

Name _____

MATH 172

Exam 1

Spring 2023

Sections 502

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Multiple Choice: (7 points each. No part credit. Circle your answers.)

1-7	/49	9	/20
8	/15	10	/20
		Total	/104

1. Find the area between the curves $x = y^2$ and $x = 2y$.

- a. $\frac{2}{3}$
- b. $\frac{4}{3}$
- c. $\frac{8}{3}$
- d. $\frac{16}{3}$
- e. $\frac{32}{3}$

2. Compute the average value of $f(x) = e^x$ on the interval $[0, 2]$.

- a. $\frac{1}{2}(e^2 + 1)$
- b. $\frac{1}{4}(e^2 + 1)$
- c. $\frac{1}{4}e^2$
- d. $\frac{1}{2}(e^2 - 1)$
- e. $\frac{1}{2}e^2$

3. Compute the right Riemann sum $\lim_{n \rightarrow \infty} \sum_{i=1}^n \left(2 + i \frac{2}{n}\right)^3 \frac{2}{n}$ by converting it into an integral and using the FTC to compute the integral.

- a. 20
- b. 40
- c. 60
- d. 320
- e. 960

4. Compute $\int x \cos(4x) dx$.

- a. $\frac{x}{4} \sin(4x) + \frac{1}{16} \cos(4x) + C$
- b. $\frac{x}{4} \sin(4x) - \frac{1}{4} \cos(4x) + C$
- c. $\frac{x}{4} \sin(4x) - \frac{1}{16} \cos(4x) + C$
- d. $4x \sin(4x) + 16 \cos(4x) + C$
- e. $4x \sin(4x) - 4 \cos(4x) + C$

5. Compute $\int e^x \sin(3x) dx$.

a. $-\frac{1}{8}e^x \sin(3x) + \frac{3}{8}e^x \cos(3x) + C$

b. $-\frac{1}{8}e^x \cos(3x) - \frac{3}{8}e^x \sin(3x) + C$

c. $e^x \sin(3x) - 3e^x \cos(3x) + C$

d. $\frac{1}{10}e^x \sin(3x) - \frac{3}{10}e^x \cos(3x) + C$

e. $\frac{1}{10}e^x \cos(3x) - \frac{3}{10}e^x \sin(3x) + C$

6. Compute $\int \tan^7 \theta \sec^2 \theta d\theta$.

a. $\frac{1}{16} \tan^8 \theta \sec^2 \theta + C$

b. $\frac{1}{24} \tan^8 \theta \sec^3 \theta + C$

c. $-\frac{\tan^8 \theta}{2} + C$

d. $\frac{\tan^8 \theta}{2} + C$

e. $\frac{\tan^8 \theta}{8} + C$

7. $\int_0^\pi \sin^2(3\theta) \cos^2(3\theta) d\theta$

a. 2π

b. $\frac{1}{8}\pi$

c. $2\pi - \frac{1}{6}$

d. $2\pi + \frac{1}{6}$

e. $\frac{1}{8}\pi - \frac{1}{96}$

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

8. (15 points) A bar of length 1 m has linear density $\delta = \frac{1}{(1+x)^3}$ kg/m where x is measured from one end.

a. Find the total mass of the bar.

b. Find the center of mass of the bar.

9. (20 points) A balloon is descending straight down with acceleration $a(t) = -20e^{-t} \frac{\text{km}}{\text{min}^2}$ where t is in minutes.

It has initial height $y(0) = 2000$ km and initial velocity $v(0) = -10 \frac{\text{km}}{\text{min}}$.

a. Find its velocity at $t = 2$ min.

b. Find its height at $t = 2$ min.

10. (20 points) Consider the curve $\vec{r}(t) = \left(\frac{4}{3}t^{3/2}, t - \frac{t^2}{2} \right)$ between $t = 0$ and $t = 1$.

a. Find the arclength.

b. If the curve is rotated about the x -axis, find the surface area swept out.