

Exercise set 7.2 solutions: Finding Derivatives

c. f(x) 1) $f(x) = 4x$ $f'(x) = 4 \cdot \frac{d}{dx}[x] = 4 \cdot 1 = 4$

Power Rule 2) $y = x^3$ $\frac{d}{dx}[y] = \frac{d}{dx}[x^3] \Rightarrow \frac{dy}{dx} = 3x^{3-1} = 3x^2$

3) $f(x) = \sqrt{x} = x^{1/2}$ $f'(x) = \frac{1}{2} x^{1/2-1} = \frac{1}{2} x^{-1/2}$ optionally $= \frac{1}{2} \frac{1}{x^{1/2}} = \frac{1}{2} \frac{1}{\sqrt{x}} = \frac{1}{2\sqrt{x}}$

Polynomial 4) $f(x) = 3x^2 - 2x + 5$ Quick: $f'(x) = 3 \cdot 2x^1 - 2 \cdot 1 + 0 = 6x - 2$

All the steps: $f'(x) = 3 \frac{d}{dx}[x^2] - 2 \frac{d}{dx}[x] + \frac{d}{dx}[5]$
 $= 3 \cdot 2x^1 - 2 \cdot 1 + 0 = 6x - 2$

f-g 5) $y = e^x - \sin x$ $\frac{d}{dx}[y] = \frac{d}{dx}[e^x - \sin x] \Rightarrow \frac{dy}{dx} = e^x - \cos x$

c. f(x) 6) $f(x) = -3x^{12}$ $f'(x) = -3 \cdot 12x^{12-1} = -3 \cdot 12x^{11} = -36x^{11}$

c 7) $y = 8\pi^3$ $\frac{dy}{dx} = 0$ $\because 8\pi^3$ is a constant! $\approx 248.0502134...$

8) $f(t) = t^2 - t$ $f'(t) = 2t - 1$ $\leftarrow$ The variable doesn't have to be x !

Product Rule 9) $y = (3x^2+6)(2x-1)$ $\frac{dy}{dx} = \overset{f}{(3x^2+6)} \overset{g'}{(2-0)} + \overset{g}{(2x-1)} \overset{f'}{(3 \cdot 2x+0)}$
 $= (3x^2+6) \cdot 2 + (2x-1) \cdot 6x$

10) $f(x) = e^x (2x + \sin x)$ $f'(x) = \overset{f}{e^x} \overset{g'}{(2+\cos x)} + \overset{g}{(2x+\sin x)} \overset{f'}{e^x}$

Quotient Rule 11) $y = \frac{4x}{x^2+1}$ $\frac{dy}{dx} = \frac{\overset{g}{(x^2+1)} \cdot \overset{f'}{4} - \overset{f}{4x} \overset{g'}{(2x)}}{\overset{g}{(x^2+1)}^2}$

12) $y = \frac{x-2}{2x^2-\cos x}$ $\frac{dy}{dx} = \frac{\overset{g}{(2x^2-\cos x)} \cdot \overset{f'}{1} - \overset{f}{(x-2)} \overset{g'}{(2 \cdot 2x - -\sin x)}}{\overset{g}{(2x^2-\cos x)}^2}$
 $= \frac{(2x^2-\cos x) - (x-2)(4x+\sin x)}{(2x^2-\cos x)^2}$

chain
rule

$$13) f(x) = \sin(5x) \quad f'(x) = \overbrace{\cos(5x)}^{\text{outer}'} \cdot \overbrace{\frac{d}{dx}[5x]}^{\text{inner}'} = \cos(5x) \cdot 5$$

$$14) f(x) = \log(2x) \quad f'(x) = \frac{1}{2x \cdot \ln 10} \cdot \frac{d}{dx}[2x] = \frac{1}{2x \cdot \ln 10} \cdot 2 = \frac{1}{x \cdot \ln 10}$$

$$15) f(x) = (x^3 + 2x)^{27} \quad f'(x) = 27(x^3 + 2x)^{26} \cdot \frac{d}{dx}[x^3 + 2x] = 27(x^3 + 2x)^{26} \cdot (3x^2 + 2)$$

$$16) y = e^{x^2-1} \quad \frac{dy}{dx} = e^{x^2-1} \cdot \frac{d}{dx}[x^2-1] = e^{x^2-1} \cdot 2x$$

$$17) y = x^4 \sin(3x) \quad \frac{dy}{dx} = x^4 \cdot \frac{d}{dx}[\sin(3x)] + \sin(3x) \cdot \frac{d}{dx}[x^4]$$

$$= x^4 \cdot \cos(3x) \cdot \frac{d}{dx}[3x] + \sin(3x) \cdot 4x^3$$

$$= x^4 \cos(3x) \cdot 3 + 4x^3 \sin(3x)$$

$$= x^3 (3x \cos(3x) + 4 \sin(3x))$$

$$18) f(x) = \cos(\sin(2x)) \quad f'(x) = \overbrace{-\sin(\sin(2x))}^{\text{outer}'} \cdot \overbrace{\frac{d}{dx}[\sin(2x)]}^{\text{inner}'}$$

$$= -\sin(\sin(2x)) \cdot \overbrace{\cos(2x)}^{\text{inner}'} \cdot \overbrace{\frac{d}{dx}[2x]}^{\text{innermost}'}$$

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