

Function Notation - PDF Copy

The presentation contains the slides below with the objective of enabling students to: i. **Understand $f(x)$ type notation and use this to evaluate given values for single and composite functions** ii. **Understand the use of inverse function notation and find the inverse of a function given in $f(x)$ notation.** The explanation begins with of $y = 2x + 1$ notation compared to $f(x) = 2x + 1$ and then goes on to evaluating given functions and finding inverses.

Function Notation

Objectives
 Understand $f(x)$ type notation and use this to evaluate given values for single and composite functions
 Understand the use of $f^{-1}(x)$ notation and find $f^{-1}(x)$ given $f(x)$

Grade B Topic



1

Here is how we usually write functions for a graph

$y = x + 2$

But we can also give the $x + 2$ function like this...

$f(x) = x + 2$

This says that a function called f changes x values by adding on 2

So we could write...

$y = f(x)$



2

$g(x) = x - 4$ $h(x) = 2x^2 - 1$

Here are two more functions written in this way but using the letters g and h for name of the function

This one says that a function called g changes x values by subtracting 4

And this one says that a function called h changes x values by squaring then multiplying by 2 and then subtracting 1



3

$g(x) = x - 4$ $h(x) = 2x^2 - 1$

We can use any letter for the name of a function but we normally start with the letter f then g then h ...

One advantage of writing a function in this way is that we can show the results obtained from values of x in this way...



4

$g(x) = x - 4$ $h(x) = 2x^2 - 1$
 $g(5) = 1$ $h(4) = 31$

Putting 5 in the brackets, for example, results in a value of 1 because $5 - 4 = 1$

Putting 4 into function h results in a value of 31 because $2 \times 4^2 - 1 = 31$



5

Evaluate these functions

- $f(x) = 2x - 4$
 $f(3) =$
 $f(5) =$
- $g(x) = 5 - x$
 $g(2) =$
 $g(7) =$
- $k(x) = x^2 + 3$
 $k(4) =$
 $k(10) =$
- $m(x) = 12 - x^2$
 $m(3) =$
 $m(6) =$
- $k(x) = 3x^2 - x - 12$
 $k(2) =$
 $k(7) =$
- $m(x) = x^4 - x^2$
 $m(5) =$
 $m(10) =$



6

Here are the answers

- $f(x) = 2x - 4$
 $f(3) = 2$
 $f(5) = 6$
- $g(x) = 5 - x$
 $g(2) = 3$
 $g(7) = -2$
- $k(x) = x^2 + 3$
 $k(4) = 19$
 $k(10) = 103$
- $m(x) = 12 - x^2$
 $m(3) = 3$
 $m(6) = -24$
- $k(x) = 3x^2 - x - 12$
 $k(2) = 2$
 $k(7) = 128$
- $m(x) = x^4 - x^2$
 $m(5) = 100$
 $m(10) = 900$



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Composite Functions



8

Here we have two functions, if we put the value 3 into function f and then put this value into function g, the combined result is...

$$f(x) = x + 1 \quad g(x) = x^2$$

$$f(3) = 3 + 1 \quad g(4) = 4^2$$

$$f(3) = 4 \quad g(4) = 16$$

Using brackets, we can write this in this way... $g(f(3)) = 16$

Evaluate 3 in function f... then put this value into function g

☆ **9**

Here we have two functions, if we put the value 3 into function f and then put this value into function g, the combined result is...

$$f(x) = x + 1 \quad g(x) = x^2$$

$$f(3) = 3 + 1 \quad g(4) = 4^2$$

$$f(3) = 4 \quad g(4) = 16$$

The brackets are a bit rather clumsy and it can be written as... $gf(3) = 16$

...which is evaluated in exactly the same way function f followed by function g

☆ **10**

Given that $f(x) = x^2$ and $g(x) = 2x + 1$, evaluate a. $fg(3)$ and b. $gf(3)$

Here is one for you to try

First find $g(3)$ $gf(3) = f(g(3))$

$$g(3) = 2 \times 3 + 1 \quad f(3) = 3^2$$

$$g(3) = 7 \quad f(3) = 9$$

Now put 7 into g $f(7) = 7^2$ $g(7) = 2 \times 9 + 1$

$$f(7) = 49 \quad g(7) = 19$$

$$fg(3) = 49 \quad gf(3) = 19$$

☆ **11**

Given that $f(x) = x - 1$, $g(x) = x^2$, $h(x) = (x + 3)^2$ and $m(x) = 2x + 1$ evaluate these composite functions

