Extra Product and Chain Rule Practice

Product Rule

Derivatives of **products** are **sums** of derivatives, taking turns across the product!

$$\frac{d}{dx}\Big[\, f(x)\, g(x) \,\Big] = \boldsymbol{f'(x)}\, g(x) + f(x)\, \boldsymbol{g'(x)}$$

Chain Rule

Derivatives of **compositions** are **products** of derivatives, peeling away layers of function!

$$\frac{d}{dx}\Big[\, f\big(\, g(x)\,\big) \,\Big] = \boldsymbol{f'}\big(\, g(x)\,\big)\, \boldsymbol{g'(x)}$$

1. Use the product rule to compute.

A. $\dfrac{d}{dx}\Big[\, (x^3 + x)\, \arctan(x) \,\Big]$

B. $\dfrac{d}{dx}\Big[\, x^{2/3}\, \ln(x) \,\Big]$

C. $\dfrac{d}{dx}\Big[\, \sec(x)\, \operatorname{arcsec}(x) \,\Big]$

D. $\dfrac{d}{dx}\Big[\, e^x\, \sin(x) \,\Big]$

2. Use the chain rule to compute.

A. $\dfrac{d}{dx}\Big[\, \arctan\big(x^3\big) \,\Big]$

B. $\dfrac{d}{dx}\Big[\, \big(\ln(x)\big)^{2/3} \,\Big]$

C. $\dfrac{d}{dx}\Big[\, \tan\big(x^5 + x^2\big) \,\Big]$

D. $\dfrac{d}{dx}\Big[\, e^{\sin(x)} \,\Big]$

3. Mixed problems!

A. $\dfrac{d}{dx}\Big[\ \sin\big(3x^2+x\big)\ \Big]$

B. $\dfrac{d}{dx}\Big[\ \ln(x)\ \cos(x)\ \Big]$

C. $\dfrac{d}{dx}\Big[\ (3x^2+x)\ \sin(x)\ \Big]$

D. $\dfrac{d}{dx}\Big[\ \ln\big(\cos(x)\big)\ \Big]$

4. Iterated problems!

A. $\dfrac{d}{dx}\Big[\ \sin\Big(\ \cos\big(\ \tan(x)\ \big)\ \Big)\ \Big]$

B. $\dfrac{d}{dx}\Big[\ \sin(x)\ \cos(x)\ \tan(x)\ \Big]$

5. Combined problems!

A. $\dfrac{d}{dx}\Big[\ e^{2x^3}\ \big(x^2+5x+1\big)\ \Big]$

B. $\dfrac{d}{dx}\Big[\ \sin\Big(x^5\ \ln(x)\Big)\ \Big]$

C. $\dfrac{d}{dx}\Big[\ \sin\big(2x^3\big)\ \tan\big(x^2+x+1\big)\ \Big]$

D. $\dfrac{d}{dx}\Big[\ \Big(\ x^2\ e^{5x}\ \Big)^{2/3}\ \Big]$