Tim Leishman
RCET 264 INTRO CALC

HW#3
Ex 2.7 #15-23 odds

# Derivative of a Power

#15 $y = x^3(x^3-x)^3$

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

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

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

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

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

$$\boxed{\frac{dy}{dx} = (12x^5-6x^3)(x^3-x)^2}$$

#17. $y = (2x+1)^2(x^2+1)^2$

$\frac{dy}{dx} = (2)(2x+1)^1(2)(x^2+1)^2 + (2)(x^2+1)(2x)(2x+1)^2$

$\frac{dy}{dx} = (4)(2x+1)(x^2+1)^2 + (4x)(x^2+1)(2x+1)^2$

$\frac{dy}{dx} = $ ~~$(8x+4)(x^2+1)^2$~~

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

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

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

#19. $y = (x^2+1)\sqrt{9x^2-2x}$

$y = (x^2+1)(9x^2-2x)^{1/2}$

$\frac{dy}{dx} = (1)(x^2+1)^{(0)}(2x)(9x^2-2x)^{1/2} + (1/2)(9x^2-2x)^{-1/2}(18x-2)(x^2+1)$

$\frac{dy}{dx} = (2x)(9x^2-2x)^{1/2} + (9x^2-2x)^{-1/2}(9x-1)(x^2+1)$

$\frac{dy}{dx} = (9x^2-2x)^{-1/2}\left[(2x)(9x^2-2x)^1 + (9x-1)(x^2+1)\right]$

$\frac{dy}{dx} = \frac{\left[(2x)(9x^2-2x) + (9x-1)(x^2+1)\right]}{(9x^2-2x)^{1/2}}$

$\frac{dy}{dx} = \frac{18x^3-4x^2+9x^3+9x-x^2-1}{\sqrt{9x^2-2x}}$

$$\boxed{\frac{dy}{dx} = \frac{27x^3-5x^2+9x-1}{\sqrt{9x^2-2x}}}$$

#21. $y = (3x+4)^{3/4}(4x^2+8)$

$$\frac{dy}{dx} = \frac{3}{4}(3x+4)^{-1/4}(3)(4x^2+8) + (8x)(3x+4)^{3/4}$$

$$\frac{dy}{dx} = \frac{9}{4}(3x+4)^{-1/4}(4x^2+8) + (8x)(3x+4)^{3/4}$$

$$\frac{dy}{dx} = (3x+4)^{-1/4}\left[\frac{9}{4}(4x^2+8) + 8x(3x+4)^{1}\right]$$

$$\frac{dy}{dx} = (3x+4)^{-1/4}\left[(9x^2+18) + 24x^2+32x\right]$$

$$\boxed{\frac{dy}{dx} = \frac{33x^2+32x+18}{(3x+4)^{1/4}}}$$

#23. $y = \frac{1}{x^4} - (2x+1)^4$

$$y = x^{-4} - (2x+1)^4$$

$$\frac{dy}{dx} = (-4x^{-5}) - \left[4(2x+1)^3(2)\right]$$

$$\frac{dy}{dx} = -4x^{-5} - (8)(2x+1)^3$$

$$\boxed{\frac{dy}{dx} = \frac{-4}{x^5} - (8)(2x+1)^3}$$

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#27. $y = \dfrac{(x^3+2)^4}{(4x^2-3x)}$

$$\frac{dy}{dx} = \frac{4(x^3+2)^3(3x^2)(4x^2-3x) - (8x-3)(x^3+2)^4}{(4x^2-3x)^2}$$

$$\frac{dy}{dx} = \frac{(12x^2)(x^3+2)^3(4x^2-3x) - (8x-3)(x^3+2)^4}{(4x^2-3x)^2}$$

$$\frac{dy}{dx} = \frac{(x^3+2)^3\left[(12x^2)(4x^2-3x) - (8x-3)(x^3+2)\right]}{(4x^2-3x)^2}$$

$$\frac{dy}{dx} = \frac{(x^3+2)^3\left[(48x^4-36x^3) - (8x^4+16x-3x^3-6)\right]}{(4x^2-3x)^2}$$

$$\frac{dy}{dx} = \frac{(x^3+2)^3\left[48x^4-36x^3-8x^4-16x+3x^3+6\right]}{(4x^2-3x)^2}$$

