King Fahd University of Petroleum and Minerals
Department of Mathematics

Math 102
Final Exam
Term 251
22 December 2025
Net Time Allowed: 120 Minutes

MASTER VERSION

Question 25 / Section 8.8 Page 579

1. $\displaystyle\int_4^{\infty} \frac{dx}{x(\ln x)^3}$

(a) converges to $\dfrac{1}{2(\ln 4)^2}$ (correct)

(b) diverges

(c) converges to $\dfrac{1}{(\ln 4)^2}$

(d) converges to $\dfrac{2}{(\ln 4)^2}$

(e) converges to $\dfrac{1}{2(\ln 2)^2}$

Question 36 / Section 8.8 Page 579

2. $\displaystyle\int_0^8 \frac{3}{\sqrt{8-x}}\,dx$

(a) converges to $12\sqrt{2}$ (correct)

(b) diverges

(c) converges to $6\sqrt{2}$

(d) converges to $4\sqrt{2}$

(e) converges to $\sqrt{2}$

Question 35 / Section 9.1 Page 596

3. The sequence whose nth term is $a_n = \dfrac{\ln(n^3)}{2n}$ converges to

(a) 0 (correct)

(b) $\dfrac{3}{2}$

(c) 3

(d) $\dfrac{2}{3}$

(e) 2

Questions 29 & 31 / Section 9.2 Page 605

4. $\displaystyle\sum_{n=1}^{\infty} 5\left(\frac{2}{3}\right)^n + \sum_{n=1}^{\infty} \frac{4}{n(n+2)} =$

(a) 13 (correct)

(b) 14

(c) 15

(d) 16

(e) 18

Questions 6 & 13 & 37 / Section 9.3 Page 613

5. Which one of the following series is/are convergent?

(I) $\sum_{n=1}^{\infty} \frac{\arctan n}{n^2+1}$ (II) $\sum_{n=1}^{\infty} 3^{-n}$ (III) $\sum_{n=1}^{\infty} \frac{1}{n^{1.03}}$

(a) I, II and III _____ (correct)

(b) I and II only

(c) I and III only

(d) II and III only

(e) III only

Questions 16 & 23 & 25 / Section 9.4 Page 620

6. Which one of the following series is/are divergent?

(I) $\sum_{n=1}^{\infty} \frac{2+\cos n}{\sqrt{n}}$ (II) $\sum_{n=1}^{\infty} \frac{1}{n\sqrt{n^2+1}}$ (III) $\sum_{n=1}^{\infty} \frac{n^k-1}{n^k+1}$, $k>2$

(a) I and III only _____ (correct)

(b) I and II only

(c) II and III only

(d) II only

(e) I only

Question 39 / Section 9.5 Page 629

7. The least number of terms required to approximate the sum of the series $\sum_{n=1}^{\infty} \frac{(-1)^n}{n!}$ with an error of less than 0.01 is
(Hint: Use the Reminder Theorem)

(a) 4 (correct)
(b) 6
(c) 2
(d) 8
(e) 10

Question 54 / Section 9.5 Page 630

8. The series $\sum_{n=0}^{\infty} \frac{(-1)^n}{\sqrt{n+4}}$

(a) converges conditionally (correct)
(b) diverges
(c) converges absolutely
(d) diverges by the Alternating Series Test
(e) converges by the Integral Test

Questions 23 & 30 & 41 / Section 9.6 Pages 637-638

9. Which one of the following series is/are divergent?

(I) $\sum_{n=1}^{\infty} \frac{9^n}{n^5}$ (II) $\sum_{n=1}^{\infty} \frac{(2n)!}{n^5}$ (III) $\sum_{n=1}^{\infty} \left(\frac{3n+2}{n+3}\right)^n$

(a) I, II and III (correct)

(b) I and II only

(c) II and III only

(d) I and III only

(e) III only

Question 25 / Section 9.7 Page 648

10. Using a Second degree Maclaurin polynomial of the function $f(x) = \sec x$, the approximation of the value $\sec 1$ is equal to

(a) $\frac{3}{2}$ (correct)

(b) $\frac{5}{2}$

(c) $\frac{7}{2}$

(d) $\frac{9}{2}$

(e) $\frac{11}{2}$

Question 25 / Section 9.8 Page 658

11. The interval of converges for the series $\sum_{n=1}^{\infty} \frac{(-1)^{n+1}(x-4)^n}{n9^n}$

(a) $(-5, 13]$ (correct)

(b) $[-5, 13]$

(c) $(4, 9]$

(d) $[4, 9]$

(e) $(-5, 13)$

Question 26 / Section 9.9 Page 666

12. A power series representation for the function $f(x) = \ln(x^2 + 1)$ centered at $c = 0$ is

(a) $\sum_{n=0}^{\infty} \frac{(-1)^n x^{2n+2}}{n+1}$, $[-1, 1]$ (correct)

