

File Home Insert Page Layout References Mailings Review View MathType

Comic Sans MS 14 A A Aa

Paste B I U abc x₂ x² A ab A

Paragraph

Styles

Find Replace Select Editing

7.7. Advanced Algebra Operations on Functions

DATE: 2/3

Target 6C. Create compositions of polynomial functions.

Functions can also be combined using **composition of functions**. In a composition, a function is performed, and then a second function is performed on the result of the first function. The composition of f and g is denoted by $f \circ g$, which is read "f of g".

Composition of Functions

The composite function $f \circ g$ can be described by the equation

$$(f \circ g)(x) = f(g(x))$$

Evaluating Polynomials

Find each value if $f(x) = 4x - 7$ and $g(x) = 2x^2 - 3x + 1$

1. $f(-3)$ "f of -3"

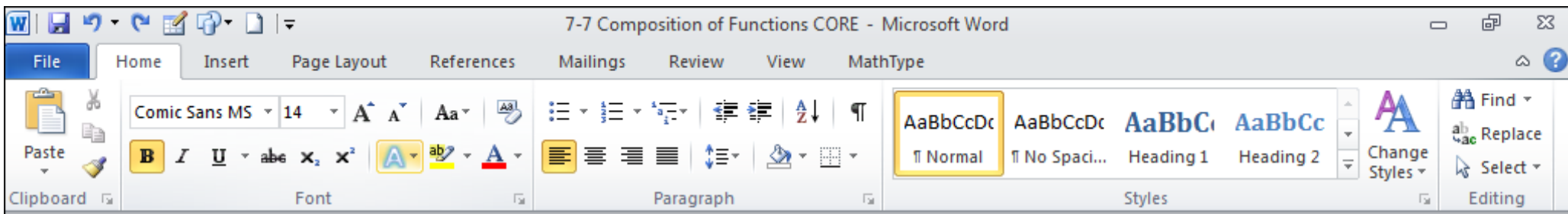
$$f(-3) = 4(-3) - 7 \\ = -12 - 7 = -19 \checkmark$$

2. $g(2a)$ "g of 2a"

$$g(2a) = 2(2a)^2 - 3(2a) + 1 \\ = 2 \cdot 2^2 \cdot a^2 - 6a + 1 \\ = 2 \cdot 4a^2 - 6a + 1 \\ = 8a^2 - 6a + 1 \checkmark$$

Replace
-3 for all
x in the
f function

Replace 2a for all
x in the g function



3. $f(g(1))$ "f of g of 1"

Evaluate $g(1)$ first: $g(1) = 2(1)^2 - 3(1) + 1$

Now evaluate outside

function f next: $f(0) = 4(0) - 7 = -7 \leftarrow \text{Answer}$

4. $g(f(1))$ "g of f of 1"

Evaluate $f(1)$ first: $f(1) = 4(1) - 7$

Now evaluate outside

function g next: $g(-3) = 2(-3)^2 - 3(-3) + 1 = 28 \leftarrow \text{Answer}$

Simplify Compositions of Functions

	$f(x) = x^2 - 3x + 5$ $g(x) = 2x - 3$ Example 1: Find $(f \circ g)(x) = f(g(x))$						
1. Plug-in the entire inside function into the outside function wherever there's an x	So $f(g(x)) =$ $(2x-3)^2 - 3(2x-3) + 5$						
2. Simplify $(2x-3)^2 = (2x-3)(2x-3)$ <table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td style="padding: 5px;">$2x$</td> <td style="padding: 5px;">-3</td> </tr> <tr> <td style="padding: 5px;">$4x^2$</td> <td style="padding: 5px;">$-6x$</td> </tr> <tr> <td style="padding: 5px;">$-6x$</td> <td style="padding: 5px;">$+9$</td> </tr> </table>	$2x$	-3	$4x^2$	$-6x$	$-6x$	$+9$	$4x^2 - 12x + 9 - 6x + 9 + 5 = 4x^2 - 18x + 23$
$2x$	-3						
$4x^2$	$-6x$						
$-6x$	$+9$						

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



$4x^2 - 12x + 9$

$4x^2 - 12x + 9 - 6x + 9 + 5 = 4x^2 - 18x + 23$

7-7 Composition of Functions CORE - Microsoft Word

File Home Insert Page Layout References Mailings Review View MathType Design Layout

Calibri (Body) 11 A A Aa

B I U abc x₂ x² ab A

Font Paragraph Styles

Table Tools Design Layout

AaBbCcDc AaBbCcDc AaBbCc AaBbCc

Normal No Spaci... Heading 1 Heading 2

Find Replace Select Editing

	$f(x) = x^2 - 3x + 5$ $g(x) = 2x - 3$
<p>Example 2: Find $g(f(x))$</p> <p>1. Plug-in the entire inside function into the outside function wherever there's an x</p>	$2(x^2 - 3x + 5) - 3$
<p>2. Simplify</p>	$2x^2 - 6x + 10 - 3 = 2x^2 - 6x + 7$

<p>Example 3: Find $g(f(x))$</p> $f(x) = 4x^2 + 2$ $g(x) = 2x$ $2(4x^2 + 2)$ $8x^2 + 4 \checkmark$	<p>Example 4: Find $f(g(x))$</p> $f(x) = 4x^2 + 2$ $g(x) = 2x$ $4(2x)^2 + 2$ $4 \cdot 2^2 \cdot x^2 + 2$ $4 \cdot 4 \cdot x^2 + 2$ $16x^2 + 2 \checkmark$
---	--

7-7 Composition of Functions CORE - Microsoft Word

File Home Insert Page Layout References Mailings Review View MathType Design Layout

Clipboard Font Paragraph Styles Editing

Example 5: Find $h(k(x))$

$$k(x) = -3x - 15$$

$$h(x) = x + 5$$

$$(-3x - 15) + 5$$

$$\underline{-3x - 10} \quad \checkmark$$

Example 6: Find $k(h(x))$

$$k(x) = -3x - 15$$

$$h(x) = x + 5$$

$$-3(x + 5) - 15$$

$$-3x - 15 - 15$$

$$\underline{-3x - 30} \quad \checkmark$$

Example 7: Find $g(f(x))$

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

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

$$(2x^2 + 4x - 3) - 2$$

$$\underline{2x^2 + 4x - 5} \quad \checkmark$$

Example 8: Find $f(g(x))$

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

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

$$2(x-2)^2 + 4(x-2) - 3$$

$$2(x^2 - 4x + 4) + 4x - 8 - 3$$

$$2x^2(-8x) + 8(+4x) - 8 - 3$$

$$\underline{2x^2 - 4x - 3} \quad \checkmark$$

	x	-2
x	x ²	-2x
-2	-2x	+4

$$\underline{x^2 - 4x + 4}$$