

For each of the following, find the derivative of the given function. Show all steps, and organize your written work:

1.  $g(x) = \sqrt{x} \sin x$

$$g'(x) =$$

2.  $f(x) = xe^x$

$$f'(x) =$$

3.  $h(x) = x^2e^x$

$$h'(x) =$$

4.  $g(x) = \sin x \cos x$

$$g'(x) =$$

5.  $y = \frac{e^x}{x}$

$$\frac{dy}{dx} =$$

6.  $y = \frac{x}{e^x}$

$$\frac{dy}{dx} =$$

7.  $y = \frac{e^x}{x^2}$

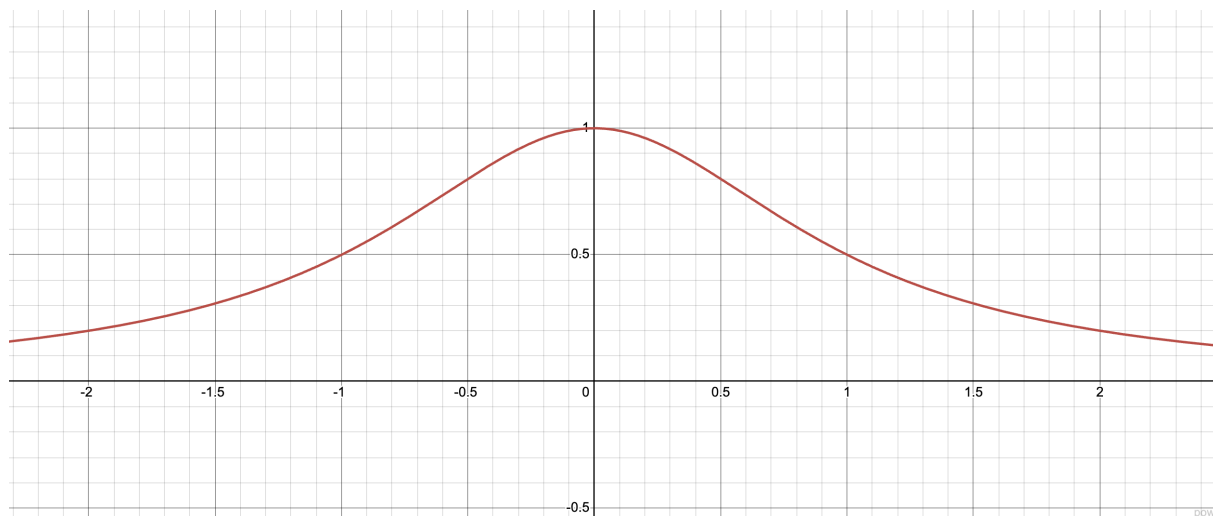
$$\frac{dy}{dx} =$$

8.  $y = \frac{e^x}{1+x^2}$

$$\frac{dy}{dx} =$$

9. Shown below is the graph of  $y = \frac{1}{1+x^2}$

(This function is called "the witch of Agnesi": [https://en.wikipedia.org/wiki/Witch\\_of\\_Agnesi](https://en.wikipedia.org/wiki/Witch_of_Agnesi))



(a) Sketch the tangent line to the curve at the point  $\left(1, \frac{1}{2}\right)$

(b) Find the derivative of the function:

$$\frac{d}{dx} \left( \frac{1}{1+x^2} \right) =$$

(c) Find the equation of the tangent line for the curve at  $\left(1, \frac{1}{2}\right)$ :

10.  $A(t) = \cos(t^2)$

$$\frac{dA}{dt} =$$

11.  $s(t) = \cos^2(t)$

$$\frac{ds}{dt} =$$

12.  $g(x) = \sqrt{x^3 + x^2 + x + e^x}$

$$g'(x) =$$

13. (5 points)  $y = (\sin x + \cos x + \tan x)^7$

$$\frac{dy}{dx} =$$

14.  $F(x) = \cos^4(6x)$

$$F'(x) =$$

15.  $y = x \sin(4x)$

$$\frac{dy}{dx} =$$

16.  $y = \sqrt{x} \tan(3x)$

$$\frac{dy}{dx} =$$

17.  $y = xe^{2x}$

$$\frac{dy}{dx} =$$

18.  $y = \ln x + \frac{1}{x}$

$$\frac{dy}{dx} =$$

19.  $f(x) = x \ln x$

$$f'(x) =$$

20.  $g(x) = \ln(x^2)$

$$g'(x) =$$