Name________________________________

MATH 172H Exam 1 Spring 2021

Sections 200 P. Yasskin

1-14	/49	16	/20
15	/15	17	/20
		Total	/104

Multiple Choice: (Points indicated.)

1. (5 pts) Compute $\int_0^{\pi/4} x\cos(4x)\,dx$.

a. $-\frac{1}{8}$

b. $-\frac{1}{16}$

c. 0

d. $\frac{1}{16}$

e. $\frac{1}{8}$

2. (5 pts) Compute $\int_0^{\pi/4} \tan^{5/2}x\sec^2 x\,dx$.

a. $\frac{2}{3}$

b. $\frac{2}{5}$

c. $\frac{2}{7}$

d. $\frac{2}{5}(2^{5/2}-1)$

e. $\frac{2}{7}(2^{5/2}-1)$

3. (1 pts) In computing the integral $\int_0^{\pi/4} \tan^{5/2}x\sec^2 x\,dx$,
you used the formula (identity):

a. $\frac{d}{dx}\tan x = \sec^2 x$

b. $\frac{d}{dx}\sec x = \sec x\tan x$

c. $\tan^2 x + 1 = \sec^2 x$

d. $\int \tan x\,dx = -\ln|\cos x| + C$

e. $\int \sec x\,dx = \ln|\sec x + \tan x| + C$

4. (5 pts) Compute $\int \frac{3x^5}{\sqrt{x^3+8}}\,dx$.

a. $\frac{2(x^3+8)^{3/2}}{3} - 16(x^3+8)^{1/2} + C$

b. $\frac{2(x^3+8)^{5/2}}{5} - \frac{16(x^3+8)^{3/2}}{3} + C$

c. $\frac{2(x^3+8)^{3/2}}{3} + 16(x^3+8)^{1/2} + C$

d. $\frac{2(x^3+8)^{5/2}}{5} + \frac{16(x^3+8)^{3/2}}{3} + C$

e. $\frac{2u^{3/2}}{3} + 16u^{3/2} + C$

f. $\frac{2u^{5/2}}{5} + \frac{16u^{3/2}}{3} + C$

g. $\frac{2u^{3/2}}{3} + 16u^{3/2} + C$

h. $\frac{2u^{3/2}}{3} + 16u^{3/2} + C$

5. (5 pts) Compute $\int x^2 \ln|x|\,dx$.

a. $\frac{x^3}{3}\ln|x| + \frac{x^4}{12} + C$

b. $\frac{x^3}{3}\ln|x| - \frac{x^4}{12} + C$

c. $\frac{x^3}{3}\ln|x| + \frac{x^2}{6} + C$

d. $\frac{x^3}{3}\ln|x| - \frac{x^2}{6} + C$

e. $\frac{x^3}{3}\ln|x| + \frac{x^3}{9} + C$

f. $\frac{x^3}{3}\ln|x| - \frac{x^3}{9} + C$

6. (1 pts) In computing the integral $\int x^2 \ln|x|\,dx$, you used:

a. the substitution $u = x^2$

b. the substitution $u = \ln|x|$

c. integration by parts with $u = x^2$

d. integration by parts with $u = \ln|x|$

e. $\int \ln x\,dx = x\ln x - x + C$

f. $\int \ln x\,dx = x\ln x + x + C$

7. (5 pts) Let $A(x)$ be the area under the graph of the function $y = f(x)$ above the x-axis between $x = 2$ and a variable point x.
If $A(x) = x^4 - 16$, then $f(x) =$

a. 0

b. $\frac{x^5}{5} - 16x + \frac{128}{5}$

c. $4x^3 - 32$

d. $\frac{x^5}{5} - 16x$

e. $4x^3$

8. (5 pts) Compute $\int_0^{2/3} (4 - 9x^2)^{3/2}\, dx$

a. π

b. 2π

c. $\frac{2}{3}\pi$

d. $\frac{4}{3}\pi$

e. $\frac{5}{3}\pi$

9. (1 pts) In computing the integral $\int_0^{2/3} (4 - 9x^2)^{3/2}\, dx$, you used:

a. the substitution $x = \frac{2}{3}\tan\theta$

b. the substitution $x = \frac{2}{3}\sin\theta$

c. the substitution $x = \frac{2}{3}\sec\theta$

d. the substitution $x = \frac{3}{2}\tan\theta$

e. the substitution $x = \frac{3}{2}\sin\theta$

f. the substitution $x = \frac{3}{2}\sec\theta$

10. (1 pts) In computing the integral $\int_0^{2/3} (4 - 9x^2)^{3/2}\, dx$, you used the identity:

a. $\sin^2 A = \frac{1 + \cos(2A)}{2}$

b. $\sin^2 A = \frac{1 - \cos(2A)}{2}$

c. $\cos^2 A = \frac{1 + \cos(2A)}{2}$

d. $\cos^2 A = \frac{1 - \cos(2A)}{2}$

11. (5 pts) Find the length of the parametric curve $x = t^2$ and $y = \frac{1}{3}t^3 - t$ for $0 \le t \le 3$.

a. 3
b. 6
c. 9
d. 12
e. 16

12. (5 pts) The curve $(x, y) = (\theta, \cosh\theta)$ for $0 \le \theta \le 1$ is rotated about the x-axis. Find the surface area swept out. Note:

$$\cosh^2\theta - \sinh^2\theta = 1 \qquad \cosh^2\theta = \frac{1 + \cosh 2\theta}{2} \qquad \sinh^2\theta = \frac{\cosh 2\theta - 1}{2}$$

a. $\pi\left(1 - \frac{\cosh 2}{2}\right)$
b. $\pi\left(1 - \frac{\sinh 2}{2}\right)$
c. $2\pi\left(1 - \frac{\cosh 2}{2}\right)$
d. $2\pi\left(1 - \frac{\sinh 2}{2}\right)$
e. $\pi\left(1 + \frac{\cosh 2}{2}\right)$
f. $\pi\left(1 + \frac{\sinh 2}{2}\right)$
g. $2\pi\left(1 + \frac{\cosh 2}{2}\right)$
h. $2\pi\left(1 + \frac{\sinh 2}{2}\right)$

13. (5 pts) A rocket takes off from rest $(v(0) = 0)$ at the ground $(y(0) = 0)$ and has acceleration $a(t) = 40e^{-2t}$. Find its height at $t = 2$.

a. $10e^{-4}$
b. $40e^{-4}$
c. $160e^{-4}$
d. $10e^{-4} + 30$
e. $10e^{-4} + 10$

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

14. (15 pts) A bar between $x = 2$ and $x = 4$ has linear density $\delta = \frac{1}{x^3}$ g/cm.

a. Find the total mass of the bar.

b. Find the center of mass of the bar.

15. (20 pts) Compute $\int e^{2x} \sin 3x \, dx$.

The answer has the form $Ae^{2x} \sin 3x + Be^{2x} \cos 3x + C$.

Then

16. (20 pts) Compute $\int \frac{\sqrt{x^2 - 9}}{x} \, dx$.

The answer has the form $A(x^2 - 9)^{3/2} + B\sqrt{x^2 - 9} + C\operatorname{arcsec} \frac{x}{3} + K$.

Then