

Final Exam Review
Calculus II
Sheet 1

1. State the definition of $\int_a^b f(x) dx$, assuming equal subintervals and right endpoints.
2. True or False, and give a short reason:
 - (a) The Alternating Series Test is sufficient to show that a series is conditionally convergent.
 - (b) You can use the Integral Test to show that a series is absolutely convergent.
 - (c) Consider $\sum a_n$. If $\lim_{n \rightarrow \infty} a_n = 0$, then the sum is said to converge.
 - (d) The sequence $a_n = 0.1^n$ converges to $\frac{1}{1-0.1}$.
 - (e) All continuous functions have derivatives.
 - (f) All continuous functions have antiderivatives.
3. Set up an integral for the volume of the solid obtained by rotating the region defined by $y = \sqrt{x-1}$, $y = 0$ and $x = 5$ about the y -axis. (I would give the graph on the exam).
4. Write the area under $y = \sqrt[3]{1+x}$, $1 \leq x \leq 4$ as the limit of a Riemann sum (use **right** endpoints and do not evaluate). For the same function, write an integral representing the arc length (do not evaluate the integral).
5. Find the Taylor series for $f(x) = \sqrt{x}$ centered at $a = 9$.
6. Find $\frac{dy}{dx}$, if $y = \int_{\cos(x)}^{5x} \cos(t^2) dt$
7. Let $f(x) = e^x$ on the interval $[0, 2]$. (a) Find the average value of f . (b) Find c such that $f_{\text{avg}} = f(c)$.
8. Use a template series to find the series for $\int \cos(x^2) dx$.
9. Does the series converge (absolute or conditional), or diverge?
 - (a) $\sum_{n=1}^{\infty} \frac{\cos(n/2)}{n^2 + 4n}$
 - (b) $\sum_{n=1}^{\infty} \frac{n^2 + 1}{5^n}$
 - (c) $\sum_{n=1}^{\infty} \frac{3^n n^2}{n!}$
10. Find the interval of convergence:
 - (a) $\sum_{n=1}^{\infty} \frac{n^2 x^n}{10^n}$
 - (b) $\sum_{n=1}^{\infty} \frac{(3x-2)^n}{n3^n}$
 - (c) $\sum_{n=1}^{\infty} \frac{(-1)^n x^{2n-1}}{(2n-1)!}$
11. Evaluate the integral.

(a) $\int \frac{1}{y^2 - 4y - 12} dy$	(e) $\int \frac{dx}{x \ln(x)}$	(i) $\int \sin^{-1}(x) dx$
(b) $\int \frac{2}{3x+1} + \frac{2x+3}{x^2+9} dx$	(f) $\int x\sqrt{x-1} dx$	(j) $\int \frac{dx}{\sqrt{x^2-9}}$
(c) $\int x^2 \cos(3x) dx$	(g) $\int_0^\infty \frac{x^2}{\sqrt{1+x^3}} dx$	
(d) $\int_{-2}^2 x-1 dx$	(h) $\int \sin^2(x) \cos^3(x) dx$	

12. The velocity function is $v(t) = 3t - 5$, $0 \leq t \leq 3$ (a) Find the displacement. (b) Find the distance traveled.

13. Set up the integral that will give the length of the graph of $y = \sqrt{x-x^2} + \sin^{-1}(\sqrt{x})$, with $0 \leq x \leq 1$.

14. Evaluate each sum. Hint on part (c): Partial Fractions

(a) $\sum_{n=0}^{\infty} \frac{(-1)^n \pi^{2n}}{6^{2n} (2n)!}$	(b) $\sum_{n=1}^{\infty} (-1)^{n-1} \frac{3^{n+2}}{2^{2n}}$	(c) $\sum_{n=1}^{\infty} \frac{1}{n(n+3)}$
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15. Compute the quantity: $\binom{4}{3}$