AP Pink

1. $$\frac{f(x+h)-f(x)}{h} \qquad x=\frac{1}{2}$$

$$8x^8$$

$$64x^7\Big|_{x=\frac{1}{2}} = 64\left(\frac{1}{2}\right)^7$$

$$\cancel{64}\cdot\frac{1}{\cancel{128}\,2}=\frac{1}{2}$$

$$h(x)=f^2(x)-g^2(x)$$

$$2f(x)\cdot f'(x)-2g(x)\cdot g'(x)$$

$$2f(x)\left(-g(x)\right)-2g(x)f(x)$$

$$-4f(x)g(x)$$

$y = x^3 + k$

$y' = 3x^2$

$\frac{3}{8} = \left(\frac{1}{2}\right)^3 + k$

$m = \frac{3}{4}$

$\cancel{3}x^2 = \frac{\cancel{3}}{4}$

$x = \pm\frac{1}{2}$

$y = \frac{3}{4}x$

$y = \frac{3}{4}\left(\frac{1}{2}\right)$

7. $y = x^{\frac{1}{3}}(x-2)^{\frac{2}{3}}$ y'

$y' = x^{\frac{1}{3}}\left(\frac{2}{3}(x-2)^{-\frac{1}{3}}\right) + (x-2)^{\frac{2}{3}}\frac{1}{3}\left(x^{-\frac{2}{3}}\right)$

$\frac{2x^{\frac{1}{3}}}{3\sqrt[3]{x-2}} + \frac{(x-2)^{\frac{2}{3}}}{3\sqrt[3]{x^2}}$

$\left(\sqrt[\cancel{3}]{x-2}\right)^3 = (0)^3$ $x = 0$

$x - 2 = 0$

$x = 2$

11.

