

unit 9: 1a 2021

1) a)  $\frac{d}{dx} x^5 x^7 = 5x^4 x^7 + x^5 7x^6 = 12x^{11}$

b)  $\frac{d}{dx} e^{2x} e^{3x} = 2e^{2x} e^{3x} + e^{2x} \cdot 3e^{3x} = 5e^{2x} e^{3x}$

c)  $\frac{d}{dx} (\sin x x^5) = \cos x x^5 + \sin x 5x^4$

2) a)  $\frac{d}{dx} \frac{1}{\cos x} = \frac{\sin x}{\cos^2 x} = \tan(x) \sec(x)$

b)  $\frac{d}{dx} \frac{1}{x^5} = \frac{-5x^4}{x^{10}} = \frac{-5}{x^6}$

c)  $\frac{d}{dx} \frac{1}{e^x} = \frac{-e^x}{(e^x)^2} = -\frac{1}{e^x}$

d)  $\frac{d}{dx} \frac{1}{\sin x} = \frac{-\cos(x)}{\sin^2(x)} = -\cot x \cdot \csc(x)$

$$\frac{d}{dx} x^n = n x^{n-1}$$

also  
for  
 $n < 0$

$$\frac{d}{dx} e^{ax} = a e^{ax}$$

also  
for  
 $a < 0$

3)

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

$$b) \frac{d}{dx} \left( \frac{x^4}{x^6} \right) = \frac{d}{dx} x^{-2} = (-2)x^{-3}$$

$$c) \frac{d}{dx} \left( \frac{1}{\log x} \right) = \frac{\log(x) \cdot 0 - 1 \cdot \frac{1}{x}}{(\log x)^2}$$

$$d) \frac{d}{dx} \frac{x^4}{\frac{\sin x}{\log x}} = -\frac{1}{x(\log x)^2}$$

$$\frac{d}{dx} \left( \frac{x^4 \log x}{\sin x} \right) = \frac{[\sin x [4x^3 \log x + 4x^2]] - [x^4 \log x \cos x]}{\sin^2 x}$$

4)

$$a) \frac{d}{dx} \frac{\sin x}{\cos x} = \sec^2(x)$$

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$$b) \frac{d}{dx} \sec(x) \csc(x)$$
$$= \frac{d}{dx} \frac{1}{\cos x \sin x}$$

$$= \sec^2 x - \csc^2 x$$

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$$c) \frac{d}{dx} \sin^2 x = 2 \sin x \cos x$$

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$$\frac{d}{dx} x \sin x = \sin x + x \cos x$$

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d)  $\frac{d}{dx} e^x \sin x \cos x \log x$

→ use product rule  
several times!

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e)  $\sqrt{\sin x} \sqrt{\sin x} = \sin x$

$2 \frac{d}{dx} \sqrt{\sin x} (\sqrt{\sin x}) = \cos x$

$$\frac{d}{dx} \sqrt{\sin x} = \frac{\cos x}{2\sqrt{\sin x}}$$

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