

Due date: \_\_\_\_\_

Name: \_\_\_\_\_

## Getting Ready for Derivatives (Part 2)

Notesex: Factor  $2(2x - 1)^3(x - 3) + 6(2x - 1)^2(x - 3)^2$ 1. Factor each of the following. You will need to factor out a binomial  $(a + b)^n$ 

a)  $32x^4(2x^2 + 1) - 12x^2(2x^2 + 1)^2$

b)  $(x - 1)^3 4x(x^2 - 3) + 3(x - 1)^2(x^2 - 3)^2$

**Notes**

ex: Given  $f(x) = \frac{1}{x}$ ,  $g(x) = 2^{x+1}$ , and  $h(x) = \sqrt{3x-1}$ , evaluate the following:

$$f(g(2))$$

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

$$f(g(h(x)))$$

2. Given  $f(x) = 4 - x^2$ ,  $g(x) = \sqrt{x+3}$ , and  $h(x) = \frac{1}{2x}$ , evaluate

a)  $(f \circ g)(3)$

b)  $g(f(0))$

c)  $(f \circ g)(x^2)$

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

e)  $(f \circ g)(-4)$

f)  $(f \circ g \circ h)(0)$

3. Find  $f \circ g$  and  $g \circ f$  for the following functions. Find the domain for each composition.

$$f(x) = e^{-2x}, \quad g(x) = \sqrt{x+1}$$

$$f \circ g = \underline{\hspace{4cm}}$$

$$g \circ f = \underline{\hspace{4cm}}$$

$$\text{Domain of } f \circ g: \underline{\hspace{4cm}}$$

$$\text{Domain of } g \circ f: \underline{\hspace{4cm}}$$

**Notes**

ex: Decompose the following functions.

$$f(g(x)) = \ln(2x^3 + 7)$$

$$f(g(h(x))) = 2^{\tan^{-1}\sqrt{x}}$$

ex: Describe the following function in words:  $\ln x \sin(2^x)$

4. Decompose the following functions.

a)  $f(g(x)) = \sqrt{x^2 + 5}$

$f(x) =$  \_\_\_\_\_

$g(x) =$  \_\_\_\_\_

b)  $f(g(x)) = \frac{3}{(3x^2 - 2x + 6)^4}$

$f(x) =$  \_\_\_\_\_

$g(x) =$  \_\_\_\_\_

c)  $f(g(x)) = e^{2 \sin x}$

$f(x) =$  \_\_\_\_\_

$g(x) =$  \_\_\_\_\_

d)  $f(g(x)) = \tan^{-1}(\sqrt[4]{x})$

$f(x) =$  \_\_\_\_\_

$g(x) =$  \_\_\_\_\_

e)  $f(g(h(x))) = \csc(\cos^{-1}(\sqrt[3]{x}))$

$f(x) =$  \_\_\_\_\_

$g(x) =$  \_\_\_\_\_

$h(x) =$  \_\_\_\_\_

f)  $f(g(h(r(x)))) = \ln(\sqrt{2 + \sin(3x - 1)})$

$f(x) =$  \_\_\_\_\_

$g(x) =$  \_\_\_\_\_

$h(x) =$  \_\_\_\_\_

$r(x) =$  \_\_\_\_\_

5. Each of the following functions is a combination of two or more functions of the variable  $x$ . They are either a sum, difference, product, quotient, composition or combination of these. Describe each in words. Don't just write "product" but follow the example shown and specify the functions.

*Example:*  $x^2 \cos(2x + 1)$  is a product of  $x^2$  and  $\cos(2x + 1)$  and a composition of  $2x + 1$  inside  $\cos x$

a)  $\ln(2x^2 + 3)$

b)  $e^x \sin(x)$

c)  $2x + \cos^2 x$

**Notes**

ex: Solve the following equation.

$$3 \sin x \cos x - 3 \sin x = 0$$

6. Solve each of the following equations.

a)  $2 \sin x \cos x + 2 \cos x = 0$

b)  $\cos^2 x - \sin^2 x = 0$

**Practice at home**

7. Factor each of the following. You will need to factor out a binomial  $(a + b)^n$

a)  $30x^2(2x - 1)^2 + 10x(2x - 1)^3$

b)  $9(x^2 + 2)^2(3x - 4)^2 + 4x(x^2 + 2)(3x - 4)^3$

8. Given  $f(x) = \frac{2}{x+1}$ ,  $g(x) = \sin x$ , and  $h(x) = 2x + 1$ , evaluate

a)  $(f \circ g)\left(\frac{\pi}{2}\right)$

b)  $h(f(0))$

c)  $(f \circ g)(x^2)$

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

$$e) (f \circ g)\left(\frac{3\pi}{2}\right)$$

9. Find  $f \circ g$  and  $g \circ f$  for the following functions. Find the domain for each composition.

a)  $f(x) = -x + 2$ ,  $g(x) = \ln x$

$$f \circ g = \underline{\hspace{2cm}}$$

$$g \circ f = \underline{\hspace{2cm}}$$

$$\text{Domain of } f \circ g: \underline{\hspace{2cm}}$$

$$\text{Domain of } g \circ f: \underline{\hspace{2cm}}$$

b)  $f(x) = \sqrt{x}$ ,  $g(x) = x - 3$

$$f \circ g = \underline{\hspace{2cm}}$$

$$g \circ f = \underline{\hspace{2cm}}$$

$$\text{Domain of } f \circ g: \underline{\hspace{2cm}}$$

$$\text{Domain of } g \circ f: \underline{\hspace{2cm}}$$

10. Decompose the following functions.

a)  $f(g(x)) = \ln(2 - x^2)$

$$f(x) = \underline{\hspace{2cm}}$$

$$g(x) = \underline{\hspace{2cm}}$$

b)  $f(g(h(x))) = -\frac{1}{\sin \sqrt{x}}$

$$f(x) = \underline{\hspace{2cm}}$$

$$g(x) = \underline{\hspace{2cm}}$$

$$h(x) = \underline{\hspace{2cm}}$$

c)  $f(g(h(x))) = e^{\tan^{-1} x^4}$

$$f(x) = \underline{\hspace{2cm}}$$

$$g(x) = \underline{\hspace{2cm}}$$

$$h(x) = \underline{\hspace{2cm}}$$

c)  $f(g(h(r(x)))) = \sqrt[3]{\frac{1}{\tan(\ln x)}}$

$$f(x) = \underline{\hspace{2cm}}$$

$$g(x) = \underline{\hspace{2cm}}$$

$$h(x) = \underline{\hspace{2cm}}$$

$$r(x) = \underline{\hspace{2cm}}$$

11. Each of the following functions is a combination of two or more functions of the variable  $x$ . They are either a sum, difference, product, quotient, composition or combination of these. Describe each in words. Don't just write "product" but follow the example shown and specify the functions.

*Example:*  $x^2 \cos(2x + 1)$  is a product of  $x^2$  and  $\cos(2x + 1)$  and a composition of  $2x + 1$  inside  $\cos x$

a)  $4^x \sec x$

b)  $(4x^2 - 1)^7 - \sqrt{x}$

c)  $\frac{\sqrt{\tan^{-1} x}}{x^2}$

12. Solve each of the following equations.

a)  $2 \sin x \cos x - \sqrt{2} \cos x = 0$

b)  $\sin x \cos x + \cos^2 x = 0$