

Name: *Solutions*

Section: 11 12 13

1. Differentiate the following functions. You do not need to simplify :)

(a)  $f(x) = \tan(\ln x) + \ln(5x^{3/2} - 1)$

$$f'(x) = \sec^2(\ln x) \cdot \frac{1}{x} + \frac{1}{5x^{3/2} - 1} \cdot \left(5 \cdot \frac{3}{2} x^{1/2} - 0\right)$$

(b)  $s(t) = e^{3t+2} + e^{t \ln 2}$

$$s'(t) = e^{3t+2} (3) + e^{t \cdot \ln 2} (\ln 2)$$

(c)  $g(x) = (\cos x)^{\cot x}$  *Logarithmic Differentiation*

$$\ln g(x) = \ln [(\cos x)^{\cot x}]$$

$$\Rightarrow \ln g(x) = \cot x \cdot \ln(\cos x)$$

$$\Rightarrow \frac{g'(x)}{g(x)} = -\csc^2 x \cdot \ln(\cos x) + \cot x \cdot \frac{-\sin x}{\cos x}$$

$$\begin{aligned} \Rightarrow g'(x) &= (\cos x)^{\cot x} \left[ -\csc^2 x \cdot \ln(\cos x) + \cot x \cdot (-\tan x) \right] \\ &= (\cos x)^{\cot x} \left[ \csc^2 x \cdot \ln(\sec x) - 1 \right] \end{aligned}$$

2. Evaluate the integrals

(a)  $\int \frac{3x}{x^2+6} dx$

u-sub

$u = x^2 + 6$

$du = 2x dx \Rightarrow \frac{3}{2} du = 3x dx$

$$= \int \frac{\frac{3}{2} du}{u} = \frac{3}{2} \int \frac{1}{u} du$$

$$= \frac{3}{2} \ln|u| + C$$

$$= \frac{3}{2} \ln|x^2+6| + C$$

(b)  $\int \sin x e^{\cos x} dx$

u-sub

$u = \cos x$

$du = -\sin x dx$

$\Rightarrow -du = \sin x dx$

$$= \int e^u (-du)$$

$$= -\int e^u du$$

$$= -e^u + C = -e^{\cos x} + C.$$