

## Math 112 EXAM II, Spring, 2022

Read each problem carefully. Show all your work for each problem! No Calculators!

1. (10) Determine if the following sequences converge or diverge. Find the limit of each convergent sequence.

$$(a) a_n = \frac{\sqrt{n+4n^2}}{2+n}; \quad (b) a_n = (2)^{1/n}.$$

2. (12) Evaluate the following integrals:

$$(a) \int \cos^3 \theta d\theta; \quad (b) \int \frac{\ln(x^2)}{x^2} dx.$$

3. (12) Evaluate the following integrals:

$$(a) \int \sqrt{4-x^2} dx, \quad (b) \int (1 + \tan x) \cos x dx.$$

4. (12) Evaluate the following integrals:

$$(a) \int \frac{dx}{\sqrt{x^2-16}}; \quad (b) \int \frac{3x-5}{x^2-3x+2} dx.$$

5. (12) Evaluate the following integrals:

$$(a) \int \sec^3 \theta \tan \theta d\theta, \quad (b) \int \frac{x}{x^4+1} dx.$$

6. (a) (6) Apply the Direct Comparison Test to determine if the following integral converges. (Do NOT evaluate the integral)

$$\int_0^1 \frac{1}{x^2 + \sqrt{x}} dx.$$

- (b) (6) Apply the Limit Comparison Test to determine if the following integral converges. (Do NOT evaluate the integral)

$$\int_1^{\infty} \frac{e^x}{x\sqrt{e^{2x}+4}} dx.$$

7. (10) Estimate the following integral using the trapezoidal rule with  $n = 4$  steps. Then find an upper bound on the error in estimating this integral using the trapezoid rule with  $n = 4$ .

$$\int_0^2 (x^3 - 1) dx, \quad |E_T| = \frac{\max|f''(x)| (b-a)^3}{12n^2}$$

8. (12) Evaluate the following improper integrals:

$$(a) \int_0^{\infty} \frac{e^{-x}}{1+e^{-x}} dx \quad (b) \int_1^2 \frac{1}{\sqrt{x-1}} dx.$$

9. (8) Evaluate the following integral:

$$\int_0^{\pi/4} \frac{\sec^4 x}{\sqrt{\tan x}} dx.$$