_____ / 15 total points

Quiz #3

Name: [handwritten: blank]

Math 180, Section 7, Prof. Beydler

Thursday, November 9, 2017

Directions: Show all work. No books or notes. A **scientific calculator** is allowed. Your desk and lap must be clear (no phones, no smart watches, etc.). If you have a phone in your lap or on your chair, it is considered cheating, and you will receive a zero on this test. Write your answers in the indicated places, or box your answers. Good luck!

1. (3 points) Find the absolute maximum and minimum values of $f(x) = xe^{-x}$ on the interval $[0, 3]$.

$$f'(x) = x(-e^{-x}) + 1\cdot e^{-x} = e^{-x}(-x+1)$$

Absolute maximum value: $\frac{1}{e}$

Absolute minimum value: 0

$f' = 0$:

$e^{-x}(-x+1) = 0$

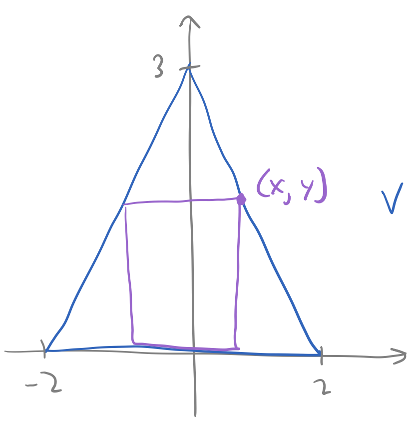
$\downarrow$

$x = 1$

x	$f(x)$
1	$\frac{1}{e} \approx 0.37$
0	0
3	$\frac{3}{e^3} \approx 0.15$

2. (5 points) A right circular cylinder is inscribed in a cone with height 3 and base radius 2. Find the largest possible volume of such a cylinder.

Dimensions: $\frac{16\pi}{9}$



$V(x,y) = \pi x^2 y$

$y - 0 = -\frac{3}{2}(x-2)$

$y = -\frac{3}{2}x + 3$

$V(x) = \pi x^2\left(-\frac{3}{2}x + 3\right)$

$= -\frac{3\pi}{2}x^3 + 3\pi x^2$

$V'(x) = -\frac{9\pi}{2}x^2 + 6\pi x = 3\pi x\left(-\frac{3}{2}x + 2\right)$

$V' = 0$:

$3\pi x\left(-\frac{3}{2}x + 2\right) = 0$

$\cancel{x = 0}$

$-\frac{3}{2}x + 2 = 0$

$-\frac{3}{2}x = -2$

$x = \frac{4}{3}$

$V\left(\frac{4}{3}\right) = \pi\left(\frac{4}{3}\right)^2\left(-\frac{3}{2}\left(\frac{4}{3}\right) + 3\right)$

$= \frac{16\pi}{9}(-2+3)$

3. (3 points) Find the most general antiderivative for $f(x) = 2\csc x \cot x + \cos 3x - \frac{4}{x} + \sqrt{x} - 5^x$.

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

$f(x) = 2\csc x \cot x + \cos 3x - 4 \cdot \frac{1}{x} + x^{1/2} - 5^x$

$F(x) = -2\csc x + \frac{1}{3}\sin 3x - 4\ln|x| + \frac{x^{3/2}}{(3/2)} - \frac{5^x}{\ln 5} + C$

4. (4 points) $\int e^{2\cos x} \sin x \, dx$

$u = \cos x$

$du = -\sin x \, dx$

$-du = \sin x \, dx$

Answer: $-\frac{1}{2}e^{2\cos x} + C$

$= \int e^{2u} \cdot (-du)$

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