Derivatives

$\frac{d}{dx}[x^3] = 3x^2$, $\frac{d}{dz}[x^3] = 3x^2 \frac{dx}{dz}$, $\frac{d}{dx}[3] = 0$, $\frac{d}{dx}[e] = 0$

$\frac{d}{dx}[\pi] = 0$, $\frac{d}{dx}[\sqrt{x}] = x^{1/2} = 1/2\, x^{1/2 - 1} = 1/2\, x^{-1/2} = 1/2\, 1/\sqrt{x}$

$\frac{d}{dx}[\frac{1}{x}] = x^{-1} = -1x^{-2} = -1/x^2$

$\frac{d}{dx}[8/x^3] = 8 \cdot 3x^{-4} = 24/x^4$

** $e^u = \frac{d}{dx}[e^u] = e^u \cdot u$

$e^{4x} = e^{4x} \cdot 4$, $e^{x^2} = e^{x^2} \cdot 2x$

$e^{4x+5} = e^{4x+5} \cdot (4+0) = 4e^{4x+5}$

** $d/dx[3^{x^2}] = a^u = a^u \cdot u' \cdot \ln(a)$

$3x^2 = 3^{x^2} \cdot 2x \cdot \ln(3)$

$5x^3 = 5x^3 \cdot 3x^2 \ln(5)$

** $d/dx[\ln u] = \frac{u'}{u}$

$\ln[x^2 + 5x] = \frac{3x+5}{x^2+5x}$ $\ln[x^3 - 4x^2] = \frac{3x^2 - 8x}{x^3 - 4x^2}$

$$\frac{d}{dx}[\log_a u] = \frac{u'}{u \log(a)}$$

$$\frac{d}{dx}[\cancel{x^4} \log_3(x^4)] = \frac{4x^3}{x^4 \log(3)}$$

$$\frac{d}{dx}[fg] = f'g + fg'$$

$$\frac{d}{dx}[x^2 \sin x] = \frac{d}{dx}x^2 \sin x + x^2 \frac{d}{dx}\sin x = 2x\sin x + x^2 \cos x$$

$$\frac{d}{dx}[x^3 \ln x] = 3x^2 \ln + x^3 \cdot 1/x$$

$$\frac{d}{dx}[x^4 \tan x\, e^{2x}] = 3x^3 \tan x\, e^{2x} + x^4 \sec^2 x\, e^{2x} + x^4 \tan x\, e^{2x} \cdot 2$$

$$\frac{d}{dx}[f/g] = \frac{gf' - fg'}{g^2}$$

$$\frac{d}{dx}\left[\frac{5x+3}{2x-4}\right] = \frac{2x-4 \frac{d}{dx} 5x+3 - 5x+3 \frac{d}{dx} 2x-4}{(2x-4)^2} = \frac{(2x-4)(5) - (5x+3)(2)}{(2x-4)^2}$$

$$[f[g(x)]] = f'[g(x)] \cdot g'(x)$$

$$(x^2+4x)^3 = 3[x^2+4x]^2 \cdot (2x+4)$$

$$\sin(4x) = \cos(4x) \cdot 4$$

$$\tan(x^3) = \sec^2(x^3) \cdot 3x^2$$

$\sin[\tan(x^5)] = \cos[\sec^2(x^5)] \cdot 5x^4$

$= \cos[\tan(x^5)] \cdot \sec^2(x^5) \cdot 5x^4]$

$\cos^7[\sin[\tan x^7]] = a$

$= 7[\cos[\sin[\tan x^7]]]^6 \, (-\sin(\sin(\tan x^7)) \, (\cos(\tan x^7)$

$(\sec^2(x^7) \, \cancel{7}x^6$