Midterm 2 Review Problems **Math 140**

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 online.

1. Calculate the following derivatives.

   (a) $\dfrac{d}{dx}e^{5x+3}$ (b) $\dfrac{d}{dx}e^{x^2}$

https://youtu.be/yg_497u6JnA

2. Calculate the following logarithms.

   (a) $\log_3(81)$ (b) $\log_2(64)$ (c) $\log_{100}(1)$

https://youtu.be/Z5myJ8dg_rM

3. Write each expression as a single natural logarithm using the properties of logarithms.

   (a) $3\ln 10 - \ln 8$ (b) $2\ln 5 + 4\ln 2 + \ln(5y)$

https://youtu.be/wRXdiePi5-0

4. Solve $7 + 3\ln x = 5$.

https://youtu.be/vTqzK32bDfE

5. Solve $5e^{-3x} + 1 = 11$.

https://youtu.be/YY2CXOHpuxA

6. Find the derivative of $f(x) = \ln\left(\dfrac{x+5}{x-1}\right)$. Hint: Use the properties of logarithms to simplify $f(x)$ before taking the derivative.

https://youtu.be/R2JsjJyr0ck

7. Find the derivative of $y = \dfrac{2}{x^3}$.

https://youtu.be/ETL_-_Vj_A0

8. Let $f(x) = \sqrt[3]{x}$. Find $f'(x)$.

https://youtu.be/H-v4oraDjuM?t=73

9. Find the derivative of $f(x) = \dfrac{5x+2}{3x-4}$.

https://youtu.be/BF4e2vbmGkk

10. Calculate $\dfrac{d}{dx}(x^2-2)(7x^3+5)$.

https://youtu.be/8Qw2aPjqW9c

11. Find $\dfrac{d}{dx}\sqrt{3x^2-x}$.

https://youtu.be/IiBC4ngwH6E

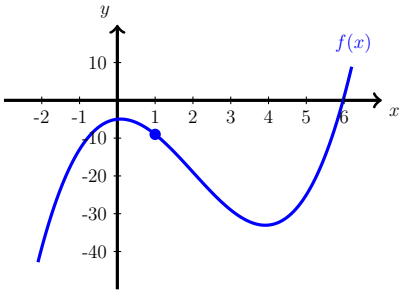
12. Suppose that the total cost for a company to produce x machines is $C(x) = 1100 + 140x - 0.2x^2$. Find the marginal cost $C'(x)$ when 105 machines are produced.

https://youtu.be/RN0BTZ46Knk

13. Where does the function $f(x) = x^3 - 6x^2 + 15$ have a horizontal tangent line?

https://youtu.be/aNfoxbMUOHk

14. Let $f(x) = x^3 - 6x^2 + x - 5$. Find the equation of the tangent line to $f(x)$ when $x = 1$.



https://youtu.be/j9FDoYNxZlw

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15. Suppose the profit for a bicycle manufacturer is $P(x) = 0.0002x^3 + 10x$ where x is the number of bicycles they sell. Find the derivative $P'(x)$ and use it to estimate the marginal profit when $x = 100$.

https://youtu.be/IB-2Umkiok8

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16. Find the intervals where $f(x) = 2 + 3x^2 - x^3$ is concave up and the intervals where it is concave down. Also, find the inflection points of $f(x)$.

https://youtu.be/c1N8zyVhWxM

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17. The kinetic energy of an object is $E = \frac{1}{2}mv^2$ where m is its mass and v is its velocity. Suppose that a rock has a mass of 2 kilograms and is falling so that its velocity is increasing at a rate of 9 meters per second every second (i.e., $\frac{dv}{dt} = 9$). Use the chain rule to find the rate of change in the rock's kinetic energy with respect to time at that instant.

https://youtu.be/NA-Ri4LJPaY
