Name_____

MATH 172 Exam 2 Spring 2023

Sections 502 P. Yasskin

Multiple Choice: (5 points each. No part credit. Circle your answers.)

1-11	/55	13	/16
12	/16	14	/18
		Total	/105

1. Find the general partial fraction expansion of $f(x) = \dfrac{(x+2)^2}{(x^4-16)(x-2)}$.

a. $\dfrac{A}{(x-2)^2} + \dfrac{Bx+C}{x^2+4}$

b. $\dfrac{A}{x-2} + \dfrac{B}{(x-2)^2} + \dfrac{Cx+D}{x^2+4}$

c. $\dfrac{A}{x-2} + \dfrac{Bx+C}{x^2+4}$

d. $\dfrac{A}{x-2} + \dfrac{Bx+C}{x^2+4} + \dfrac{Dx+E}{x^2-4}$

e. $\dfrac{A}{(x-2)^2} + \dfrac{Bx+C}{x^2+4} + \dfrac{Dx+E}{(x^2+4)^2}$

2. Given the partial fraction expansion:

$$\frac{x^2+32x-4}{x^4-16} = \frac{2}{x-2} + \frac{2}{x+2} + \frac{-4x+1}{x^2+4}$$

which term in the following integral is INCORRECT?

$$\int \frac{x^2+32x-4}{x^4-16}\,dx = \underbrace{\ln|x-2|^2}_{\text{A}} + \underbrace{\ln|x+2|^2}_{\text{B}} - \underbrace{\ln|x^2+4|^2}_{\text{C}} + \underbrace{\frac{1}{2}\arctan\left(\frac{x}{2}\right)}_{\text{D}}$$

a. A

b. B

c. C

d. D

e. They are all correct.

3. $\int \frac{1}{(x^2-9)^{3/2}}\,dx =$

a. $\frac{1}{3}\frac{1}{\sqrt{x^2-9}}$

b. $\frac{1}{3}\frac{x}{\sqrt{x^2-9}}$

c. $\frac{1}{9}\frac{1}{\sqrt{x^2-9}}$

d. $\frac{1}{9}\frac{x}{\sqrt{x^2-9}}$

e. $-\frac{1}{9}\frac{x}{\sqrt{x^2-9}}$

4. $\int_0^4 \frac{1}{(9+x^2)^{3/2}}dx =$

a. $\frac{1}{15}$

b. $\frac{1}{45}$

c. $\frac{4}{45}$

d. $\frac{4}{135}$

e. $\frac{4}{225}$)

5. $\int_0^4 \frac{1}{x^2-25}dx =$

a. $-\frac{1}{5}\ln 3$

b. $\frac{1}{5}\ln 3$

c. $\frac{1}{5}\ln 4 - \frac{1}{5}$

d. $-\frac{1}{5}\ln 4 + \frac{1}{5}$

e. $\frac{1}{5}\ln 4$

6. Consider the integrals:

$$A = \int_3^4 \frac{1}{(x-3)^{2/3}}dx \qquad B = \int_3^4 \frac{1}{(x-3)^{4/3}}dx \qquad C = \int_4^\infty \frac{1}{(x-3)^{2/3}}dx \qquad D = \int_4^\infty \frac{1}{(x-3)^{4/3}}dx$$

Which are finite? Which are infinite?

a. A and B are finite. C and D are infinite.

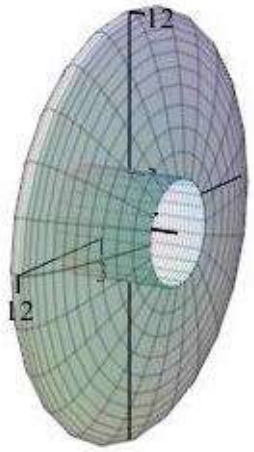
b. B and C are finite. A and D are infinite.

c. B and D are finite. A and C are infinite.

d. A and D are finite. B and C are infinite.

e. A and C are finite. B and D are infinite.

7. The region between $y = 12 - x^2$ and $y = 3$ is rotated about the x-axis.
Which integral gives the volume swept out?



a. $V = \pi \int_{-3}^{3} (x^4 - 24x^2 + 135)\, dx$

b. $V = 2\pi \int_{-3}^{3} (x^4 - 24x^2 + 135)\, dx$

c. $V = \pi \int_{0}^{3} (9x - x^3)\, dx$

d. $V = 2\pi \int_{0}^{3} (9x - x^3)\, dx$

e. $V = 2\pi \int_{-3}^{3} (9x - x^3)\, dx$

8. The region between $y = 12 - x^2$ and $y = 3$ is rotated about the y-axis.
Find the volume swept out.

a. $\frac{81\pi}{4}$

b. $\frac{81\pi}{2}$

c. 18π

d. 36π

e. 81π

9. The base of a solid is the region between $y = x^2$ and the x-axis for $0 \le x \le 3$. The cross sections perpendicular to the x-axis are squares. Find the volume of the solid.

a. 9

b. 27

c. 81

d. $\frac{3^5}{5}$

e. $\frac{3^4}{4}$

10. A spring has a rest length of $x_0 = 5$ m. It requires 12 N of force to hold the spring at $x = 7$ m. Find the work done to stretch the spring from $x = 6$ m to $x = 8$ m.

a. 6

b. 8

c. 12

d. 18

e. 24

11. A 20 ft rope hangs from the top of a building. It's linear weight density is $\rho = 3$ lb/ft. How much work is done to lift the rope to the top of the building?

a. 600 ft-lb

b. 450 ft-lb

c. 300 ft-lb

d. 200 ft-lb

e. 150 ft-lb

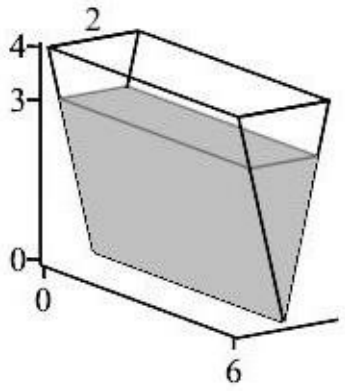
Work Out: (Points indicated. Part credit possible. Show all work.)

12. (16 points) Find the coefficients in the partial fraction expansion

$$\frac{10}{(x^2+4)(x^2-1)} = \frac{Ax+B}{x^2+4} + \frac{C}{x+1} + \frac{D}{x-1}$$

$A =$
$B =$
$C =$
$D =$

13. (16 points) The tank shown is 6 m long, 2 m wide at the top and 4 m high. It is filled with water to a depth of 3 m.
How much work is done to pump the water out the top of the tank? Take the density of water to be ρ kg/m^3 and the acceleration of gravity to be g m/sec^2. (You don't need numbers for ρ and g.)



$W =$

14. (18 points) Consider the integral $\int_1^9 (x-4)^2\,dx$ The exact value is $\frac{152}{3}$.
Use each of the following numerical techniques to approximate the integral.

a. Left Riemann Sum with 4 intervals

$L_4 =$

a. Right Riemann Sum with 4 intervals

$R_4 =$

a. Midpoint Riemann Sum with 4 intervals

$M_4 =$

a. Trapezoid Rule with 4 intervals

$T_4 =$

a. Simpson's Rule with 4 intervals

$S_4 =$