MSLC – Math 1151
Exam 2 Review (AAOL to CFGF)

Disclaimer: This review should NOT be used as your only guide for what to study.

1. Let $f(x)=\dfrac{1}{x+1}$. Find $\lim\limits_{x\to 2}\dfrac{f(x)-f(2)}{x-2}$

2. Let $f(x)=x^2-3x+2$. Using $\lim\limits_{h\to 0}\dfrac{f(a+h)-f(a)}{h}$ find $f'(1)$. Give the equation of the tangent line at $x=1$.

3. Let $f(x)=\sqrt{x-4}$. Using $\lim\limits_{h\to 0}\dfrac{f(a+h)-f(a)}{h}$ find $f'(6)$.

4. Compute the following derivatives using the **differentiation rules**:

   a. $\dfrac{d}{d\theta}\left(\dfrac{\cot(4\theta)}{\theta^3+2}\right)$

   b. $\dfrac{d}{dx}\left(\cos^3(5x)\right)$

   c. $\dfrac{d}{d\theta}\left(\theta^{\sin(\theta)}\right)$

   d. $\dfrac{d}{dx}\left(\sin\left(e^{x^2}\right)\right)$

   e. $\dfrac{d}{dy}\left(\left(y^{1/4}-\dfrac{1}{\sqrt{y}}\right)\tan(y)\right)$

   f. $\dfrac{d}{dt}\left(t^3-3^t+\ln(3)\right)$

   g. $\dfrac{d}{dx}\left[\left(5x^2+3x\right)^{-10}+2\pi-\sec(6x)-\sqrt{x+3}+\cos\left(\frac{\pi}{4}\right)\right]$

   h. $\dfrac{dy}{dx}$ *for* $\cos\left(xy^2\right)=y^3+x$

5. Find the following:
   a. The equation of the tangent line to the curve $y=(3x-1)^5$ at the point where $x=1$.

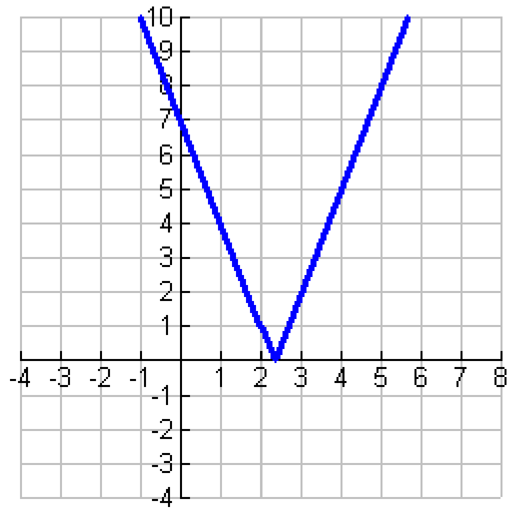
   b. Find the equation of the tangent line to the curve $x+xy+y^2=7$ at the point (1, 2).

6. Find the points on the curve $2x^2+x+3y^2=4$ where the tangent lines are horizontal and vertical.

7. The position of a particle moving along the *y*-axis after *t* seconds is given by $y=\sqrt{3t+1}$.
   a. What is the velocity of the particle after 1 second?
   b. After 1 second, what is the acceleration of the particle?
   c. When is the particle stationary?

8. Let $H(x)=f\left(f(x)\right)$, and $G(x)=\left(H(x)\right)^2$. Also let $f(5)=14$, $f(14)=3$, $f'(14)=10$, and $f'(5)=7$.
   a. Find $H'(5)$.
   b. Find $G'(5)$.

9. Sketch the graph of $2x^3-9x^2+20$ using your knowledge of the information obtained from the original function and the first and second derivatives. Be sure to indicate all important features. (Includes increasing, decreasing, max, min, concavity, intercepts, etc)



10. Let $f(x)$ be defined by the graph on the right.
    Let $g(x)=5x^3-2x$. Let $h(x)=\dfrac{f(x)}{g(x)}$
    a) Find $\dfrac{d}{dx}\big(f(g(x))\big)$ when $x=1$.
    b) Find $\dfrac{d}{dx}\big(h(x)\big)$ when $x=2$.
    c) Find $\dfrac{d^2}{dx^2}\big(h(x)\big)$ when $x=2$.

11. Compute the following derivative using **logarithmic differentiation**:

$$\frac{d}{dx}\left(\frac{\left(x^2+e^x\right)^{10}\left[\cos\left(\pi x^3\right)-\ln\sqrt{x}\right]^{-\pi}}{\sqrt[3]{e^{\pi x}}}\right)$$

12. Let $f(x)=x^4-2x^3-5x^2+1$. Find:
    a. Critical points
    b. Intervals of increasing and decreasing
    c. Any local maximums and minimums
    d. Intervals of concave up and concave down
    e. Any inflection points

13. A particle is moving along a curve $y=\sqrt{3x+1}$. As the particle passes through the point $(1,2)$ its x-coordinate is increasing at a rate of 3 cm/s. How fast is the distance from the particle to the origin changing at this instant?

14. A boat is being pulled to a dock by a rope attached to the bow of the boat and is passing through a pulley on the end of the dock that is 1 meter higher than the bow of the boat. The rope is being pulled at a constant rate of 1 meter per second.
    a) How fast is the boat approaching the dock when the boat is 8 meters away from the dock?
    b) How fast is the angle between the rope and the horizontal line from the bow of the boat to the dock changing at this moment?

15. Suppose sand is being poured onto a conical pile at the rate of 2 cubic feet per second.
    a) Assume the height is twice the radius of the base. What rate does the radius need to be changing in order to keep this ratio constant? (This should depend on the length of the radius!)
    b) What is the rate of change of the radius when the pile is 10 feet high?