Given that $f(x) = \frac{x+2}{4x-2}$ , find $f^{-1}(x)$ .	10. Given that $g(x) = \frac{2x}{4-x}$ , find $g^{-1}(x)$ .

## FINDING THE VALUE OF $f^{-1}(a)$ WHEN GIVEN $f(x)$

Example : Given that  $f : x \rightarrow 2x + 1$ , find the value of  $f^{-1}(7)$ .

<b>METHOD 1</b> [ Finding $f^{-1}$ first ]	<b>METHOD 2</b> [ Without finding $f^{-1}(x)$ ]
$f(x) = 2x + 1$ $f(y) = 2y + 1$ $f^{-1}(2y + 1) = y$ $f^{-1}(x) = y \quad \text{when} \quad x = 2y + 1$ $x - 1 = 2y$ $y = \frac{x-1}{2}$ $f^{-1}(x) = \frac{x-1}{2}$ $f^{-1}(7) = \frac{7-1}{2}$ $= 3$	$f(x) = 2x + 1$ Let $f^{-1}(7) = k$ $f(k) = 7$ $2k + 1 = 7$ $2k = 6$ $k = 3$ $\therefore f^{-1}(7) = 3$

( If you are not asked to find  $f^{-1}(x)$  but only want to have the value of  $f^{-1}(a)$ , then use Method 2 )

### EXERCISES

1. Given that $f : x \rightarrow x + 2$ , find the value of $f^{-1}(3)$ .	2. Given that $g : x \rightarrow 7 - x$ , find the value of $g^{-1}(2)$ .
3. Given that $f : x \rightarrow 7 - 3x$ , find the value of $f^{-1}(-5)$ .	4. Given that $g : x \rightarrow 5 + 2x$ , find the value of $g^{-1}(5)$ .
5. Given that $f : x \rightarrow 3x - 2$ , find the value of $f^{-1}(10)$ .	6. Given that $g : x \rightarrow 7 - x$ , find the value of $g^{-1}(2)$ .
7. Given that $f : x \rightarrow 4 + 6x$ , find the value of $f^{-1}(-2)$ .	8. Given that $g : x \rightarrow \frac{1}{2} - x$ , find the value of $g^{-1}(4)$ .
9. Given that $f : x \rightarrow \frac{4}{x-3}$ , find the value of $f^{-1}(-1)$ .	10. Diberi $g : x \rightarrow \frac{3}{2-x}$ , cari nilai $g^{-1}(-1)$ .

## Finding the Other Related Component Function when given a Composite Function and One of its Component Function

<p style="text-align: center;"><b>TYPE 1 ( Easier Type )</b></p> <p>Given the functions <math>f</math> and <math>fg</math>, find the function <math>g</math>.</p> <p style="text-align: center;">OR</p> <p>Given the functions <math>g</math> and <math>gf</math>, find the function <math>f</math>.</p>	<p style="text-align: center;"><b>TYPE 2 ( More Challenging Type )</b></p> <p>Given the functions <math>f</math> and <math>gf</math>, find the function <math>g</math>.</p> <p style="text-align: center;">OR</p> <p>Given the functions <math>g</math> and <math>fg</math>, find the function <math>f</math>.</p>
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### EXAMPLE :

<p>1. Given the functions <math>f : x \rightarrow 2x + 3</math> and <math>fg : x \rightarrow 6x - 1</math>, find the function <math>g</math>.</p> <p>Answer :            <math>f(x) = 2x + 3</math>                                   <math>fg(x) = 6x - 1</math></p> <p>Find <math>g(x)</math> from <math>fg(x) = 6x - 1</math>                                   <math>f [g(x)] = 6x - 1</math>                                   <math>2g(x) + 3 = 6x - 1</math>                                   <math>2g(x) = 6x - 4</math>                                   <math>\therefore g(x) = 3x - 2</math></p>	<p>2. Given the functions <math>f : x \rightarrow 2x - 5</math> and <math>gf : x \rightarrow 10x - 25</math>, find the function <math>g</math>.</p> <p>Answer :            <math>f(x) = 2x - 5</math>                                   <math>gf(x) = 10x - 25</math></p> <p>Find <math>g(x)</math> from <math>gf(x) = 10x - 25</math>                                   <math>g [ f(x) ] = 10x - 25</math>                                   <math>g ( 2x - 5 ) = 10x - 25</math>                                   <math>g ( 2y - 5 ) = 10y - 25</math>                                   <math>g(x) = 10y - 25</math>    when <math>x = 2y - 5</math>             <math>x + 5 = 2y</math>             <math>y = \frac{x+5}{2}</math></p> <p>So :                    <math>g(x) = 10 \left( \frac{x+5}{2} \right) - 25</math>             <math>= 5x + 25 - 25</math>                                   <math>\therefore g(x) = 5x</math></p>
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### EXERCISES

