Section A

This section is designed to provide examples which develop routine skills necessary for completion of this section.

R1 I have had experience of graphing linear and quadratic functions.

1. Sketch the graphs of the following straight lines:

(a) $y = 2x + 3$ **(b)** $y = -3x - 2$ **(c)** $y = \frac{1}{2}x + 1$

(d) $2x + y - 4 = 0$ **(e)** $x - 3y + 6 = 0$ **(f)** $3x + 4y - 8 = 0$

2. For the following Quadratic Functions:

- Calculate where the graph crosses the x-axis and the y-axis
- Find the Turning Point and state it's nature
- Sketch the graph

(a) $y = x^2 - 4x + 3$ **(b)** $y = x^2 + 10x + 24$ **(c)** $y = x^2 + 2x - 15$

(d) $y = x^2 - 4x - 12$ **(e)** $y = x^2 - x - 12$ **(f)** $y = 4x^2 - 8x + 3$

3. For the following Quadratic Functions:

- Express in the form $y = a(x + b)^2 + c$
- State the Turning Point and state it's nature
- Sketch the graph indicating the turning point and y-intercept

(a) $y = x^2 - 4x + 5$ **(b)** $y = x^2 + 6x - 1$ **(c)** $y = x^2 - 3x + 4$

(d) $y = 2x^2 - 12x + 5$ **(e)** $y = 2 + 8x - x^2$ **(f)** $y = 3x^2 - 12x - 4$

(g) $y = 3 + 6x - x^2$ **(h)** $y = 5 - 12x - 2x^2$ **(i)** $y = x^2 + 5x - 2$

(j) $y = 3x^2 - 18x + 5$ **(k)** $y = 2x^2 + 8x - 4$ **(l)** $y = 4x^2 - 8x + 1$

(m) $y = 2x^2 - 10x - 3$ **(n)** $y = 2 + 8x - 2x^2$ **(o)** $y = 4x^2 - 16x + 9$

(p) $y = 7 + 12x - 3x^2$ **(q)** $y = 5 - 12x - 4x^2$ **(r)** $y = 6x^2 + 24x - 5$

R2 I have found x and y - intercepts for a range of graphs of functions.

1. Calculate where the graph of the following functions crosses the x-axis and the y-axis:

(a) $y = 4x + 8$ **(b)** $y = \frac{1}{4}x - 3$ **(c)** $3x + 5y - 15 = 0$

(d) $y = x^2 - 3x$ **(e)** $y = x^2 + 9x$ **(f)** $y = 3x^2 - 12x$

(g) $y = x^2 - 16$ **(h)** $y = 4x^2 - 9$ **(i)** $y = 2x^2 - 18$

(j) $y = x^2 - 7x + 10$ **(k)** $y = x^2 + 6x - 27$ **(l)** $y = 6x^2 - 13x - 5$

(m) $y = \sqrt{x + 4}$ **(n)** $y = \sqrt{2x + 9}$ **(o)** $y = \sqrt{x + 16}$

R3 I can solve linear and quadratic inequalities

1. Solve the following inequalities:

(a) $4x - 12 < 0$ **(b)** $15 - 3x \geq 0$ **(c)** $6x + 15 \leq 0$

(d) $-2x - 7 > 0$ **(e)** $5x + 17 \leq 0$ **(f)** $18 - 4x \geq 0$

(g) $x^2 - 5x = 0$ **(h)** $x^2 + 7x = 0$ **(i)** $4x^2 - 36x = 0$

(j) $x^2 - 49 = 0$ **(k)** $9x^2 - 25 = 0$ **(l)** $3x^2 - 12 = 0$

(m) $x^2 - 5x + 6 = 0$ **(n)** $x^2 + 8x - 20 = 0$ **(o)** $x^2 - 2x - 35 = 0$

(p) $6x^2 - 11x + 3 = 0$ **(q)** $2x^2 + 7x + 6 = 0$ **(r)** $4x^2 - 17x - 15 = 0$

R4 I can understand and use basic set notation.

1. Using the { } brackets notation, list the following sets:

(a) The set of months ending in the letter y.

(b) The set of the first ten prime numbers.

(c) The set of letters of the alphabet between G and P.

(d) The set of odd numbers greater than 20 but less than 30.

2. Describe the following sets in words:

(a) { January, June, July }

(b) { Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, Pluto }

(c) { Cone, Pyramid }

(d) { 1, 4, 9, 16, 25 }

3. Connect these elements with their sets, using $\in$:

Elements: a, green, 12, b, 13

Sets: {a,b,c}, {even numbers}, {colours}, {10,11,12,13}, {vowels in the English alphabet}, {red,yellow,green}

4. State which of the following are true and which are false:

(a) $2 \in$ { prime numbers }

(b) { x,y,z } and { p,q,r } are equal sets

(c) { 0 } is the empty set

(d) { k,l,m,n } = { m,l,k,n }

(e) If A = { whole numbers greater than 50 }, then $46 \notin A$

5. Using set notation, rewrite the following:

(a) 3 is a member of the set W.

