Math 130 Day 15

Office Hours (LN 301/301.5): M 3:30-4:30, Tu 11:00-1:00, W 12:15-1:15, F 1:30-2:30. Other times by appointment. **Math Intern:** Sun through Thurs: 3:00–6:00, 7:00–10:00pm. **Website:** Use the links at the course homepage on **Canvas** or go to my course Webpage: `http://math.hws.edu/~mitchell/Math130F16/index.html`.

Practice and Reading

1. Today we will begin to make a catalogue of functions whose derivatives we know. Review Chapter 3.2. Read 3.3. We will begin to pick up the pace now.

2. I expect to cover the **Sum/Difference Rule**, the **Constant Multiple Rule** and the **Power Rule for Derivatives** today. Use them to for some of the problems below. Practice page 151ff #1, 5, 7–17 odd, 19 and 21. These should be quick!

- **a)** Practice page 151ff: Multiply out first: #25 and 27.
- **b)** More challenging: #39, 41 and 51 Hint: Use the graph to determine $f'(1)$ and $g'(1)$. Use a derivative property to evaluate $G'(1)$.

3. Quickly determine the derivatives of the following functions by using derivative rules.

a) x^4 **b)** $-3x+2\pi$ **c)** $x^{2/5}$ **d)** $\sqrt{x}$ **e)** $\dfrac{1}{x}$ **f)** $4x^{-3}$ **g)** $8x^{3/2}$

h) $\dfrac{10}{\sqrt[3]{x}}$ **i)** $x^{27}+9$ **j)** 12 **k)** $2\sqrt[5]{x^4}+1$ **l)** $\dfrac{1}{4x^3}$ **m)** $\dfrac{12}{\sqrt[5]{x^4}}$ **n)** $3x^{-8/7}-101$

- **o)** Find the equation of the tangent line in part (c) at $x=1$.
- **p)** Using (d), what is the equation of the tangent line at $x=4$?

Answers: (a) $4x^3$; (b) -3; (c) $\frac{2}{5}x^{-3/5}$; (d) $\frac{1}{2}x^{-1/2}$; (e) $-x^{-2}$; (f) $-12x^{-4}$; (g) $12x^{1/2}$; (h) $-\frac{10}{3}x^{-4/3}$; (i) $27x^{26}$; (j) 0; (k) $\frac{8}{5}x^{-1/5}$; (l) $-\frac{3}{4}x^{-4}$; (m) $-\frac{48}{5}x^{-9/5}$; (n) $-\frac{24}{7}x^{-15/7}$. (o) $y=\frac{x}{4}+1$.

Home Work Part I: Prep for Derivatives of Exponentials. Name: ____________________

1. a) Fill in Table 1 below for the values of $y=a^x$. Then graph the remaining functions on the given axes using your table values.

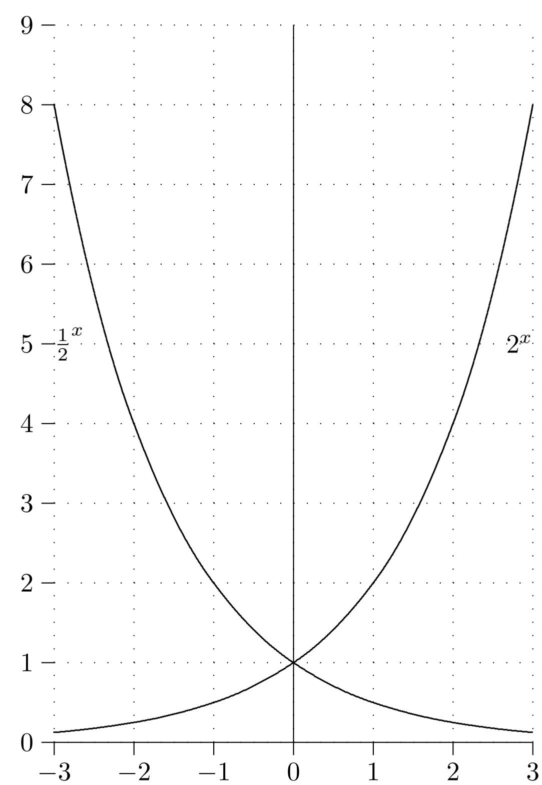
b) Then fill in Table 2 using a calculator and at least 5 decimal places.

