Midterm 3 Review Problems **Math 140**

These are suggested review problems similar to what might be on Midterm 3. 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.

1. Find the absolute max and min for $f(x) = x^3 - 3x^2$, $-\frac{1}{2} \leq x \leq 4$.

https://youtu.be/S3YA6K9iEGM

2. Find the intervals of increase & decrease for the function $f(x) = 2x^3 + 18x^2 + 30x + 3$.

https://youtu.be/jB451pFTi6c

3. Determine the increasing & decreasing intervals for $f(x) = \dfrac{x}{x^2 + 1}$.

https://youtu.be/oThEqQVHo9c

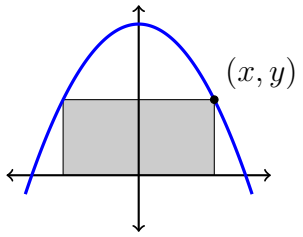
4. Find the intervals of increase/decrease for $f(x) = (x^2 - 1)^3$.

https://youtu.be/jJb_Qk0O5a0?t=263

5. Morpheus sells 1000 packages of sleeping pills every month at a price of \$12 per package. Suppose that for each \$1 increase in price, 10 less packages would be sold. At what price should Morpheus sell each package in order to maximize his revenue?

https://youtu.be/vfIFLryA_DU

6. Find the dimensions of the rectangle with largest area when its base lies on the x-axis and its two top corners are on the parabola $y = 8 - x^2$.



https://youtu.be/EOJbmMB8uCQ

7. Find the differential of $y = \sqrt{x}$ at $x = 16$ when $dx = 4$ Use it to approximate $\sqrt{20}$.

https://youtu.be/0jG3enZdEmk

8. Suppose that a company has demand function $Q(p) = 10 - \frac{1}{2}p$ where p is price. Calculate the price elasiticty of demand when $p = \$16$. Recall that $E = \left|\frac{pQ'}{Q}\right|$.

https://youtu.be/io4GwFGiVcI?t=446

9. Find the differential dy for each of the following functions.

   (a) $y = x^3 - 5x + 10$ at $x = 2$ when $dx = \frac{1}{4}$.

   (b) $y = 2x^3 - 4x^2 + 8x - 1$ at $x = 3$ when $dx = 0.1$.

https://youtu.be/C5RI5eLzVfo?t=78

10. 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

11. Find the intervals where $h(x) = (x^2 - 1)^3$ is concave up and the intervals where it is concave down.

https://youtu.be/c1N8zyVhWxM?t=183

12. If a stereo manufacturer wants to sell x units of a new stereo, the price per unit (in dollars) must be

$$p(x) = 1000 - x.$$

The total cost of producing x stereos is

$$C(x) = 3000 + 20x.$$

Find the level of production x that maximizes profit. Recall that profit is revenue minus cost and revenue is price times quantity sold.

https://www.youtube.com/watch?v=XEr-t6TWP18&t=19s

13. Find the partial derivatives $\dfrac{\partial z}{\partial x}$ and $\dfrac{\partial z}{\partial y}$ for the function $z = e^{x^2 y^3}$.

https://youtu.be/JAf_aSIJryg?t=311