MATH 152, FALL 2021
COMMON EXAM I - VERSION B

LAST NAME(print): ________________ FIRST NAME(print): ________________

INSTRUCTOR: ________________

SECTION NUMBER: ________

DIRECTIONS:

1. The use of a calculator, laptop or computer is prohibited.
2. TURN OFF cell phones and put them away. If a cell phone is seen during the exam, your exam will be collected and you will receive a zero.
3. In Part 1 (Problems 1-15), mark the correct choice on your ScanTron using a No. 2 pencil. The scantrons will not be returned, therefore *for your own records, also record your choices on your exam!*
4. In Part 2 (Problems 16-19), present your solutions in the space provided. *Show all your work* neatly and concisely and *clearly indicate your final answer.* You will be graded not merely on the final answer, but also on the quality and correctness of the work leading up to it.
5. Be sure to *write your name, section number and version letter of the exam on the ScanTron form.*
6. **Again. The use of a calculator, laptop or computer is prohibited.**

THE AGGIE HONOR CODE

"An Aggie does not lie, cheat, or steal, or tolerate those who do."

Signature: ________________________

FOR INSTRUCTOR USE ONLY

Question	Points Awarded	Points
1-15	ScanTron	60
16		9
17		11
18		8
19		12
TOTAL		100

Part 1: Multiple Choice (4 points each)

1. Evaluate $\int x^3\sqrt{x^2+1}\ dx$.

   (a) $\frac{1}{5}(x^2+1)^{\frac{5}{2}} - \frac{1}{3}(x^2+1)^{\frac{3}{2}} + C$
   (b) $3x^2\sqrt{x^2+1} + \frac{x^4}{\sqrt{x^2+1}} + C$
   (c) $\frac{2}{5}(x^2+1)^2 - \frac{2}{3}(x^2+1) + C$
   (d) $\frac{1}{3}(x^2+1)^{\frac{3}{2}} + C$
   (e) None of these

2. Evaluate $\int \frac{1+x}{1+x^2}\ dx$.

   (a) $\frac{1}{2}\ln(1+x^2) + C$
   (b) $\frac{1}{2}\ln(1+x^2) + \arctan x + C$
   (c) $\frac{3}{2}\ln(1+x^2) + C$
   (d) $\ln(1+x^2) + C$
   (e) $\arctan x + \arcsin(x^2) + C$

3. Compute $\int_1^e (\ln x)^2\ dx$.

   (a) $e-2$
   (b) $\frac{1}{e} - 1$
   (c) $\frac{2}{e} - 2$
   (d) $e-1$
   (e) 1

4. Which of the following gives the volume of the solid found by rotating the region bounded by the curves $y = 7 - x^2$ and $y = 3$ about the line $y = 0$?

   (a) $\displaystyle\int_3^7 2\pi y\sqrt{4-y}\ dy$
   (b) $\displaystyle\int_{-2}^2 \pi(4-x^2)^2\ dx$
   (c) $\displaystyle\int_{-2}^2 \pi[(7-x^2)^2-9]\ dx$
   (d) $\displaystyle\int_3^7 2\pi x(7-x^2)\ dx$
   (e) $\displaystyle\int_{-2}^2 \pi[(7-x^2)-3]\ dx$

5. A spring has a natural length of 2 m. If a force of 12 N is required to hold the spring to a length of 4 m, find the work done to stretch the spring from 3 m to 5 m.

   (a) 30 J
   (b) 27 J
   (c) 12 J
   (d) 24 J
   (e) 6 J

6. Evaluate $\displaystyle\int_{\sqrt{2}}^2 \frac{4x}{x^2-1}\ dx$

   (a) $\ln 3 - 1$
   (b) $2\ln 2 - 2\ln\sqrt{2}$
   (c) $2\ln 3 - 2$
   (d) $2\ln 2$
   (e) $2\ln 3$

7. If f is continuous and $\int_0^{16} f(x)\ dx = 8$, find $\int_0^4 xf(x^2)\ dx$.

(a) 2
(b) 4
(c) 8
(d) 16
(e) 64

8. Evaluate $\int \tan^3(x)\sec^5(x)\ dx$.

(a) $\frac{1}{7}\tan^7 x - \frac{1}{5}\sec^5 x + C$
(b) $\frac{1}{4}\sec^6 x - \frac{1}{6}\tan^{10} x + C$
(c) $\frac{1}{4}\sec^4 x - \frac{1}{6}\tan^6 x + C$
(d) $\frac{1}{7}\sec^7 x - \frac{1}{5}\tan^5 x + C$
(e) $\frac{1}{7}\sec^7 x - \frac{1}{5}\sec^5 x + C$

9. A 20 ft rope weighing 0.1 lb/ft is hanging down the side of a 20 ft building. There is a 5 lb bucket attached to the rope. How much work is required to pull the rope with the bucket 2 ft up the side of the building?