Table 1.

x	2^x	3^x	1^x	$\frac{1}{2}^x$	$\frac{1}{3}^x$
-3	$\frac{1}{8}$			8	
-2	$\frac{1}{4}$			4	
-1	$\frac{1}{2}$			2	
0	1			1	
1	2			$\frac{1}{2}$	
2	4			$\frac{1}{4}$	
3	8			$\frac{1}{8}$	

Table 2.

h	$\dfrac{(2^h-1)}{h}$
.01	
.0001	
.000001	
$-.001$	
$-.000001$	



☞Additional homework on next two pages.
Monday's homework will be shorter, I promise. But you need to practice the basic derivative rules.

Math 130 Day 15, Hand In. Name: ________________________

Do lots of differentiation practice (see page 1). WeBWorK Set Day 15. Due **Tuesday**. Try for Monday's class.

1. Use the derivative rules to determine these derivatives. Convert to exponent notation if needed. **Mathematical Grammar.** Write your answers in the form $\frac{d}{dx}[f(x)] = f'(x)$ (or other appropriate variable).

Model Problem: Find the derivative of $f(t) = \dfrac{3}{t^{4/3}}$.

Solution: First rewrite f in exponent form: $\dfrac{d}{dt}\left[\dfrac{3}{t^{4/3}}\right] = \dfrac{d}{dt}[3t^{-4/3}] \overset{\text{Const Mult, Power Rules}}{=} 3(-\frac{4}{3}t^{-7/3}) = -4t^{-7/3}$.

Note the use of $\frac{d}{dt}$ because the variable is t.

a) P. 151 #8

b) P. 151 #10 (be careful)

c) P. 151 #12

d) P. 151 #18

e) P. 151 #20

f) P. 151 #22

g) $\frac{d}{dt}\left[\frac{10}{t^2}\right] =$

h) $\frac{d}{ds}\left[\frac{1}{\sqrt[5]{s^2}} + 6\right] =$

i) What is the equation of the tangent line in part (e) at $(1, f(1))$?

2. Remember that the derivative represents an instantaneous rate of change. Suppose the position of an object moving along a line is given by $s(t) = 2t^2 - 12t + 10$, where position is measured in meters and time in seconds.

a) Determine the function that describes the *instantaneous velocity* of the object. (Use derivative rules—short way.)

b) At what time t is the *instantaneous velocity* 0?

3. Rates of Growth. Remember that the derivative represents an instantaneous rate of change. The surface area (skin) S, measured in m^2, and the weight w, measured in kg, of a cow are related by the function $S(w) = 0.9w^{2/3}$. What is the *instantaneous rate of change* in the surface area S of the cow? (Use derivative rules—short way.)

4. **a)** Let $f(x) = (x^2 + 1)(x + 3)$. Determine $f'(x)$. Hint: First multiply $f(x)$, then use derivative properties.

5. Fill in this table using your knowledge of continuity an differentiability.

a	$\lim_{x\to a^-} f(x)$	$\lim_{x\to a^+} f(x)$	$\lim_{x\to a} f(x)$	$f(a)$	Continuous	Removable	Differentiable
2				1			Yes
3		2				Yes	
4			1	2			

6. Let $f(x) = \dfrac{1}{x+1}$. We do not have a derivative rule to handle this. Use the definition of the derivative as $\lim_{h \to 0} \dfrac{f(x+h) - f(x)}{h}$ to determine $f'(x)$.

7. Let $f(x) = \sqrt{x+1}$. We do not have a derivative rule to handle this. Use the definition of the derivative as a limit (as above) to find the derivative.