_____ / 15 total points

Quiz #3 Name: _____

Math 180, Prof. Beydler Wednesday, May 20, 2020

Directions: We're working on the honor system here: no notes, books, phones, or computers during the quiz (except for using a computer to write your answers). Also, no getting help from other people. You may e-mail me to ask for clarification about any problem. **Show all work**. A **scientific calculator** is allowed. Write your answers in the indicated places, or box your answers. Good luck!

1. (3 points) Find the most general antiderivative for $f(x) = \frac{1}{3}\csc^2 x + \sin 3x - \frac{2}{x} + \sqrt[4]{x} - 3^x$.

Answer: $-\frac{1}{3}\cot x - \frac{1}{3}\cos 3x - 2\ln|x| + \frac{4}{5}x^{5/4} - \frac{3^x}{\ln 3} + C$

2. (2 points) A particle is moving with the given data. Find a function $s(t)$ that represents the position of the particle as a function of time t.

$v(t) = \frac{4}{1+t^2}$, $s(1) = 4$

$s(t) = 4\tan^{-1}t + C$

$s(1) = 4$:

$4\tan^{-1}1 + C = 4$

$4\left(\frac{\pi}{4}\right) + C = 4$

$\pi + C = 4$

$C = 4 - \pi$

$s(t) = 4\tan^{-1}t + (4-\pi)$

$s(t) =$ $4\tan^{-1}t + 4 - \pi$

3. (3 points) Evaluate the following integral using a substitution: $\int \frac{-1}{3x(\ln x)^2}\,dx$

$= -\frac{1}{3}\int \frac{1}{x(\ln x)^2}\,dx$

$u = \ln x$

$du = \frac{1}{x}\,dx$

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

$= -\frac{1}{3}\left(-\frac{1}{u}\right) + C$

$= \frac{1}{3\ln x} + C$

Answer: $\frac{1}{3\ln x} + C$

4. (3 points) Evaluate the following integral using integration by parts: $\int e^{3x}\cos x\,dx$

$\int e^{3x}\cos x\,dx = e^{3x}\sin x + 3e^{3x}\cos x - 9\int e^{3x}\cos x\,dx$

$+9\int e^{3x}\cos x\,dx \qquad +9\int e^{3x}\cos x\,dx$

$10\int e^{3x}\cos x\,dx = e^{3x}\sin x + 3e^{3x}\cos x$

Answer: $\frac{1}{10}e^{3x}\sin x + \frac{3}{10}e^{3x}\cos x + C$

$e^{3x} \xrightarrow{+} \cos x$

$3e^{3x} \xrightarrow{-} \sin x$

$9e^{3x} \xleftarrow{+} -\cos x$

5. (4 points) Evaluate the following integral using a integration by parts and then a substitution: $\int x\sec^2 x\,dx$

$= x\tan x - \int \tan x\,dx$

$x \xrightarrow{+} \sec^2 x$

$1 \xleftarrow{} \tan x$

Answer: $x\tan x + \ln|\cos x| + C$

$= x\tan x - \int \frac{\sin x}{\cos x}\,dx$

$= x\tan x - \int \frac{1}{u}(-du)$

$= x\tan x + \ln|u| + C$

$u = \cos x$

$du = -\sin x\,dx$

$-du = \sin x\,dx$