Math 330 – Test 1
2/6/15

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Take your time and make sure you follow all instructions. Where necessary, work must be shown in order to receive partial credit.

Find the derivatives of the following functions. [10 pts each]

1. $y = \cos\left(6x^3\right)$

$y' = -\sin(6x^3)\, 3x^2 = -3x^2 \sin(6x^3)$

2. $y = \sin^{-1}\left(5x^2\right)$

$y' = \dfrac{1}{\sqrt{1-(5x^2)^2}}\, 10x = \dfrac{10x}{\sqrt{1-25x^4}}$

3. $y = \ln\left(x^3 - x + 1\right)$

$y' = \dfrac{3x^2 - 1}{x^3 - x + 1}$

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Find the derivatives of the following function. [11 points]

4. $y = e^{\csc 4x^2}$

$y' = e^{\csc 4x^2} \cdot -\csc 4x^2 \cot 4x^2 \cdot 8x$

$= -8x \csc 4x^2 \cot 4x^2 \, e^{\csc 4x^2}$

Evaluate the limit (if it exists) using L'Hospital's Rule. [12 points]

5. $\lim_{x\to 2} \frac{3\sin(x-2)}{x-2}$ $\to 0$ $\to 0$

$\overset{LR}{=} \lim_{x\to 2} \frac{3\cos(x-2)}{1} = 3$

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Find the derivatives of the following functions. [13 pts each]

6. $y = \sec^4\left(e^{2x^3}\right)$

$$y' = 4\sec^3\left(e^{2x^3}\right)\sec\left(e^{2x^3}\right)\tan\left(e^{2x^3}\right)e^{2x^3}\,6x^2$$

$$= 24x^2e^{2x^3}\sec^4\left(e^{2x^3}\right)\tan\left(e^{2x^3}\right)$$

7. $y = \underbrace{4x^3}_{F}\underbrace{\ln\left(3x^2\right)}_{S}$

$$y' = 4\cancel{x^3}^{\,x}\,\frac{\overset{2}{\cancel{6}}x}{\cancel{3}\cancel{x^2}} + \ln\left(3x^2\right)\,12x^2$$

$$= 8x^2 + 12x^2\ln\left(3x^2\right)$$

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Evaluate the following integrals. [13 pts each]

8. $\int \tan^5 3x \sec^2 3x \, dx$

$u = \tan 3x$

$du = 3 \sec^2 3x \, dx$

$\frac{1}{3} \int \tan^5 3x \; 3 \sec^2 3x \, dx$

$= \frac{1}{3} \int u^5 \, du = \frac{1}{3} \frac{u^6}{6} + C = \frac{1}{18} \tan^6 3x + C$

9. $\int \frac{e^{4t}}{\left(5+2e^{4t}\right)^3} dt$

$u = 5 + 2e^{4t}$

$du = 8e^{4t} dt$

$= \frac{1}{8} \int \left(5+2e^{4t}\right)^{-3} 8e^{4t} \, dt = \frac{1}{8} \int u^{-3} \, du$

$= \frac{1}{8} \frac{u^{-2}}{-2} + C$

$= -\frac{1}{16\left(5+2e^{4t}\right)^2} + C$

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