- $fg(3)$
- $gf(3)$
- $fh(5)$
- $hf(5)$
- $gh(3)$
- $hg(3)$
- $mh(2)$
- $fm(10)$

☆ **12**

Given that $f(x) = x - 1$, $g(x) = x^2$, $h(x) = (x + 3)^2$ and $m(x) = 2x + 1$ evaluate these composite functions

- $fg(3) = 8$
- $gf(3) = 4$
- $fh(5) = 63$
- $hf(5) = 49$
- $gh(3) = 1296$
- $hg(3) = 144$
- $mh(2) = 51$
- $fm(10) = 20$

☆ **13**

Inverse Functions

☆ **14**

Another advantage of this type of notation is that gives us a way of writing inverse functions. Here is an example of how the inverse of function f would be written...

The function f changes x values by adding on 3 $f(x) = x + 3$

The inverse of $+3$ is -3 $f^{-1}(x) = x - 3$

We write the inverse function of f like this... The small -1 says that it is the inverse of function f

☆ **15**

In more complicated functions, it may help to find the inverse by writing down the operations of the function like this...

Function f does this to x value... $f(x) = 2x - 5$

The inverse of these two operations are $f^{-1}(x) = \frac{(x+5)}{2}$

So the inverse of function f is...

☆ **16**

Remember that you can always check your answer. Here is an example...

$$f(x) = 5(x+1)^2 \Rightarrow f^{-1}(x) = \sqrt{(x/5)} - 1$$

We think that the inverse is... But is this correct? ✓

Put a simple value of x into f. We've used 3 $f(3) = 80$

Put this into f^{-1} if this results in 3, the f^{-1} is correct $f^{-1}(80) = 3$

It's 3, so f^{-1} is correct

☆ **17**

Remember that you can always check your answer. Here is an example...

$$f(x) = 5(x+1)^2 \Rightarrow f^{-1}(x) = (\sqrt{(x-1)})/5$$

We think... Here is an example of how this shows that f^{-1} is incorrect $f^{-1}(80) = 1.77...$ ✗

Put a simple value of x into f. We've used 3 $f(3) = 80$

Put this into f^{-1} if this results in 3, the f^{-1} is correct $f^{-1}(80) = 1.77...$

It's not 3, so f^{-1} is incorrect

☆ **18**

Try to complete the inverse functions...

- $f(x) = x - 2 \Rightarrow f^{-1}(x)$
- $g(x) = 3x \Rightarrow g^{-1}(x)$
- $h(x) = 2x - 1 \Rightarrow h^{-1}(x)$
- $m(x) = x^2 \Rightarrow m^{-1}(x)$
- $n(x) = (x + 3)^2 \Rightarrow n^{-1}(x)$
- $p(x) = 4x^2 - 3 \Rightarrow p^{-1}(x)$
- $q(x) = (3x + 2)^2 \Rightarrow q^{-1}(x)$
- $r(x) = \sqrt{(x + 3)} \Rightarrow r^{-1}(x)$

☆ **19**

Try to complete the inverse functions...

- $f(x) = x - 2 \Rightarrow f^{-1}(x) = x - 2$
- $g(x) = 3x \Rightarrow g^{-1}(x) = x/3$
- $h(x) = 2x - 1 \Rightarrow h^{-1}(x) = (x + 1)/2$
- $m(x) = x^2 \Rightarrow m^{-1}(x) = \sqrt{x}$
- $n(x) = (x + 3)^2 \Rightarrow n^{-1}(x) = \sqrt{x} - 3$
- $p(x) = 4x^2 - 3 \Rightarrow p^{-1}(x) = (\sqrt{(x + 3)})/2$
- $q(x) = (3x + 2)^2 \Rightarrow q^{-1}(x) = \sqrt{(x - 2)}/3$
- $r(x) = \sqrt{(x + 3)} \Rightarrow r^{-1}(x) = x^2 - 3$

☆ **20**