

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

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

---

[https://youtu.be/yg\\_497u6JnA](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](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/YY2CX0HpuxA>

6. 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.

---

<https://youtu.be/R2JsjJyr0ck>

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

---

[https://youtu.be/ETL\\_-\\_Vj\\_A0](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  $f(x) = \frac{5x + 2}{3x - 4}$ .

---

<https://youtu.be/BF4e2vbmGkk>

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

---

<https://youtu.be/8Qw2aPjqW9c>

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

---

<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.

---

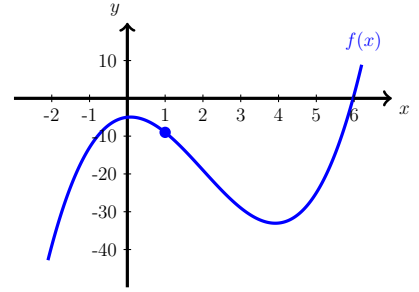
<https://youtu.be/RN0BTZ46Knk>

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>

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>

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>

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 the instant when the rock's velocity is 5 meters per second.

---

<https://youtu.be/NA-Ri4LJPaY>