(b) The empty set.

(c) x does not belong to the set A.

(d) S is a subset of the set T.

(e) The set P is equal to the set Q.

6. S = { 1,2,3,4,5,6,7,8,9,10 }. List the following subsets of S:

(a) The set of prime numbers in S.

(b) The set of odd numbers in S less than 8.

(c) The set of elements in S which are factors of 70.

(d) The set of numbers in S which are divisible by 3.

7. Find a set equal to each of the following:

(a) $\{ 1,2,3 \} \cap \{ 2,3,4,5 \}$

(b) $\{ 1,2,3 \} \cap \{ 4,5,6 \}$

(c) $\{ 1,2,3 \} \cap \{ 3,1,2 \}$

(d) $\emptyset \cap \{ 2,3,4,5 \}$

8. E = { 1,2,3,4,5,6,8,10 } A = { 1,2,3,4 } B = { 3,4,5 } and C = { 2,4,6,8,10 }

(a) Find $A \cap B$, $B \cap C$ and $A \cap C$.

(b) The set of elements common to A,B and C is denoted by $A \cap B \cap C$.

Find $A \cap B \cap C$.

9. Given that A = { 0,1,2 }, which of the following are true?

(a) $2 \in A$ **(b)** $1 \subset A$ **(c)** $\{1\} \subset A$

(d) $0 \in \emptyset$ **(e)** $A \subset A$ **(f)** $1 \notin A$

10. P = { 1,2,3,4,5,6,7 } Q = { 5,6,7,8,9,10 } are subsets of E = { 1,2,3,…,12 }.

List the members of the following sets:

(a) P ∩ Q **(b)** P ∪ Q **(c)** P'

(d) Q' **(e)** (P ∩ Q)' **(f)** (P ∪ Q)'

(g) P ∩ Q' **(h)** P' ∩ Q **(i)** P ∩ ∅

R5 I have investigated domains and ranges.

1. State a suitable domain for the following functions:

(a) $f(x) = \frac{x^2}{x-1}$ **(b)** $f(x) = \frac{4x-2}{2x-3}$ **(c)** $f(x) = \frac{x^2+5}{(x-1)(x+4)}$

(d) $f(x) = \frac{4x^2}{x^2-3x}$ **(e)** $f(x) = \frac{2x+7}{x^2-16}$ **(f)** $f(x) = \frac{x^2-5x+4}{x^2+8x+12}$

(g) $f(x) = \sqrt{x-7}$ **(h)** $f(x) = \sqrt{10-x}$ **(i)** $f(x) = \sqrt{x^2-9}$

(j) $f(x) = \sqrt{36-x^2}$ **(k)** $f(x) = \sqrt{x^2-5x-6}$ **(l)** $f(x) = \sqrt{x^2+3x}$

2. State the range of each function given its domain:

(a) $f(x) = 3x - 4$; $x \in \{2, 3, 4, 5\}$

(b) $f(x) = x^2 - 3x + 4$; $x \in \{-2, -1, 0, 1, 2\}$

(c) $f(x) = 3x^2 - 7$; $x \in \{-3, -2, 0, 2, 3\}$

(d) $f(x) = \frac{x^2+3}{2x-1}$; $x \in \{1, 3, 5, 7\}$

R6 I can calculate a basic composite function.