(a) 6.8 $ft - lb$
(b) 14.2 $ft - lb$
(c) 14 $ft - lb$
(d) 13.8 $ft - lb$
(e) 120 $ft - lb$

10. Compute $\int_0^1 (x^2 + 3)e^{-x} \; dx$.

(a) $-\frac{8}{e} + 5$
(b) $-\frac{8}{e}$
(c) $\frac{2}{e} + 1$
(d) $\frac{2}{e} - 1$
(e) $-\frac{2}{e} + 5$

11. Calculate the area of the region bounded by the curves $4x + y^2 = 12$ and $x = y$.

(a) 21
(b) 22
(c) $\frac{64}{3}$
(d) $\frac{62}{3}$
(e) $\frac{73}{3}$

12. Compute $\int_0^{\pi/2} \sin(2x) \cos x \; dx$.

(a) $\frac{2}{3}$
(b) $\frac{3}{2}$
(c) 0
(d) 1
(e) $\frac{1}{2}$

13. Find the volume of the solid found by rotating the region bounded by the curves $y = -x^2 + 2x$ and $y = 0$ about the y-axis.

(a) $\frac{16}{3}\pi$
(b) $\frac{1}{3}\pi$
(c) $\frac{2}{3}\pi$
(d) $\frac{4}{3}\pi$
(e) $\frac{8}{3}\pi$

14. Evaluate $\displaystyle\int \sin^2(x)\ dx$.

(a) $\frac{1}{3}\cos^3 x + C$
(b) $\frac{1}{2}x - \frac{1}{4}\sin(2x) + C$
(c) $\frac{1}{3}\sin x \cos x + C$
(d) $\frac{1}{2}x - \frac{1}{4}\sin x + C$
(e) $\frac{1}{2}x + \frac{1}{2}\sin x + C$

15. Which of the following represents the area bounded by the curves $y = x^2 - 4$ and $y = -x^2 - 2x$ on the interval $-3 \leq x \leq 1$.

(a) $\displaystyle\int_{-3}^{1} (-2x^2 - 2x + 4)\ dx$

(b) $\displaystyle\int_{-2}^{1} (-2x^2 - 2x + 4)\ dx$

(c) $\displaystyle\int_{-3}^{1} (2x^2 + 2x - 4)\ dx$

(d) $\displaystyle\int_{-3}^{-2} (-2x^2 - 2x + 4)\ dx + \int_{-2}^{1} (2x^2 + 2x - 4)\ dx$

(e) $\displaystyle\int_{-3}^{-2} (2x^2 + 2x - 4)\ dx + \int_{-2}^{1} (-2x^2 - 2x + 4)\ dx$

Part 2: Work Out

Directions: Present your solutions in the space provided. *Show all your work* neatly and concisely and *box your final answer.* You will be graded not merely on the final answer, but also on the quality and correctness of the work leading up to it.

16. (9 pts) Consider the region R bounded by $y = x^3$, $y = -x + 2$, $x = 0$, and $x = 1$.

    (a) (3 pts) Sketch the region R.

    (b) (3 pts) Set up the integral that gives the volume obtained by revolving the region R about the x-axis using the method of washers. **DO NOT EVALUATE THE INTEGRAL.**

    (c) (3 pts) Set up the integral that gives the volume obtained by revoling the region R about the line $x = 1$ using the method of cylindrical shells. **DO NOT EVALUATE THE INTEGRAL.**

17. (11 pts) The base of a solid is the region bounded by the curve $y = 5 - x^2$ and the x-axis. Cross-Sections perpendicular to the y-axis are rectangles with height equal to twice the base. Find the volume of this solid.

18. (8 pts) Compute $\int \sin^7 \theta \cos^5 \theta \ d\theta$.

19. (12 pts) A spherical tank with radius 5 m is half full of a liquid that has a density of 1000 kg/m^3. The tank has a 1 m spout at the top. Set up an integral to find the work required to pump all the water out of the spout. (Use 9.8 m/s^2 for g.)

Note 1. Do NOT evaluate your integral.

Note 2. Clearly indicate in the picture below where you are placing your axis and which direction is positive.