

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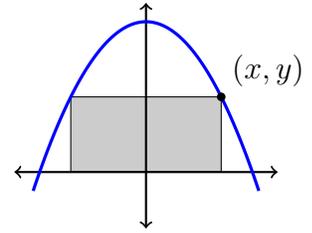
[https://youtu.be/jJb\\_Qk005a0?t=263](https://youtu.be/jJb_Qk005a0?t=263)

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 linear approximation function  $L(x)$  for  $f(x) = \sqrt{x}$  at  $x_0 = 81$ , and use it to approximate  $\sqrt{80}$ .

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<https://youtu.be/VVtGpDPn1CU>

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. Calculate the following derivatives.

(a)  $\frac{d}{dx} e^{5x+3}$

(b)  $\frac{d}{dx} e^{x^2}$

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[https://youtu.be/yg\\_497u6JnA](https://youtu.be/yg_497u6JnA)

10. Calculate the following logarithms.

(a)  $\log_3(81)$

(b)  $\log_2(64)$

(c)  $\log_{100}(1)$

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[https://youtu.be/Z5myJ8dg\\_rM](https://youtu.be/Z5myJ8dg_rM)

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

(a)  $3 \ln 10 - \ln 8$

(b)  $2 \ln 5 + 4 \ln 2 + \ln(5y)$

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<https://youtu.be/wRXdiePi5-0>

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

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<https://youtu.be/vTqzK32bDfE>

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

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<https://youtu.be/YY2CX0HpuxA>

14. At an annual rate of growth of 3.8%, how long (exactly) does it take to double an investment if nothing else is added to the account along the way?

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<https://youtu.be/iB3xENjuxmI>

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

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<https://youtu.be/R2JsJyr0ck>