1. Given $f(x) = x + 1$, $g(x) = x^2$ and $\boldsymbol{h(x) = x^2 - 2}$, find the following functions:

(a) $f(g(x))$ **(b)** $f(h(x))$ **(c)** $f(f(x))$

(d) $g(f(x))$ **(e)** $g(h(x))$ **(f)** $g(g(x))$

(g) $h(f(x))$ **(h)** $h(g(x))$ **(i)** $h(h(x))$

2. Given $f(x) = 2x - 3$, $g(x) = x^2$ and $h(x) = x^2 + 4$, find the following functions:

(a) $f(g(x))$ **(b)** $f(h(x))$ **(c)** $f(f(x))$

(d) $g(f(x))$ **(e)** $g(h(x))$ **(f)** $g(g(x))$

(g) $h(f(x))$ **(h)** $h(g(x))$ **(i)** $h(h(x))$

3. Given $f(x) = x^2$, $g(x) = 3x + 1$ and $h(x) = 4 - 2x$, find the following functions:

(a) $f(g(x))$ **(b)** $f(h(x))$ **(c)** $f(f(x))$

(d) $g(f(x))$ **(e)** $g(h(x))$ **(f)** $g(g(x))$

(g) $h(f(x))$ **(h)** $h(g(x))$ **(i)** $h(h(x))$

4. Given $f(x) = x - 2$, $g(x) = \frac{2}{x^2}$ and $h(x) = \frac{4}{x+1}$, find the following functions:

(a) $f(g(x))$ **(b)** $f(h(x))$ **(c)** $f(f(x))$

(d) $g(f(x))$ **(e)** $g(h(x))$ **(f)** $g(g(x))$

(g) $h(f(x))$ **(h)** $h(g(x))$ **(i)** $h(h(x))$

5. Given $f(x) = x - 2$, $g(x) = sin\, x$ and $h(x) = \log_a x$, find the following functions:

(a) $f(g(x))$ **(b)** $f(h(x))$ **(c)** $f(f(x))$

(d) $g(f(x))$ **(e)** $g(g(x))$ **(f)** $h(f(x))$

6. Given $f(x) = 2x$, $g(x) = \cos x$ and $h(x) = e^x$, find the following functions:

(a) $f(g(x))$ **(b)** $f(h(x))$ **(c)** $f(f(x))$

(d) $g(f(x))$ **(e)** $g(g(x))$ **(f)** $h(f(x))$

7. Given $f(x) = 3x^2 + 2x - 1$, $g(x) = \sin x$ and $h(x) = \log_4 x$, find the following functions:

(a) $f(g(x))$ **(b)** $f(h(x))$ **(c)** $f(f(x))$

(d) $g(f(x))$ **(e)** $g(g(x))$ **(f)** $h(f(x))$

8. Given $f(x) = x + 2$, $g(x) = e^x$ and $h(x) = \tan x$, find the following functions:

(a) $f(g(x))$ **(b)** $f(h(x))$ **(c)** $f(f(x))$

(d) $g(f(x))$ **(e)** $g(g(x))$ **(f)** $h(f(x))$

R7 I understand that $f(g(x)) = x$ implies that $g(x)$ is the inverse of $f(x)$.

1. If $f(x) = 3x - 2$ and $g(x) = \frac{x+2}{3}$

(a) Find $f(g(x))$ and $g(f(x))$.
(b) State a relationship between $f(x)$ and $g(x)$.

2. If $f(x) = 2x + 5$ and $g(x) = \frac{x-5}{2}$

(a) Find $f(g(x))$ and $g(f(x))$.
(b) State a relationship between $f(x)$ and $g(x)$.

3. If $f(x) = 4x - 7$ and $g(x) = \frac{x+7}{4}$

(a) Find $f(g(x))$ and $g(f(x))$.
(b) State a relationship between $f(x)$ and $g(x)$.

4. If $f(x) = 6x - 3$ and $g(x) = \frac{x+3}{6}$

(a) Find $f(g(x))$ and $g(f(x))$.
(b) State a relationship between $f(x)$ and $g(x)$.

5. If $f(x) = 5x + 1$ and $g(x) = \frac{x-1}{5}$

(a) Find $f(g(x))$ and $g(f(x))$.
(b) State a relationship between $f(x)$ and $g(x)$.

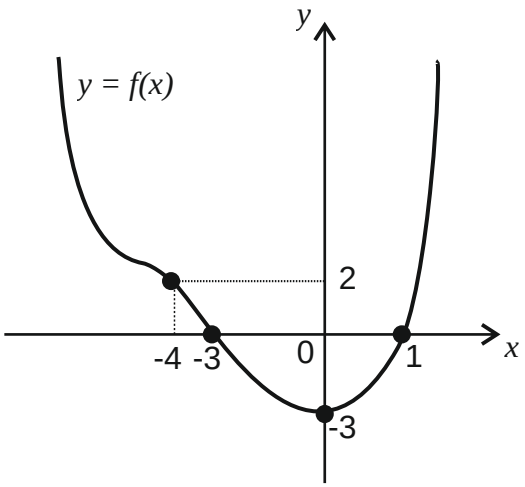
Section B

This section is designed to provide examples which develop Course Assessment level skills

NR1 **I can identify and sketch a function after a transformation of the form $kf(x), f(x) + k, f(kx), f(x + k), -f(x), f(-x)$, or a combination of these.**

