Find the derivative of the following functions:

1. $f(x) = (x^2 + 3x + 4)^{20}$ $\quad f'(x) = 20(x^2 + 3x + 4)^{19} \cdot (2x+3)$

2. $f(x) = 30e^{3x+1}$ $\quad f'(x) = 30e^{3x+1} \cdot (3) = 90e^{3x+1}$

3. $f(x) = \frac{\sqrt{x}}{e^x}$ $\quad f'(x) = \sqrt{x}(-e^{-x}) + e^{-x}(\frac{1}{2}x^{-1/2})$

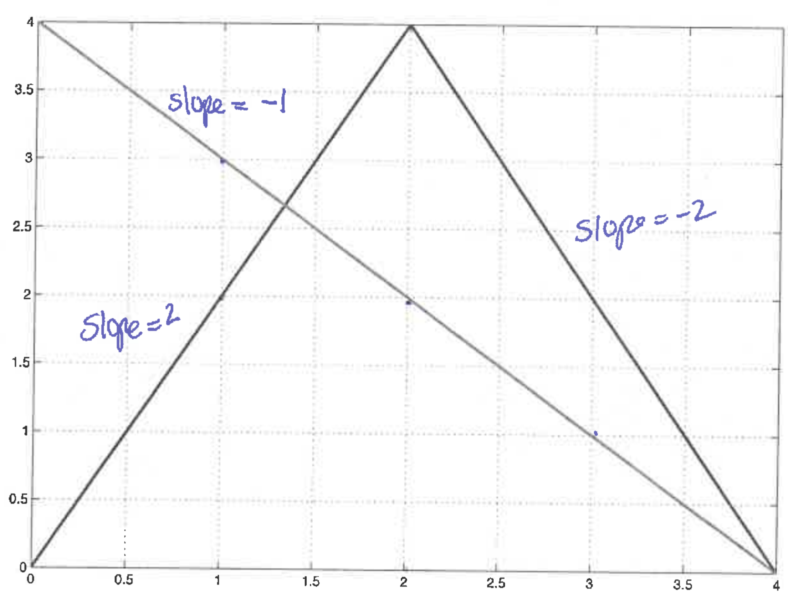
$$= -\sqrt{x}e^{-x} + \frac{1}{2\sqrt{x}}e^{-x}$$

4. $f(x) = e^x(4x^2 + x)^3$

$$= e^x(4x^2+x)^3 + e^x \cdot 3(4x^2+x)^2(8x+1)$$

If $h(x) = f(g(x))$, from looking at the figure below, and using the product rule, find:

$h'(1)$, $h'(2)$, and $h'(3)$. $\quad h(x) = f(g(x)) \quad h' = f'(g(x)) \cdot g'(x)$



$h'(1) = f'(g(1)) \cdot g'(1) = f'(3) \cdot g'(1) = -2 \cdot -1 = 2$

$h'(2) = f'(g(2)) \cdot g'(2) = f'(2) \cdot g'(2)$

↳ doesn't exist

$h'(3) = f'(g(3)) \cdot g'(3) = f'(1) \cdot g'(3) = 2 \cdot -1 = -2$

#6 product and chain:

$$f'(x) = e^x \sin(3x^2) + 6x\cos(3x^2)e^x$$

#7 chain rule two deep

$$f'(x) = e^{-\cos(2x)} \cdot \sin(2x) \cdot 2$$

#8 chain and tangent.

$$f'(\theta) = \frac{2}{\cos^2(3\theta)} \cdot 3 = \frac{6}{\cos^2(3\theta)}$$