PRODUCT RULE

$$\frac{d}{dx}[PQ] = P'Q + PQ'$$

1. $f(x) = \underbrace{(x^4-3)}_{P}\underbrace{(5x^2+2x-3)}_{Q}$

$P' = 4x^3 \qquad Q' = 10x+2$

$P'Q + PQ'$

$f'(x) = 4x^3(5x^2+2x-3) + (x^4-3)(10x+2)$

$= 20x^5 + 8x^4 - 12x^3 + 10x^5 + 2x^4 - 30x - 6$

$= \boxed{30x^5 + 10x^4 - 12x^3 - 30x - 6}$

2. $f(x) = \sqrt[5]{x}\,(x-3)$

$= \underbrace{x^{\frac{1}{5}}}_{P}\underbrace{(x-3)}_{Q}$

$P' = \frac{1}{5}x^{\frac{1}{5}-1} \qquad Q' = 1$

$= \frac{1}{5}x^{-\frac{4}{5}}$

$= \frac{1}{5x^{4/5}}$

$P'Q + PQ'$

$f'(x) = \frac{1}{5x^{4/5}}(x-3) + x^{\frac{1}{5}}(1)$

$= \frac{x-3}{5x^{4/5}} + \frac{x^{\frac{1}{5}}}{1}$

$= \frac{x-3}{5x^{4/5}} + \frac{x^{\frac{1}{5}} \cdot 5x^{\frac{4}{5}}}{5x^{4/5}}$

$= \frac{x-3}{5x^{4/5}} + \frac{5x^{\frac{1}{5}+\frac{4}{5}}}{5x^{4/5}}$

$= \frac{x-3}{5x^{4/5}} + \frac{5x^1}{5x^{4/5}}$

$= \frac{6x-3}{5x^{4/5}}$

$= \boxed{\frac{3(2x-1)}{5x^{4/5}}}$

$x^2 x^5$

x^7