1. The diagram shows the graph of a function f.

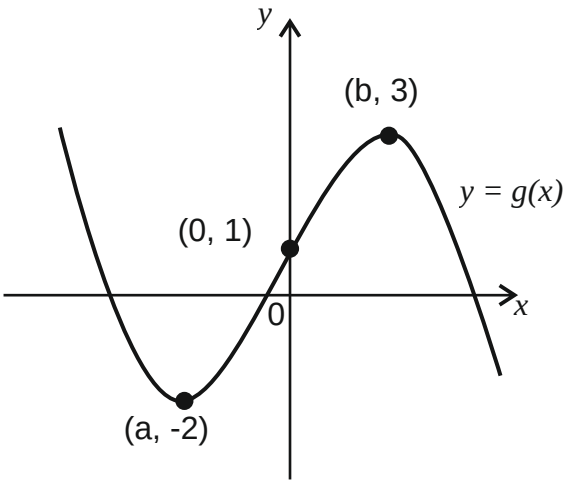
f has a minimum turning point at (0, −3) and a point of inflexion at (−4, 2).



(a) Sketch the graph $y = f(-x)$.

(b) On the same diagram, sketch the graph $y = 2f(-x)$.

2. The diagram shows the graph of $y = g(x)$.



(a) Sketch the graph of $y = -g(x)$.

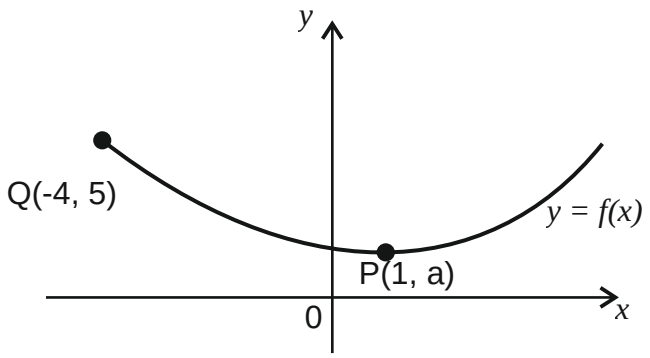
(b) On the same diagram, sketch the graph $y = 3 - g(x)$.

3. The diagram shows the graph of a function $y = f(x)$.

Copy the diagram and on it sketch the graphs of:

(a) $y = f(x-4)$.

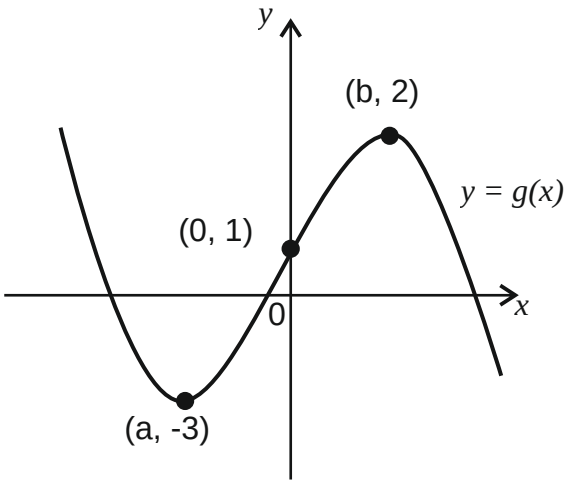
(b) $y = 2 + f(x-4)$.



4. The diagram shows the graph of $y = g(x)$.

(a) Sketch the graph of $y = -g(x)$.

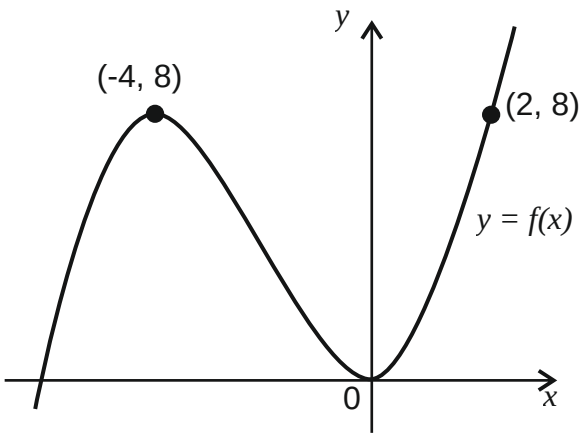
(b) On the same diagram, sketch the graph $y = 4 - g(x)$.



5. The diagram shows a sketch of the function $y = f(x)$.

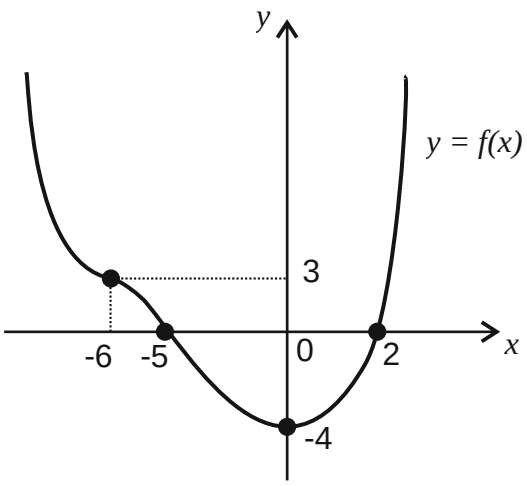
(a) Copy the diagram and on it sketch the graph of $y = f(2x)$.

