Name_____

MATH 172 Honors Exam 1 Spring 2024

Section 200 P. Yasskin

Points indicated. Part credit possible. Show all work.

1	/8	5	/8	9	/12
2	/8	6	/8	10	/12
3	/8	7	/8	11	/8
4	/8	8	/8	12	/8
Total			/104		

1. (8 points) Estimate the integral $\int_0^8 x^2\,dx$ Approximate integral using a Riemann sum with 4 equal intervals and left endpoints.
Is this an over estimate or under estimate. Why? Your answer should be based on the concepts of increasing, decreasing, concave up or concave down.

2. (8 points) Consider the area below the graph of $y = x^3$ above the x-axis. Find the number c so that the area between $x = 0$ and $x = c$ is equal to the area between $x = c$ and $x = 4$.

3. (8 points) Compute $\int_2^4 \frac{x+1}{(x^2+2x)^2}\,dx$. Simplify to a rational number.

4. (8 points) Compute $\int_0^{\pi/4} (\sec^4\theta - \tan^2\theta\sec^2\theta)\,d\theta$. Evaluate all trig functions.

5. (8 points) Compute $\int 2x \arctan x \, dx$.

6. (8 points) Compute $\int \sin(2\theta)\cos^2(\theta)\, d\theta$

7. (8 points) Compute $\int e^{2x} \sin 4x \, dx$.

8. (8 points) Compute $\int \frac{\sqrt{x^2 - 4}}{x} \, dx$.

9. (12 points) A bar of length $\frac{\pi}{4}$ m has linear density $\delta = \sin x$ 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.

10. (12 points) A race car starts from rest ($x = 0$ and $v = 0$ at $t = 0$) and has acceleration $a = \frac{t}{1+t}$.

a. Find its velocity at time t.

b. Find its position at time t.

11. (8 points) Find the arclength of the curve $y = \frac{e^x + e^{-x}}{2}$ for $0 \le x \le 1$.

HINT: Look for a perfect square.

12. (8 points) The curve $\vec{r}(t) = (t^2, 6t)$ between $t = 0$ and $t = 4$ is rotated about the x-axis, find the surface area swept out.