

## HOMEWORK #16

Math 105 Review Packet for Exam #2

**Due Wednesday October 30** at the beginning of class.

**Derivatives:** Compute the derivative of each of the following functions **two** different ways:

- First use the **limit definition of the derivative**.
- Second use the Differentiation Rules.

1.  $f(x) = \frac{1}{x^2}$

2.  $f(x) = \sqrt{3x - 7}$

3.  $f(x) = \frac{3x + 2}{5 - 6x}$

**Horizontal Tangent Lines:** Find **all**  $x$ -coordinates at which the graphs of the following functions have horizontal tangent lines. Please **simplify** your derivatives first by factoring out common factors.

4.  $f(x) = \frac{1}{(x^2 - 3x)^7}$

5.  $f(x) = (4x - 1)^3(2x + 7)^5$

**Differentiation Rules:** Differentiate the following functions. Please do **not** simplify your derivatives here.

6.  $H(x) = \left(1 - \frac{2}{x^2}\right)^5$

7.  $g(t) = \frac{t^3 + \frac{1}{t}}{1 + t^2}$

8.  $p(x) = \frac{1}{(-2x + 3)^5}$

9.  $r(x) = \frac{(2x + 1)^3}{(3x + 1)^4}$

10.  $S(x) = \left(\frac{1 + 2x}{1 + 3x}\right)^4$

11.  $y = ((x^2 + 3x)^4 + x)^{-\frac{5}{7}}$

**Tangent Lines:**

12. Find an equation for the tangent line to the graph of  $y = x^2 - 4x + 2$  when  $x = 1$ .
13. Find an equation for the tangent line to the graph of  $f(x) = \frac{1}{x-1}$  at the point  $(0, -1)$ .
14. Find an equation for the tangent line to the graph of  $f(x) = \sqrt{x}$  at  $x = 4$
15. Find an equation for the tangent line to the graph of  $f(x) = \frac{1+x^2}{\sqrt{2x+1}}$  at  $x = 0$
16. At which point(s) of the graph of  $f(x) = -x^3 + 13$  is the slope of the tangent line equal to  $-27$ ? What's the picture representing this problem?

**More derivatives:**

17. Let  $f$  and  $g$  be two differentiable functions, and suppose that their values and the values of their derivatives at  $x = 1, 2, 3$  are given by the following table:

$x$	1	2	3
$f(x)$	3	2	5
$f'(x)$	-2	1	3
$g(x)$	3	1	4
$g'(x)$	-3	2	7

Let  $h(x) = f \circ g(x)$  and  $k(x) = f(x) \cdot g(f(x))$ . Compute  $h'(2)$  and  $k'(1)$ .

18. Let  $f$  and  $g$  be two differentiable functions, and suppose that their values and the values of their derivatives at  $x = 2, 3$  are given by the following table:

$x$	2	3
$f(x)$	4	0
$f'(x)$	1	-7
$g(x)$	3	-1
$g'(x)$	-5	4

Let  $h(x) = f(x)g(x)$ ,  $k(x) = \frac{f(x)}{g(x)}$  and  $W(x) = f \circ g(x)$ . Compute  $h'(2)$  and  $k'(2)$  and  $W'(2)$ .

19. Let  $f(x) = \sqrt{x+1} \cdot g(x)$  where  $g(0) = -7$  and  $g'(0) = 4$ . Compute  $f'(0)$ .
20. Let  $f(x) = \frac{\sqrt{x^2+1}}{g(x)}$  where  $g(0) = -7$  and  $g'(0) = 4$ . Compute  $f'(0)$ .

**Implicit Differentiation:** Use implicit differentiation to find the derivative of  $y$  with respect to  $x$ , for each of the following equations.

21.  $x^2 + x^2y^2 + y^3 = 3x + 7$
22.  $x^3 + x^2y^{\frac{3}{2}} = y^3 + 7$