(b) On a separate diagram sketch the graph of $y = 1 - f(2x)$.



6. The diagram shows the graph of a function f.

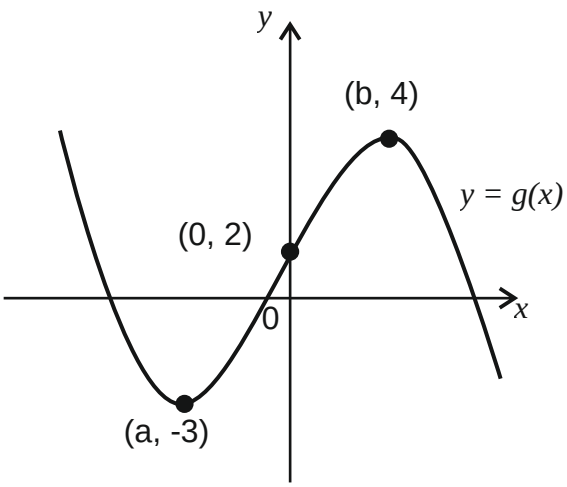
f has a minimum turning point at (0, –4) and a point of inflexion at (–6, 3).



(a) Sketch the graph $y = f(-x)$.

(b) On the same diagram, sketch the graph $y = 3f(-x)$.

7. The diagram shows the graph of $y = g(x)$.

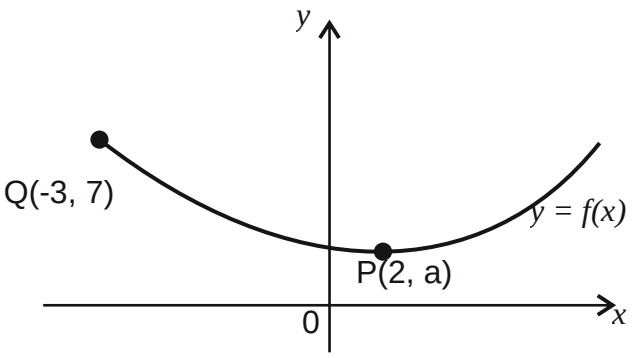


(a) Sketch the graph of $y = -g(x)$.

(b) On the same diagram, sketch the graph $y = 4 - g(x)$.

8. The diagram shows the graph of a function $y = f(x)$.

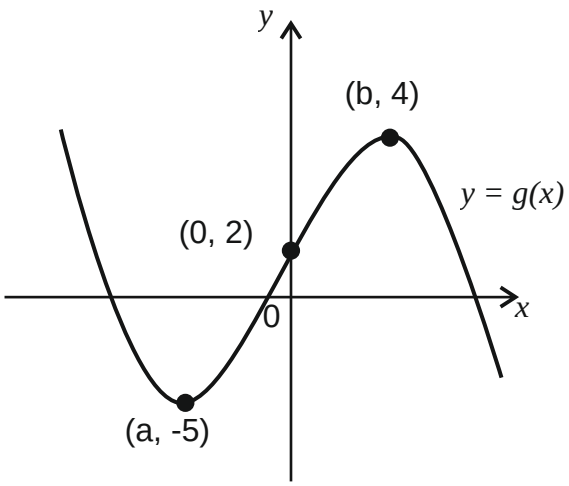
Copy the diagram and on it sketch the graphs of:



(a) $y = f(x+2)$.

(b) $y = 3 + f(x+2)$.

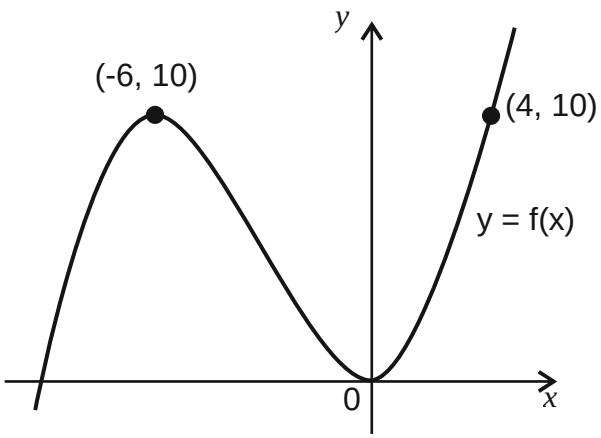
9. The diagram shows the graph of $y = g(x)$.



