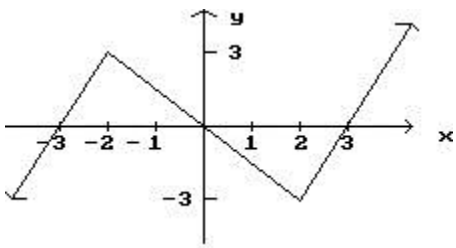
MTH-140 Review for Test 2 Luczak

1. Find $f'(x)$ by the definition if $f(x)=4x^2-3x+5$
2. Find $f'(x)$ by the definition if $f(x)=\dfrac{1}{x+1}$

3. Is $f(x)=|x-4|$ continuous at $x=4$? Is $f(x)=|x-4|$ differentiable at $x=4$? Explain your answer.
4. For what values of *x* is the graph not differentiable?



5. Let $f(x)=2x^3-5x^2+7$ find the following:
   a. The instantaneous rate of change at $x=4$
   b. The average rate of change on the interval $[3,5]$

6. For each of the following functions find the derivative.

a) $f(x)=\left(5-e^{\frac{1}{x}}\right)^{\frac{3}{2}}$

b) $f(x)=\dfrac{\left(5x^2+3\right)^2}{x-1}$

c) $f(x)=(x+5)^2\sqrt{x^2+1}$

d) $f(x)=\sin^{-1}(\cos x)$

e) $f(x)=\ln\dfrac{e^2}{5}$

f) $f(x)=\sec^2\dfrac{x^2}{3}$

g) $f(x)=\ln\dfrac{\sqrt{x^2+1}}{x\left(2x^3-1\right)^2}$

h) $f(x)=10^{\csc 3x}$

i) $y=\left(\dfrac{\cos x}{1+\sin x}\right)^6$

j) $y=\ln\left(\cos\left(\ln x\right)\right)$

k) $y=\left(x+\dfrac{1}{x}\right)\left(x-\dfrac{1}{x}\right)$

7. Find the equation of the line tangent to the graph of $f(x)=\dfrac{e^{2x}+1}{x+1}$ at $x=0$.
8. Does the function $f(x)=12x+6\sin x$ have any points at which the tangent line is horizontal on the interval $[0,2\pi]$? Explain.

9. Given $f(x)=\dfrac{1}{3}x^3-2x^2-5x+3$

   a. Find $f'(x)=$ _____

   b. At what point (ordered pair) is the slope of the tangent line zero?

10. Let f and g be functions that satisfy $f(4)=-1,\ g(4)=3,\ f'(4)=2,$ and $g'(4)=-3.$ $h'(4)$ for $h(x)=f(x)g(x)-2f(x)+7$

11. The derivative of a function is given state the original function:

a) $f'(x)=3\left(e^{2x}+1\right)^2\left(2e^{2x}\right)$

b) $f'(x)=\dfrac{1}{2}(\ln x)^{-\frac{1}{2}}\left(\dfrac{1}{x}\right)$

12. TRUE or FALSE: If $P(x)$ is a 6th degree polynomial then $P^{(7)}(x)=0$. Explain.

13. Prove: $\frac{d}{dx}(fgh)=f'gh+fg'h+fgh'$

14. Prove one of the following:

a. $\frac{d}{dx}(\tan x)=\sec^2 x$

b. $\frac{d}{dx}(\csc x)=-\csc x\cot x$

c. $\frac{d}{dx}(\sec x)=\sec x\tan x$

d. $\frac{d}{dx}(\cot x)=-\csc^2 x$

15. TRUE or FALSE: $\frac{d}{dx}\left(f(x)g(x)\right)=f'(x)g'(x)$. Explain your answer.