

**Math 100 – WORKSHEET 6**  
**POLYNOMIALS AND EXPONENTIALS**

1. DIRECT PROBLEMS

(1) If  $f, g$  are functions and  $a, b$  are numbers then  $(af + bg)' = af' + bg'$ ,  
(2)  $(fg)' = f'g + fg'$ ,  $\left(\frac{f}{g}\right)' = \frac{f'g - fg'}{g^2}$ , (3)  $\frac{d}{dx}(x^r) = rx^{r-1}$ , (4)  $\frac{d}{dx}(e^x) = e^x$ .

(1) Differentiate

(a)  $f(x) = 6x^\pi + 2x^e - x^{7/2}$

(b) (Final, 2016)  $f(x) = x^2 e^x$  (also try  $x^a e^x$ )

(c) (Final, 2016)  $f(x) = \frac{x^2+3}{2x-1}$

(d)  $f(x) = \frac{\sqrt{x(1-3x)}}{x^2+1}$

(e)  $f(x) = \frac{x^2 + xe^x}{\cos x + \sin x}$

## 2. EXPONENTIALS

(1) Simplify  $(e^5)^3$ ,  $(2^{1/3})^{12}$ ,  $7^{3-5}$ .

(2) Differentiate:

(a)  $10^x$

(b)  $\frac{5 \cdot 10^x + x^2}{3^x + 1}$

## 3. TANGENT LINES

(1) Suppose that  $f(1) = 1$ ,  $g(1) = 2$ ,  $f'(1) = 3$ ,  $g'(1) = 4$ . Find  $(fg)'(1)$  and  $\left(\frac{f}{g}\right)'(1)$ .

(2) (Final, 2015) Find the equation of the line tangent to the function  $f(x) = \sqrt{x}$  at  $(4, 2)$ .

(3) Find the lines of slope 3 tangent the curve  $y = x^3 + 4x^2 - 8x + 3$ .

(4) Let  $f(x) = \frac{g(x)}{x}$ , where  $g(x)$  is differentiable at  $x = 1$ . The line  $y = 2x - 1$  is tangent to the graph  $y = f(x)$  at  $x = 1$ . Find  $g(1)$  and  $g'(1)$ .

(5) (Final 2015) The line  $y = 4x + 2$  is tangent at  $x = 1$  to which function:  $x^3 + 2x^2 + 3x$ ,  $x^2 + 3x + 2$ ,  $2\sqrt{x+3} + 2$ ,  $x^3 + x^2 - x$ ,  $x^3 + x + 2$ , none of the above?