$h(x) = f(g(x))$

$h'(1) = f'(g(\cancel{x}1)) \cdot g'(\cancel{x}1)$

$f'(2) \cdot -3$

$-4 \cdot -3$

12

12. $(2x+1)^4$

$y' = 4(2x+1)^3 \cdot 2$

$8(2x+1)^3$

$y'' = 24(2x+1)^2 \cdot 2$

$48(2x+1)^2$

$y''' = 96(2x+1)^1 \cdot 2$

$192(2x+1)$

$y^4 = 192(2)$

$f(x) = x$

$f'(x) = 1$

$f(x) = \cos^2 x - \sin^2 x$

$2\cos x \cdot (-\sin x) - 2\sin x \cdot \cos x$

$-4 \cos x \sin x$

$-2(2 \sin x \cos x)$

$-2\sin 2x$

18. $\frac{d}{dx}\left(\frac{1}{x^3} - \frac{1}{x} + x^2\right)$ @ $x = -1$

x^{-3} x^{-1}

$-3x^{-4} - (-x^{-2}) + 2x \Big|_{x=-1}$

$\frac{-3}{x^4}$

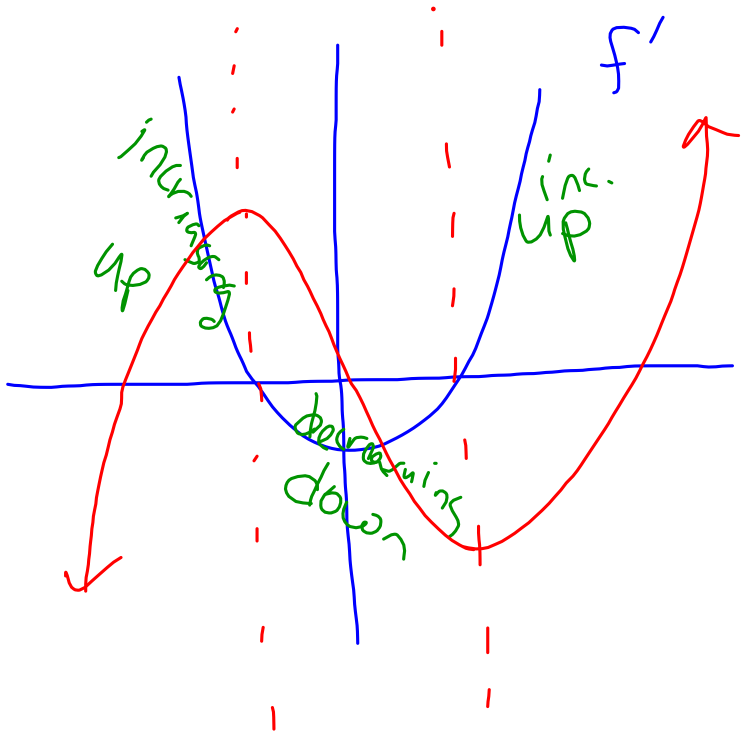
$-3 + 1 - 2 = -4$

19. Avg. Velocity $\underbrace{0 \le t \le 3}$

$(0, 0)$

$(3, -45)$

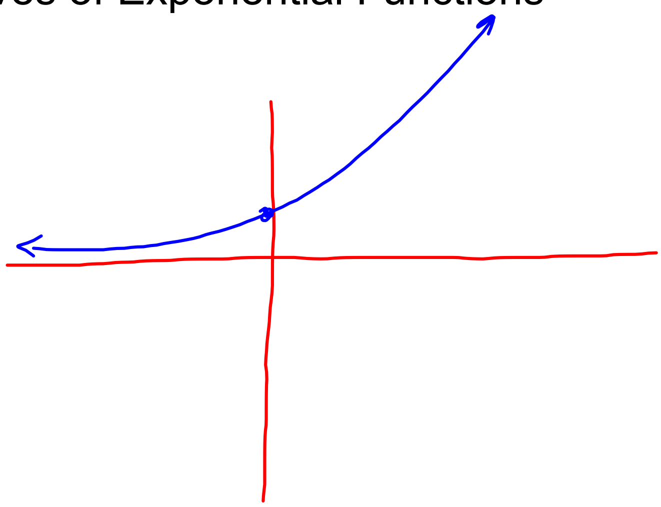
$\frac{-45}{3} = -15$



3.9a Derivatives of Exponential Functions

$y = e^x$

$y' = e^x$



general form:

$$\frac{d}{dx}\left(e^u\right) = e^u \cdot \frac{du}{dx}$$

Find $\frac{dy}{dx}$

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

$$y' = e^{x+x^2}(1+2x)$$

$e^{(3x)^{\frac{1}{2}}}$

2. $y = \underbrace{x^2}\underbrace{e^x} - e^{\sqrt{3x}}$

$$x^2e^x + e^x(2x) - e^{\sqrt{3x}}\left(\frac{1}{2}(3x)^{-\frac{1}{2}} \cdot 3\right)$$

Derivative of $\frac{d}{dx}\left(2^x\right)$

using properties of exponents and logs $\underline{2^x} = e^{x\ln 2}$ $e^{x\ln 2^x}$

$$\frac{d}{dx}\left(2^x\right) = \frac{d}{dx}\left(e^{x\ln 2}\right) = 2^x \ln 2$$

$$e^{x\ln 2}(\ln 2)$$

Derivative of $y = a^x$

$$y' = a^x \ln a$$

general: $\frac{d}{dx}\left(a^u\right) = a^u \ln a \cdot \frac{du}{dx}$

The spread of a cold at AFHS is modeled by $y=\frac{1000}{1+3^{3-t}}$

How fast is the flu spreading after 3 days?

$$y' = \frac{\cancel{(1+3^{3-t})}(0) - (1000)(3^{3-t}\cdot \ln 3(-1))}{(1+3^{3-t})^2}$$

$$y' = \left.\frac{1000\cdot 3^{3-t}\cdot \ln 3}{(1+3^{3-t})^2}\right|_{t=3}$$

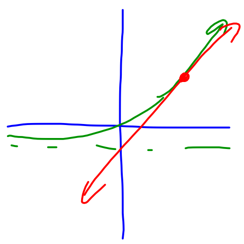
$$y' = \frac{1000(1)\ln 3}{(1+1)^2}$$

$$= \frac{1000\ln 3}{4} = 274$$

At what point on the graph of $y=2^t-1$

does the tangent line have a slope of 15?

$y' = 2^t \ln 2 \leftarrow$ slope anywhere on curve



$$\frac{2^t \cancel{\ln 2}}{\cancel{\ln 2}} = \frac{15}{\ln 2}$$

$$2^t = \frac{15}{\ln 2}$$

$$\log_2\left(\frac{15}{\ln 2}\right) = t$$

$$\frac{\log\left(\frac{15}{\ln 2}\right)}{\log 2} =$$

Ms. Apezteguia removes a cold soda from her fridge and leaves it on her desk.

Its temperature T after sitting on the desk is: $T = 72 - 30(.98)^t$

At what time is the soda warming the fastest?

$$T' = -30(.98^t)(\ln .98)$$

graph and find highest point