(b) $\sum_{n=0}^{\infty} \frac{(-1)^n x^{2n}}{n+1}$, $[-1, 1]$

(c) $\sum_{n=0}^{\infty} \frac{(-1)^n x^{n+1}}{n+1}$, $[-1, 1]$

(d) $\sum_{n=0}^{\infty} \frac{(-1)^n x^{2n+1}}{n+1}$, $[-1, 1]$

(e) $\sum_{n=1}^{\infty} \frac{(-1)^n x^{2n+2}}{n}$, $[-1, 1]$

Example 3 / Section 9.10 Page 672

13. The Coefficient of x^{11} in the Maclaurin Series for the function $f(x) = x\sin(x^2)$ is

(a) $\dfrac{1}{5!}$ ——————————————————————————— (correct)

(b) $\dfrac{-1}{5!}$

(c) $\dfrac{-1}{4!}$

(d) $\dfrac{1}{4!}$

(e) $\dfrac{1}{9!}$

Question 83 / Review Chapter 5 Page 384

14. $\displaystyle\int_0^1 \frac{e^{2x} - e^{-2x}}{e^{2x} + e^{-2x}}\,dx =$

(a) $\dfrac{1}{2}\ln\dfrac{(e^2 + e^{-2})}{2}$ ——————————————————————————— (correct)

(b) $\ln(e^2 + e^{-2})$

(c) $\ln\left(\dfrac{e^2 + e^{-2}}{2}\right)$

(d) $\dfrac{1}{2}\ln 2(e^2 + e^{-2})$

(e) $\ln(e^2 - e^{-2})$

Question 37 / Section 8.4 Page 547

15. $\displaystyle\int_0^{\frac{\sqrt{3}}{2}} \frac{t^2}{(1-t^2)^{3/2}}\,dt =$

(a) $\sqrt{3} - \dfrac{\pi}{3}$ (correct)

(b) $\sqrt{2} + \dfrac{\pi}{3}$

(c) $\sqrt{3} + \dfrac{\pi}{6}$

(d) $\sqrt{2} + \dfrac{\pi}{6}$

(e) $\sqrt{3} - \pi$

Question 7 / Section 8.5 Page 557

16. $\displaystyle\int \frac{x^2+12x+12}{x^3-4x}\,dx =$

(a) $5\ln|x-2| - \ln|x+2| - 3\ln|x| + C$ (correct)

(b) $\ln|x-2| - \ln|x+2| - \ln|x| + C$

(c) $5\ln|x-2| - \ln|x+2| + \ln|x| + C$

(d) $\ln|x-2| + \ln|x+2| - 3\ln|x| + C$

(e) $5\ln|x-2| + \ln|x+2| - 3\ln|x| + C$

17. The volume of the solid generated by revolving the region bounded by the graphs of $y = 1 - x^2$,
(in the first quadrant) about the x-axis is

(a) $\frac{8\pi}{15}$ ——————————————————————————————(correct)
(b) $\frac{4\pi}{15}$
(c) $\frac{8\pi}{5}$
(d) $\frac{4\pi}{5}$
(e) $\frac{2\pi}{15}$

Question 17 / Section 7.1 Page 450

18. The area of the region bounded by the graphs of the equations

$y = x^2 + 2x$ and $y = x + 2$ is

(a) $\frac{9}{2}$ ——————————————————————————————(correct)
(b) $\frac{7}{2}$
(c) $\frac{5}{2}$
(d) $\frac{11}{2}$
(e) $\frac{13}{2}$

Question 17 / Section 7.4 Page 481

19. The arc length of the graph of the function $f(x) = \frac{1}{2}(e^x + e^{-x})$ over the interval $[0, 2]$ is

(a) $\frac{1}{2}\left(e^2 - \frac{1}{e^2}\right)$ (correct)

(b) $\frac{1}{4}\left(e^2 + \frac{1}{e^2}\right)$

(c) $\left(e^2 + \frac{1}{e}\right)$

(d) $\frac{1}{2}\left(e - \frac{1}{e}\right)$

(e) $\frac{1}{4}\left(e + \frac{1}{e^2}\right)$

Question 22 / Section 8.2 Page 529

20. $\int \frac{\ln x}{x^3}\, dx =$

(a) $\frac{-1}{2x^2}\ln x - \frac{1}{4x^2} + C$ (correct)

(b) $\frac{1}{x^2}\ln x - \frac{1}{4x^2} + C$

(c) $\frac{-1}{x^2}\ln x + \frac{1}{x^2} + C$

(d) $\frac{-1}{2x^2}\ln x + \frac{1}{x^2} + C$

(e) $\frac{-1}{x^2}\ln x + \frac{1}{2x^2} + C$