$$\boxed{\frac{dy}{dx} = \frac{(x^3+2)^3(40x^4-33x^3-16x+6)}{(4x^2-3x)^2}}$$

#29. $y = \dfrac{(3x+2)^5}{(2x-1)^3}$

$$\frac{dy}{dx} = \frac{(5)(3x+2)^4(3)(2x-1)^3 - (3)(2x-1)^2(2)(3x+2)^5}{((2x-1)^3)^2}$$

$$\frac{dy}{dx} = \frac{(15)(3x+2)^4(2x-1)^3 - (6)(2x-1)^2(3x+2)^5}{(2x-1)^6}$$

$$\frac{dy}{dx} = \frac{(3)(3x+2)^4(2x-1)^2[(5)(2x-1) - (2)(3x+2)]}{(2x-1)^6}$$

$$\frac{dy}{dx} = \frac{(3)(3x+2)^4[(10x-5) - (6x+4)]}{(2x-1)^4}$$

$$\frac{dy}{dx} = \frac{(3)(3x+2)^4[10x-5-6x-4]}{(2x-1)^4}$$

$$\frac{dy}{dx} = \frac{(3)(3x+2)^4(4x-9)}{(2x-1)^4}$$

$$\frac{dy}{dx} = \frac{(12x-27)(3x+2)^4}{(2x-1)^4}$$

$$\boxed{\frac{dy}{dx} = \frac{(3x+2)^4(12x-27)}{(2x-1)^4}}$$

#31. $y = \dfrac{(3x-1)^{\frac{2}{3}}}{\sqrt{4x+3}}$

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

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

$$\frac{dy}{dx} = \frac{(2)(3x-1)^{-1/3}(4x+3)^{1/2} - (2)(4x+3)^{-1/2}(3x-1)^{2/3}}{(4x+3)}$$

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

$$\frac{dy}{dx} = \frac{(2)(4x+3-3x+1)}{(3x-1)^{1/3}(4x+3)^{1/2}(4x+3)}$$

$$\frac{dy}{dx} = \frac{(2)(x+4)}{(3x-1)^{1/3}(4x+3)^{1/2}(4x+3)^{1}}$$

$$\frac{dy}{dx} = \frac{2x+8}{(3x-1)^{1/3}(4x+3)^{1/2}(4x+3)^{2/2}}$$

$$\boxed{\frac{dy}{dx} = \frac{2x+8}{(3x-1)^{1/3}(4x+3)^{3/2}}}$$

#33. $y = \left(\frac{1+x}{1-x}\right)^4$

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

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

$$\frac{dy}{dx} = \frac{(4)(1+x)^3(1-x)^4 - (-4)(1-x)^3(1+x)^4}{(1-x)^8}$$

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

$$\frac{dy}{dx} = \frac{(4)(1+x)^3\left[(1-x) - (-1-x)\right]}{(1-x)^5}$$

$$\frac{dy}{dx} = \frac{(4)(1+x)^3\left[1-x+1+x\right]}{(1-x)^5}$$

$$\boxed{\frac{dy}{dx} = \frac{(8)(1+x)^3}{(1-x)^5}}$$

#35 FIND THE VELOCITY OF AN OBJECT AFTER 3s OF TRAVEL WHERE THE DISTANCE S (IN METERS) TRAVELED BY THE OBJECT IS GIVEN BY

$$S = \frac{t+1}{\sqrt{t^2-1}}$$

$$S = \frac{(t+1)}{(t^2-1)^{1/2}}$$

$$\frac{ds}{dt} = \frac{(1)(t+1)^0(1)(t^2-1)^{1/2} - (\frac{1}{2})(t^2-1)^{-1/2}(2t)(t+1)}{((t^2-1)^{1/2})^2}$$

$$\frac{ds}{dt} = \frac{(1)(t^2-1)^{1/2} - (t^2-1)^{-1/2}(t)(t+1)}{(t^2-1)}$$

$$\frac{ds}{dt} = \frac{(t^2-1)^{-1/2}[(t^2-1) - (t)(t+1)]}{(t^2-1)^1}$$

$$\frac{ds}{dt} = \frac{(t^2-1) - (t^2+t)}{(t^2-1)^{1/2}(t^2-1)^1}$$

$$\frac{ds}{dt} = \frac{t^2-1-t^2-t}{(t^2-1)^{3/2}}$$

$$\frac{ds}{dt} = \frac{-t-1}{(t^2-1)^{3/2}} = \frac{-3-1}{(3^2-1)^{3/2}} = \frac{-4}{22.627}$$

$$\boxed{\frac{ds}{dt} = -176.777 \text{ m/s}}$$