(a) Sketch the graph of $y = -g(x)$.

(b) On the same diagram, sketch the graph $y = 5 - g(x)$.

10. The diagram shows a sketch of the function $y = f(x)$.

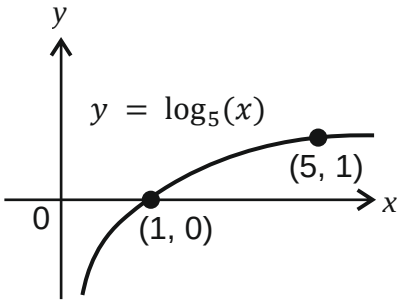


(a) Copy the diagram and on it sketch the graph of $y = f(2x)$.

(b) On a separate diagram sketch the graph of $y = 3 - f(2x)$.

NR2 I can sketch logarithmic and exponential functions and determine a suitable domain or range for a given function/composite function.

1.



The diagram shows a sketch of part of the graph of $y = \log_5 x$.

a) Make a copy of the graph of $y = \log_5 x$.

On your copy, sketch the graph of $y = \log_5 x + 1$.

Find the coordinates of the point where it crosses the ***x***-axis.

b) Make a second copy of the graph of $y = \log_5 x$.

On your copy, sketch the graph of $y = \log_5 \frac{1}{x}$.

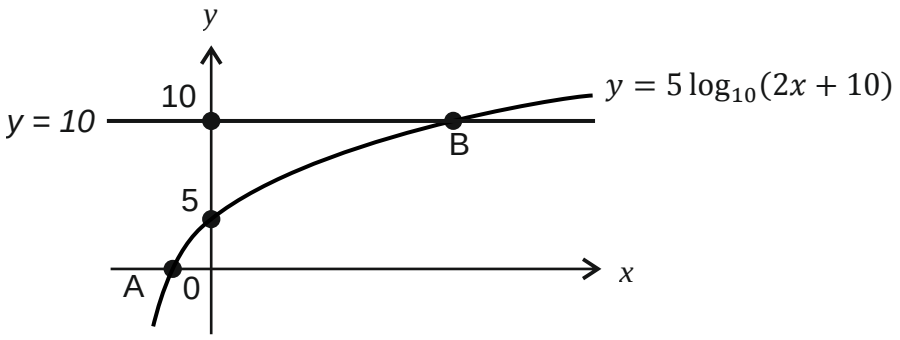
2. The functions *f* and *g*, defined on suitable domains, are given by

$f(x) = \frac{1}{x^2 - 4}$ and $g(x) = 2x + 1$.

a) Find an expression for $h(x)$ where $h(x) = g\big(f(x)\big)$.
Give your answer as a single fraction.

b) State a suitable domain for *h*.

3.



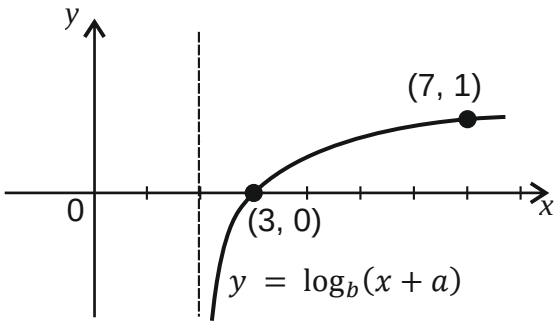
Part of the graph of $y = 5\log_{10}(2x + 10)$ is shown in the diagram (not to scale).

This graph crosses the ***x***-axis at the point A and the straight line $y = 10$ at the point B.

Find algebraically the ***x***-coordinates of A and B.

4. The diagram shows part of the graph of $y = \log_b(x + a)$.

Determine the values of *a* and *b*.



5. The diagram shows part of the graph of $y = 2^x$.

a) Sketch the graph of $y = 2^{-x} - 8$.

b) Find the coordinates of the points where it crosses the ***x*** and ***y*** axes.

6. a) (i) Sketch the graph of $y = a^x + 1,\ a > 2$.

(ii) On the same diagram, sketch the graph of $y = a^{x+1},\ a > 2$

b) Prove that the graphs intersect at a point where the ***x***-coordinate is $\log_a\left(\frac{1}{a-1}\right)$

7. Functions $f(x) = 3x - 1$ and $g(x) = x^2 + 7$ are defined on the set of real numbers.

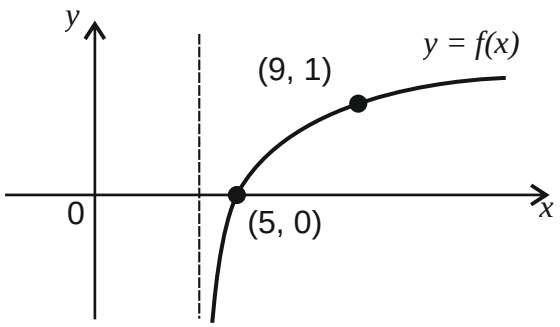
a) Find $h(x)$ where $h(x) = g\big(f(x)\big)$.

b) (i) Write down the coordinates of the minimum turning point y = h(x)

(ii) Hence state the range of the function *h*.