<p>1. Given the functions <math>f : x \rightarrow 2x + 2</math> and <math>fg : x \rightarrow 4 - 6x</math>, find the function <math>g</math>.</p> <p>Answer :</p>	<p>2. Given the functions <math>f : x \rightarrow 2x + 2</math> and <math>gf : x \rightarrow -5 - 6x</math>, find the function <math>g</math>.</p> <p>Answer :</p>
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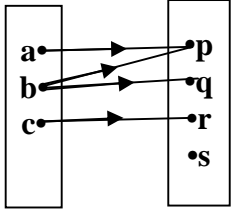
**REINFORCEMENT EXERCISES on finding Component Function from Composite Function (TYPE 1)**

<p>1. Given the functions <math>f : x \rightarrow 2x - 3</math> and <math>fg : x \rightarrow 2x + 3</math>, find the function <math>g</math> . Answer :</p>	<p>2. Given the functions <math>g: x \rightarrow x + 3</math> and <math>gf : x \rightarrow 2x</math> , find the function <math>f</math> . Answer :</p>
<p>3. Given the functions <math>f : x \rightarrow 3x + 4</math> and <math>fg : x \rightarrow 6x + 1</math>, find the function <math>g</math> . Answer :</p>	<p>4. Given the functions <math>g : x \rightarrow 2x - 1</math> and <math>gf : x \rightarrow 6x + 7</math> , find the function <math>f</math> . Answer :</p>
<p>5. Given the functions <math>f : x \rightarrow 2 - x</math> and <math>fg : x \rightarrow 2 - 2x</math> , find the function <math>g</math> . Answer :</p>	<p>6. Given the functions <math>p : x \rightarrow 2x</math> and <math>pq : x \rightarrow 4 - 2x</math> , find the function <math>q</math> . Answer :</p>
<p>7. Given the functions <math>g : x \rightarrow 2 + 4x</math> and <math>gf : x \rightarrow 6 + 4x^2</math>, find the function <math>f</math> . Answer :</p>	<p>8. Given the functions <math>f : x \rightarrow 2x + 7</math> and <math>fg : x \rightarrow 7 - 4x</math> , find the function <math>g</math> . Answer :</p>
<p>9. Given the functions <math>h : x \rightarrow 1 - x</math> and <math>hg : x \rightarrow 1 - 3x^2</math>, find the function <math>g</math> . Answer :</p>	<p>10. Given the functions <math>h : x \rightarrow 3x + 1</math> and <math>hf : x \rightarrow 7 - 9x^2</math> , find the function <math>f</math> . Answer :</p>

