Midterm 2 Review Problems **Math 141**

These are suggested review problems similar to what might be on Midterm 2. Included with each problem is a link to a video where you can see how the problem is solved. I didn't make the videos, they are all available on YouTube.

1. Find the derivative of $f(x) = \dfrac{36x^5 - 12x^4 + 6}{3x^2}$.

https://youtu.be/PZXNRzLgXXU

2. Find the derivative of $f(x) = (x^3 + 2x^2 - x^{-2})^{-7}$.

https://youtu.be/6_lmiPDedsY

3. Find the derivative of $y = \sec\theta \tan\theta$.

https://youtu.be/uNk7NoVlWlQ

4. Use implicit differentiation to find the derivative y' when $4\,(\cos x \sin y) = 1$.

https://youtu.be/fUNfxxOI1Rs

5. Suppose that $C(A)$ is the cost of building a house as a function of its area in square feet. For each of the following equations, give a simple one sentence explanation (including units) of what exactly the equation is saying.

   (a) $C(1{,}000) = 300{,}000$

   (b) $C'(1{,}000) = 350$

https://youtu.be/QirtTPD0Unk?t=138

6. Find the first, second, and third derivatives of the function $y = \dfrac{6}{(x-1)^2}$.

https://youtu.be/yIfA_ux1cos

7. Use a linear approximation to estimate $\sqrt[3]{1001}$. Hint: use the linearization of $f(x) = \sqrt[3]{x}$ with $a = 1000$.

https://youtu.be/KO4mGU5_ZkU

8. The radius of a sphere is measured to be $r = 5$ meters with an error of $dr = 0.05$ meters. Find the differential of the volume $V = \frac{4}{3}\pi r^3$ and use it to estimate the error in the computed volume.

https://youtu.be/O05Rg4cvXWM

9. A cone is being filled with 1 cubic centimeter of water per second. If the cone is 4 cm tall and has a diameter of 4 centimeters, then how fast is the water level rising when the water level is 2 cm? Hint: The volume of the water in the cone is $V = \frac{1}{12}\pi h^3$ where h is the water level in centimeters.

https://youtu.be/Xe6YlrCgkIo

10. Find the absolute max and min for $f(x) = x + \dfrac{1}{x}$ on the interval $[\frac{1}{5}, 4]$.

https://youtu.be/enaSoNJTnFM

11. Find the critical points of $f(\theta) = 4\sec\theta + 2\tan\theta$ on the interval $0 < \theta < 2\pi$.

https://youtu.be/MRG1X4ld2As?t=87

12. A hammer is thrown upwards from the surface of the moon. Its height is given by $s(t) = 32t - 0.8t^2$ where s is in meters and t is in seconds. How long until the hammer stops going up and starts falling back down? And what is the maximum height of the hammer?

https://youtu.be/R1H0i5Dx8IE