8. The function *f* is of the form $f(x) = \log_b(x - a)$

The graph of $y = f(x)$ is shown in the diagram.

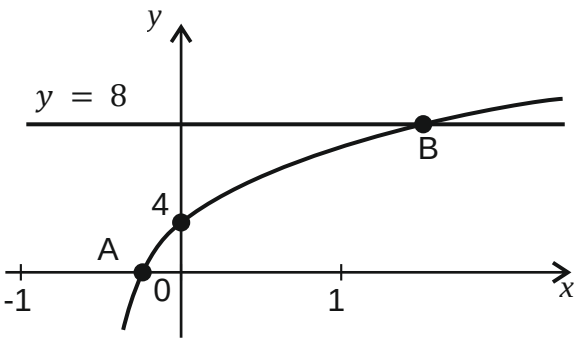


a) Write down the values of *a* and *b*.

b) State the domain of *f*.

9. Part of the graph of $y = 4\log_3(5x + 3)$ is shown in the diagram. This graph crosses the ***x***-axis at the point A and the straight line $y = 8$ at the point B.

Find the ***x***-coordinate of B.



$y = 4\log_3(5x + 3)$

10. Sketch the following pairs of graphs on the same set of axes:

(a) $y = 2^x$ and $y = 2^x + 1$

(b) $y = a^x$ and $y = 3(a^x)$

(c) $y = 3^x$ and $y = 3^{(x+1)}$

(d) $\mathrm{y} = \log_2 x$ and $\mathrm{y} = \log_2 x(x - 3)$

(e) $\mathrm{y} = \log_3 x$ and $\mathrm{y} = \log_3 x + 4$

(f) $\mathrm{y} = \log_5 x$ and $\mathrm{y} = \log_5 25$

(g) $\mathrm{y} = \log_a x$ and $\mathrm{y} = \log_a \frac{1}{x}$

(h) $\mathrm{y} = \log_4 x$ and $\mathrm{y} = 3\log_4(x + 1)$

NR3 I can determine a composite function.

1. Functions f and g, determined on suitable domains, are given by $f(x) = x^2 + 1$ and $g(x) = 1 - 2x$.

Find:

(a) $g(f(x))$ **(b)** $f(g(x))$ **(c)** $g(g(x))$

2. Two functions f and g, are defined by $f(x) = 2x + 3$ and $g(x) = 2x - 3$, where x is a real number.

(a) Find expressions for $f(g(x))$ and $g(f(x))$.

(b) Determine the least possible value of the product $f(g(x)) \times g(f(x))$.

3. Functions $f(x) = 3x - 1$ and $g(x) = x^2 + 7$, are defined on a set of real numbers..

(a) Find h(x) where $h(x) = g(f(x))$.

(b) (i) Write down the coordinates of the minimum turning point of $y = h(x)$

(ii) Hence state the range of the function h.

4. Functions $f(x) = \frac{1}{x-4}$ and $g(x) = 2x + 3$ are defined on suitable domains.

(a) Find an expression for $h(x)$ where $h(x) = f(g(x)$.

(b) Write down any restriction on the domain of h.

5. $f(x) = 3 - x$ and $(x) = \frac{3}{x}$, $x \neq 0$

(a) Find $p(x)$ where $p(x) = f(g(x))$.

(b) If $q(x) = \frac{3}{3-x}$, $x \neq 3$, find $p(q(x))$ in it's simplest form.

6. Functions f and g, determined on suitable domains, are given by $f(x) = x^2 - 1$ and $g(x) = 2 - 3x$.

Find:

(a) $g(f(x))$ **(b)** $f(g(x))$ **(c)** $g(g(x))$

7. Two functions f and g, are defined by $f(x) = 2x + 1$ and $g(x) = 2x - 1$, where x is a real number.

(a) Find expressions for $f(g(x))$ and $g(f(x))$.

(b) Determine the least possible value of the product $f(g(x)) \times g(f(x))$.

8. Functions $f(x) = x - 3$ and $g(x) = x^2 + 2$, are defined on a set of real numbers.

(a) Find $h(x)$ where $h(x) = g(f(x))$.

(b) (i) Write down the coordinates of the minimum turning point of $y = h(x)$

(ii) Hence state the range of the function h.