**REINFORCEMENT EXERCISES on finding Component Function from Composite Function  
( TYPE 2 )**

<p>1. Given the functions <math>f : x \rightarrow 2x - 3</math> and <math>gf : x \rightarrow 2x</math>, find the function <math>g</math>. Answer :</p>	<p>2. Given the functions <math>g : x \rightarrow x + 3</math> and <math>fg : x \rightarrow 2x + 3</math>, find the function <math>f</math>. Answer :</p>
<p>3. Given the functions <math>f : x \rightarrow 3x + 4</math> and <math>gf : x \rightarrow 6x + 7</math>, find the function <math>g</math>. Answer :</p>	<p>4. Given the functions <math>g : x \rightarrow 2x - 1</math> and <math>fg : x \rightarrow 6x + 1</math>, find the function <math>f</math>. Answer :</p>
<p>5. Given the functions <math>f : x \rightarrow 2 - x</math> and <math>gf : x \rightarrow 4 - 2x</math>, find the function <math>g</math>. Answer :</p>	<p>6. Given the functions <math>g : x \rightarrow 2x</math> and <math>fg : x \rightarrow 2 - 2x</math>, find the function <math>f</math>. Answer :</p>
<p>7. Given the functions <math>f : x \rightarrow 3x</math> and <math>gf : x \rightarrow 1 - 3x</math>, find the function <math>g</math>. Answer :</p>	<p>8. Given the functions <math>f : x \rightarrow 2 + 4x</math> and <math>gf : x \rightarrow 5 + 16x + 16x^2</math>, find the function <math>g</math>. Answer :</p>

**QUESTIONS BASED ON SPM FORMAT**

<p>1.</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <math>P = \{1, 2\}</math>  <math>Q = \{2, 4, 6, 8, 10\}</math> </div> <p>Base on the information above, a relation from P into Q is defined by the set of ordered pairs <math>\{(1, 4), (1, 6), (2, 6), (2, 8)\}</math>.</p> <p>State</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">(a) the images of 1,</td> <td style="width: 50%;">Ans:</td> </tr> <tr> <td>(b) the object of 4,</td> <td>Ans:</td> </tr> <tr> <td>(c) the domain,</td> <td>Ans:</td> </tr> <tr> <td>(d) the codomain,</td> <td>Ans:</td> </tr> <tr> <td>(e) the range,</td> <td>Ans:</td> </tr> <tr> <td>(f) the type of relation</td> <td>Ans:</td> </tr> </table>	(a) the images of 1,	Ans:	(b) the object of 4,	Ans:	(c) the domain,	Ans:	(d) the codomain,	Ans:	(e) the range,	Ans:	(f) the type of relation	Ans:	<p>2.</p> <div style="text-align: center;">  </div> <p>The above diagram shows the relation between set A and set B</p> <p>State</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">(a) the images of b,</td> <td style="width: 50%;">Ans:</td> </tr> <tr> <td>(b) the objects of p,</td> <td>Ans:</td> </tr> <tr> <td>(c) the domain,</td> <td>Ans:</td> </tr> <tr> <td>(d) the codomain,</td> <td>Ans:</td> </tr> <tr> <td>(e) the range,</td> <td>Ans:</td> </tr> <tr> <td>(f) the type of relation</td> <td>Ans:</td> </tr> </table>	(a) the images of b,	Ans:	(b) the objects of p,	Ans:	(c) the domain,	Ans:	(d) the codomain,	Ans:	(e) the range,	Ans:	(f) the type of relation	Ans:
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(f) the type of relation	Ans:																								
<p>3. Given the functions <math>f : x \rightarrow 2x + 1</math> and <math>g : x \rightarrow x^2 - 3</math>, find</p> <p>(a) <math>f^{-1}(5)</math>,</p> <p>(b) <math>gf(x)</math>.</p>	<p>4. Given the functions <math>g : x \rightarrow 4x + 1</math> and <math>h : x \rightarrow x^2 - 3</math>, find</p> <p>(a) <math>g^{-1}(3)</math>,</p> <p>(b) <math>hg(x)</math>.</p>																								
<p>5. Given the function <math>f : x \rightarrow 2 - 3x</math> and <math>h : x \rightarrow x^2 + x - 2</math>, find</p> <p>(a) <math>f^{-1}(3)</math>,</p> <p>(b) <math>hf(x)</math>,</p> <p>(c) <math>f^2(x)</math>.</p>	<p>6. Given the functions <math>f : x \rightarrow 2x + 1</math> and <math>h : x \rightarrow 2 - x^2</math>, find</p> <p>(a) <math>f^{-1}(-1)</math>,</p> <p>(b) <math>hf(x)</math>,</p> <p>(c) <math>f h(x)</math>.</p>																								

