

Math 1220-003, Summer 2018

Final Exam Review

1. Find the following limits:

(a) $\lim_{x \rightarrow 0^+} \frac{\cot x}{\sqrt{-\ln x}}$

(b) $\lim_{x \rightarrow 0^+} (3x)^{x^2}$

(c) $\lim_{x \rightarrow 0} (\csc^2 x - \cot^2 x)$

2. Find the following integrals:

(a) $\int \frac{(\ln x)^2}{x} dx$

(b) $\int \frac{x+1}{x(x-1)} dx$

(c) $\int \sin^2 x \cos^3 x dx$

(d) $\int x^2 e^x dx$

(e) $\int \frac{dx}{\sqrt{3-2x^2}}$

3. The half-life of Tritium is 12 years. If you start with 50 grams of Tritium, how much will you have after 100 years?

4. Salt water, at a concentration of 2 kg/L, flows into a tank of water at a rate of 5 L/min. Salt water flows out of the tank at a rate of 4 L/min. The tank starts with 10 Liters of water. Find the differential equation describing the amount of salt in the tank after t minutes. (You don't have to solve it).

5. Solve the differential equation

$$x \frac{dy}{dx} + \ln x = 0$$

given $y(1) = 2$.

6. Find the convergence set of the power series $\sum_{n=0}^{\infty} \frac{(n+1)^2}{n!} (x-1)^n$.

7. Find the first 3 terms of the Taylor series of $\frac{1}{x^3+1}$ at $x = 0$.

8. Find the area of the region enclosed by the curve given in polar coordinates by $r = 2 \cos \theta \sqrt{\sin \theta}$, $0 \leq \theta \leq \frac{\pi}{2}$.