9. Functions $f(x) = \frac{1}{x+2}$ and $g(x) = 3x - 1$ are defined on suitable domains.

(a) Find an expression for $h(x)$ where $h(x) = f(g(x))$.

(b) Write down any restriction on the domain of h.

10. $f(x) = 4 - x$ and $g(x) = \frac{4}{x}, x \neq 0$

(a) Find $p(x)$ where $p(x) = f(g(x))$.

(b) If $q(x) = \frac{4}{4-x}, x \neq 4$, find $p(q(x))$ in it's simplest form.

NR4 I can determine the inverse of a linear function.

1. Given $f(x) = 3x - 4$, find an expression for $f^{-1}(x)$.

2. Given $g(x) = 5x + 2$, find an expression for $g^{-1}(x)$.

3. Given $h(x) = 2x - 6$, find an expression for $h^{-1}(x)$.

4. Given $f(x) = \frac{1}{2}x + 5$, find an expression for $f^{-1}(x)$.

5. Given $g(x) = \frac{1}{4}x - 3$, find an expression for $g^{-1}(x)$.

6. Given $h(x) = 7 - 3x$, find an expression for $h^{-1}(x)$.

7. Given $f(x) = 2 - 4x$, find an expression for $f^{-1}(x)$.

8. Given $g(x) = \frac{2x-4}{5}$, find an expression $g^{-1}(x)$.

9. Given $h(x) = \frac{3x+2}{4}$, find an expression for $h^{-1}(x)$.

10. Given $f(x) = \frac{6-3x}{2}$, find an expression for $f^{-1}(x)$.

NR5 I have experience of cross topic exam standard questions.

1. Functions f, g and h are defined on the set of real numbers by

- $f(x) = x^3 - 1$
- $g(x) = 3x + 1$
- $h(x) = 4x - 5$

(a) Find $g(f(x))$

(b) Show that $g(f(x)) + xh(x) = 3x^3 + 4x^2 - 5x - 2$

(c) **(i)** Show that $(x - 1)$ is a factor of $3x^3 + 4x^2 - 5x - 2$

(ii) Factorise $3x^3 + 4x^2 - 5x - 2$ fully.

(d) Hence solve $g(f(x)) + xh(x) = 0$

2. Functions f and g are defined on a suitable domain by $f(x) = sin(x°)$ and $g(x) = 2x$

(a) Find expressions for

(i) $f(g(x))$

(ii) $g(f(x))$

(b) Solve $2f(g(x)) = g(f(x))$ for $0 \leq x \leq 360$

3. Functions f, g and h are defined on suitable domains by

$f(x) = x^2 - x + 10$ $\quad g(x) = 5 - x$ $\quad$ and $\quad h(x) = \log_2 x$

(a) Find expressions for h(f(x)) and h(g(x)).

(b) Hence solve $h(f(x)) - h(g(x)) = 3$.

4. Functions $f(x) = \sin x,\ g(x) = \cos x$ and $h(x) = x + \frac{\pi}{4}$ are defined on a suitable set of real numbers.

(a) Find expressions for:

(i) $f(h(x))$

(ii) $g(h(x))$

(b) **(i)** $h(f(x))$

(ii) $h(g(x))$

5. Functions f and g are given by $f(x) = 3x + 1$ and $g(x) = x^2 - 2$

(a) **(i)** Find $p(x)$ where $p(x) = f(g(x))$

(ii) Find $q(x)$ where $q(x) = g(f(x))$

(b) Solve $p'(x) = q'(x)$

6. Functions f and g are defined on the set of real numbers by

- $f(x) = x^2 + 3$
- $g(x) = x + 4$

(a) Find expressions for

(i) $f(g(x))$

(ii) $g(f(x))$

(b) Show that $f(g(x)) + g(f(x)) = 0$ has no real roots.

7. Functions $a(x) = \sin x,\ \ b(x) = \cos x$ and $c(x) = x - \frac{\pi}{4}$ are defined on a suitable set of real numbers.

(a) Find expressions for;

(i) $a(c(x))$;

(ii) $b(c(x))$.

(b) **(i)** Show that $a(c(x)) = \frac{1}{\sqrt{2}}\sin x - \frac{1}{\sqrt{2}}\cos x$.

(ii) Find a similar expression for $b(c(x))$ and hence solve the equation $a(c(x)) + b(c(x)) = 1$ for $0 \leq x \leq 2\pi$.

8. Functions f and g are defined on suitable domains by $f(x) = \sin x°$ and $g(x) = 2x$.

(a) Find expressions for;

(i) $f(g(x))$;

(ii) $g(f(x))$.

(b) Solve $3f(g(x)) = g(f(x))$ for $0 \leq x \leq 360$.