

*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  $f(x) = x^3 - 3x^2$ ,  $-\frac{1}{2} \leq x \leq 4$ .

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<https://youtu.be/S3YA6K9iEGM>

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

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<https://youtu.be/jB451pFTi6c>

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

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<https://youtu.be/oThEqQVHo9c>

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

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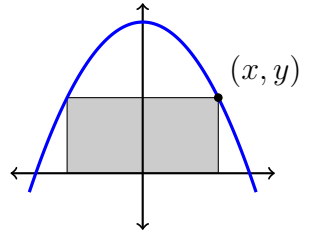
[https://youtu.be/jJb\\_Qk005a0?t=263](https://youtu.be/jJb_Qk005a0?t=263)

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?

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[https://youtu.be/vfIFLryA\\_DU](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  $y = 8 - x^2$ .



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<https://youtu.be/E0JbmMB8uCQ>

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

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<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 elasticity of demand when  $p = \$16$ . Recall that  $E = \left| \frac{pQ'}{Q} \right|$ .

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<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  $dx = 0.1$ .

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<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  $f(x)$ .

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<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.

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<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.

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

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

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[https://youtu.be/JAf\\_aSIJryg?t=311](https://youtu.be/JAf_aSIJryg?t=311)