Derivative Tips:

1. If two expressions containing variables are multiplied or divided, use a product or quotient rule to find the derivative.

$Note\ that\ things\ such\ as\ \pi, e, ln2\ and\ \cos\left(\frac{5\pi}{6}\right)\ are\ not\ variables.$

If the numerator of a fraction is a constant it is easier to rewrite the expression using a negative exponent and then use a chain rule to find the derivative.

2. When doing a chain rule only change one piece each step. For example, the first step of $\frac{d}{dx}[2\sin^5(3x-2)]$ is $[10\sin^4(3x-2)]$, $\boldsymbol{not}$ $[10\cos^4(3x-2)]$.

Each step of the chain is multiplied by the one before. The next step would be: $[10\sin^4(3x-2)][cos(3x-2)]$ and finally

$$[10\sin^4(3x-2)][cos(3x-2)][3]$$

3. If a base and an exponent both have variables, you **must** use logarithmic differentiation. This technique also can be used to avoid complicated products and quotients.

To find $\frac{d}{dx}\left[y = (5x)^{\tan(x)}\right]$, take the ln of both sides and bring the exponent down as a coefficient:

$$\ln(y) = ln(5x)^{\tan(x)}$$

$$\ln(y) = \tan(x) \cdot ln(5x)$$

Next, take $\frac{d}{dx}$ of both sides: $\frac{d}{dx}\ln(y) = \frac{d}{dx}[\tan(x) \cdot ln(5x)]$

Do the product rule on the right: $\frac{1}{y}\frac{dy}{dx} = \tan(x)\frac{1}{5x} \cdot 5 + \ln(5x)\, sec^2(x)$

Multiply both sides by y, which = $(5x)^{\tan(x)}$:

$$\frac{dy}{dx} = \left[\tan(x)\frac{1}{x} + \ln(5x)\, sec^2(x)\right]\left[(5x)^{\tan(x)}\right]$$