<p>7. Given that <math>f : x \rightarrow 4x + m</math> and <math>f^{-1} : x \rightarrow nx + \frac{3}{4}</math>, find the values of <math>m</math> and <math>n</math>.</p> <p style="text-align: right;">[ <math>m = -3</math> ; <math>n = \frac{1}{4}</math> ]</p>	<p>8. Given that <math>f : x \rightarrow 2x - 1</math>, <math>g : x \rightarrow 4x</math> and <math>fg : x \rightarrow ax + b</math>, find the values of <math>a</math> and <math>b</math>.</p> <p style="text-align: right;">[ <math>a = 8</math> ; <math>b = -1</math> ]</p>
<p>9. Given that <math>f : x \rightarrow x + 3</math>, <math>g : x \rightarrow a + bx^2</math> and <math>gf : x \rightarrow 6x^2 + 36x + 56</math>, find the values of <math>a</math> and <math>b</math>.</p> <p style="text-align: right;">[ <math>a = 2</math> ; <math>b = 6</math> ]</p>	<p>10. Given that <math>g : x \rightarrow m + 3x</math> and <math>g^{-1} : x \rightarrow 2kx - \frac{4}{3}</math>, find the values of <math>m</math> and <math>k</math>.</p> <p style="text-align: right;">[ <math>k = \frac{1}{6}</math> ; <math>m = 4</math> ]</p>
<p>11. Given that <math>g(x) = mx + n</math> and <math>g^2(x) = 16x - 25</math>, find the values of <math>m</math> and <math>n</math>.</p> <p style="text-align: right;">[ <math>m = 4</math>, <math>n = -5</math> ; <math>m = -4</math>, <math>n = \frac{25}{3}</math> ]</p>	<p>12. Given the inverse function <math>f^{-1}(x) = \frac{2x-3}{2}</math>, find</p> <p>(a) the value of <math>f(4)</math>,</p> <p>(b) the value of <math>k</math> if <math>f^{-1}(2k) = -k - 3</math>.</p> <p style="text-align: right;">[ (a) <math>\frac{11}{2}</math> ; (b) <math>k = -\frac{1}{2}</math> ]</p>

**QUESTIONS BASED ON SPM FORMAT**

1. (SPM 06, P2, Q2)  
 Given the function  $f : x \rightarrow 3x - 2$  and  
 $g : x \rightarrow \frac{x}{5} + 1$ , find  
 (a)  $f^{-1}(x)$ ,  
 (b)  $f^{-1}g(x)$ ,  
 (c)  $h(x)$  such that  $hg(x) = 2x + 6$ .

- (a)  $\frac{x+2}{3}$       (b)  $\frac{x+15}{10}$       (c)  $10x - 4$

2. Given the function  $f : x \rightarrow 2x - 1$  and  
 $g : x \rightarrow \frac{x}{3} - 2$ , find  
 (a)  $f^{-1}(x)$ ,  
 (b)  $f^{-1}g(x)$ ,  
 (c)  $h(x)$  such that  $hg(x) = 6x - 3$ .

- (a)  $\frac{x+1}{2}$       (b)  $\frac{1}{6}x - \frac{1}{2}$       (c)  $18x + 9$

3. (SPM 06, P1, Q2)  
 Diagram 2 shows the function  $h : x \rightarrow \frac{m-x}{x}$ ,  
 $x \neq 0$ , where  $m$  is a constant.

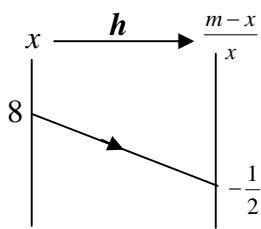


Diagram 2

Find the value of  $m$ .

$m = 4$

4. Diagram 3 shows the function  $g : x \rightarrow \frac{p+3x}{x-2}$ ,  
 $x \neq 2$ , where  $p$  is a constant.

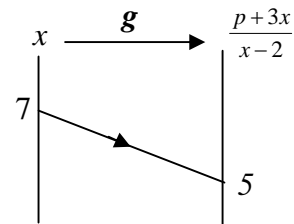


Diagram 3

Find the value of  $p$ .

$p = 4$