$$\frac{e^y}{\tan(x)} = x^3 y^2$$

$$\frac{\tan(x) \cdot e^y \cdot \frac{dy}{dx} - e^y \cdot \sec^2 x}{\tan^2 x} = x^3 \cdot 2y \frac{dy}{dx} + y^2 \cdot 3x^2$$

$$e^y \tan(x) \frac{dy}{dx} - e^y \sec^2 x = 2x^3 y \tan^2 x \frac{dy}{dx} + 3x^2 y^2 \tan^2 x$$

$$e^y \tan(x) \frac{dy}{dx} - 2x^3 y \tan^2 x \frac{dy}{dx} = 3x^2 y^2 \tan^2 x + e^y \sec^2 x$$

$$\frac{dy}{dx}\left(e^y \tan(x) - 2x^3 y \tan^2 x\right) = 3x^2 y^2 \tan^2 x + e^y \sec^2 x$$

$$\frac{dy}{dx} = \frac{3x^2 y^2 \tan^2 x + e^y \sec^2 x}{e^y \tan(x) - 2x^3 y \tan^2 x}$$

11:8

$$\frac{d}{dx}\left(\frac{\sqrt[3]{x-2}}{(1+x^2)^4}\right)$$

$$y = \frac{\sqrt[3]{x-2}}{(1+x^2)^4}$$

$$\ln y = \ln\left(\frac{\sqrt[3]{x-2}}{(1+x^2)^4}\right)$$

$$\ln y = \ln (x-2)^{\frac{1}{3}} - \ln(1+x^2)^4$$

$$\ln y = \frac{1}{3}\ln(x-2) - 4\ln(1+x^2)$$

$$\frac{1}{y}\frac{dy}{dx} = \frac{1}{3}\cdot\frac{1}{x-2} - 4\cdot\frac{1}{1+x^2}\cdot 2x$$

$$\frac{1}{y}\frac{dy}{dx} = \frac{1}{3(x-2)} - \frac{8x}{1+x^2}$$

$$\frac{dy}{dx} = y\left[\frac{1}{3(x-2)} - \frac{8x}{1+x^2}\right]$$

$$\frac{dy}{dx} = \frac{\sqrt[3]{x-2}}{((1+x^2))^4}\left[\frac{1}{3(x-2)} - \frac{8x}{1+x^2}\right]$$

<u>12:12</u>

$f(x) = x^4 \ln x$

$f'(x) = x^4 \cdot \frac{1}{x} + \ln x \cdot 4x^3$

$= x^3 + 4x^3 \ln x$

$f''(x) = 3x^2 + 4x^3 \cdot \frac{1}{x} + \ln x \cdot 12x^2$

$= 3x^2 + 4x^2 + 12x^2 \ln x$

$= 7x^2 + 12x^2 \ln x$

13 : 3 $\quad h(t) = -5t^2 + 4t + 2$

reach peak @ $t = ?$

$v(t) = h'(t) = -10t + 4$

$0 = -10t + 4$

$10t = 4$

$t = \frac{2}{5}$

height @ peak?

$h\left(\frac{2}{5}\right) = -5\left(\frac{2}{5}\right)^2 + 4\left(\frac{2}{5}\right) + 2$

$= -\cancel{5} \cdot \frac{4}{5\,\cancel{25}} + \frac{8}{5} + \frac{10}{5}$

$= -\frac{4}{5} + \frac{8}{5} + \frac{10}{5} = \frac{14}{5}$

12 : 6

$\frac{d}{dx}\left(x^{\sin x}\right)$

$y = x^{\sin x}$

$\ln y = \ln x^{\sin x}$

$\ln y = \sin x \ln x$

$\frac{1}{y}\frac{dy}{dx} = \sin x \cdot \frac{1}{x} + \ln x \cdot \cos x$

$\frac{dy}{dx} = y\left(\frac{\sin x}{x} + \ln x \cdot \cos x\right)$

$\frac{dy}{dx} = x^{\sin x}\left(\frac{\sin x}{x} + \ln x \cdot \cos x\right)$

11 : 11

$\frac{d}{dx}\left(-\arctan(x^2)\right) = \frac{-1}{1 + (x^2)^2} \cdot 2x = \frac{-2x}{1 + x^4}$

11: 12

$$\frac{d}{dx}\left(-2\operatorname{arcsec}(x+1)\right) = \frac{-2 \cdot 1}{|x+1|\sqrt{(x+1)^2-1}} = \frac{-2}{|x+1|\sqrt{(x+1)^2-1}}$$

12: 5

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

$$\ln y = \ln(x+1)^2 - \ln(x^2+1)^{\frac{1}{2}}$$

$$\ln y = 2\ln(x+1) - \frac{1}{2}\ln(x^2+1)$$

$$\frac{1}{y}\frac{dy}{dx} = 2 \cdot \frac{1}{x+1} - \frac{1}{2} \cdot \frac{1}{x^2+1} \cdot 2x$$

$$\frac{1}{y}\frac{dy}{dx} = \frac{2}{x+1} - \frac{x}{x^2+1}$$

$$\frac{dy}{dx} = \frac{(x+1)^2}{\sqrt{x^2+1}}\left[\frac{2}{x+1} - \frac{x}{x^2+1}\right]$$

12: 10 $\quad \frac{dy}{dx} = ?$

$$7\ln(x^2y^2) = 6$$

$$7 \cdot \frac{1}{x^2y^2}\left(x^2 \cdot 2y\frac{dy}{dx} + y^2 \cdot 2x\right) = 0$$

$$\frac{14\cancel{x^2}\cancel{y}\frac{dy}{dx}}{\cancel{x^2}y^{\cancel{2}}} + \frac{14\cancel{x}\cancel{y^2}}{x^{\cancel{2}}\cancel{y^2}} = 0$$

$$\frac{14}{y}\frac{dy}{dx}+\frac{14}{x}=0$$

$$\frac{y}{14}\cdot\frac{14}{y}\frac{dy}{dx}=-\frac{\cancel{14}}{x}\cdot\frac{y}{\cancel{14}}$$

$$\frac{dy}{dx}=\frac{-y}{x}$$

12:11 $f(x)=\sqrt{x}\ln x$

$$f'(x)=\sqrt{x}\cdot\frac{1}{x}+\ln x\cdot\frac{1}{2}x^{-\frac{1}{2}}$$

$$f'(x)=x^{-\frac{1}{2}}+\frac{1}{2}x^{-\frac{1}{2}}\cdot\ln x$$

$$f''(x)=-\frac{1}{2}x^{-\frac{3}{2}}+\frac{1}{2}x^{-\frac{1}{2}}\cdot\frac{1}{x}+\ln x\cdot-\frac{1}{4}x^{-\frac{3}{2}}$$

$$=\cancel{-\frac{1}{2x^{3/2}}}+\cancel{\frac{1}{2x^{3/2}}}-\frac{1}{4x^{3/2}}\ln x$$

$$=-\frac{\ln x}{4x^{3/2}}$$

$$\frac{d}{dx}(\arcsin x)=\frac{1}{\sqrt{1-x^2}} \qquad \frac{d}{dx}(\arccos x)=\frac{-1}{\sqrt{1-x^2}}$$

$$\frac{d}{dx}(\arctan x)=\frac{1}{1+x^2} \qquad \frac{d}{dx}(\operatorname{arccot} x)=\frac{-1}{1+x^2}$$

$$\frac{d}{dx}(\operatorname{arcsec} x)=\frac{1}{|x|\sqrt{x^2-1}} \qquad \frac{d}{dx}(\operatorname{arccsc} x)=\frac{-1}{|x|\sqrt{x^2-1}}$$