LAST NAME(print): ________________________ FIRST NAME(print): ________________________

INSTRUCTOR: ________________________

SECTION NUMBER: __________

ROW 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 16-21), 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.

THE AGGIE CODE OF HONOR

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

Signature: ________________________
PART I: Multiple Choice. 4 points each

1. Evaluate \( \int \frac{4x^3 + 2x + 1}{x^2} \, dx \)

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

2. Evaluate \( \int_{0}^{\pi/4} \frac{\sec^2 \theta}{(2 + \tan \theta)^2} \, d\theta \).

   (a) \(-\frac{1}{3}\)
   (b) \(\ln \left( \frac{3}{2} \right) \)
   (c) None of these.
   (d) \(\frac{1}{6}\)
   (e) \(\frac{5}{36}\)

3. Compute \( \int_{1}^{e} 8x \ln x \, dx \)

   (a) None of these.
   (b) \(2e^2\)
   (c) \(2 + 2e^2\)
   (d) \(2 - 2e^2\)
   (e) \(\frac{1}{4} + \frac{e^2}{4}\)
4. Which of the following represents the area bounded by the curves \( y = x^2 - 2x \) and \( y = 2x \) on the interval from \( x = 1 \) to \( x = 6 \)?

(a) \( \int_{1}^{4} 4x - x^2 \, dx + \int_{4}^{6} x^2 - 4x \, dx \)

(b) None of these.

(c) \( \int_{0}^{4} 4x - x^2 \, dx \)

(d) \( \int_{1}^{4} x^2 - 4x \, dx + \int_{4}^{6} 4x - x^2 \, dx \)

(e) \( \int_{1}^{6} 4x - x^2 \, dx \)

5. A cable 40 feet long weighing 6 pounds per foot is hanging off the side of a 50 foot tall building. At the bottom of the cable is a bucket of rocks weighing 100 pounds. How much work is required to pull 10 feet of the cable to the top of the building?

(a) 280 ft-lbs

(b) 300 ft-lbs

(c) 3100 ft-lbs

(d) 2100 ft-lbs

(e) None of these

6. Compute \( \int \cos^3(2x) \, dx \)

(a) \( \frac{1}{2} \sin(2x) - \frac{1}{6} \sin^3(2x) + C \)

(b) \( -\sin(2x) + \frac{1}{3} \sin^3(2x) + C \)

(c) None of these.

(d) \( -\frac{1}{2} \sin(2x) + \frac{1}{6} \cos^3(2x) + C \)

(e) \( \sin(2x) - \frac{1}{3} \sin^3(2x) + C \)
7. After an appropriate substitution, the integral \( \int_0^1 16x(4x + 2)^8 \, dx \) is equivalent to which of the following?

(a) \( \int_0^1 (4u^9 - 8u^8) \, du \)

(b) \( \int_2^6 (u^9 - 2u^8) \, du \)

(c) \( \int_2^6 (4u^9 - 8u^8) \, du \)

(d) None of these

(e) \( \int_0^1 (u^9 - 2u^8) \, du \)

8. The base of a solid is the region bounded by the curve \( y = 4 - x^2 \) and the \( x \)-axis. Cross sections perpendicular to the \( y \)-axis are squares. Find the volume of the solid.

(a) \( \frac{256}{3} \)

(b) 8

(c) None of these

(d) \( \frac{64}{3} \)

(e) 32

9. Compute \( \int 8 \cos^2 \theta d\theta \)

(a) \( 8\theta + 4\sin(2\theta) + C \)

(b) \( 4\theta - 2\sin(2\theta) + C \)

(c) \( \frac{8}{3} \cos^3 \theta + C \)

(d) \( 4\theta + 2\sin(2\theta) + C \)

(e) None of these.
10. Consider the region bounded by the curves $y = x^3$, $y = 8$, and the $y$–axis. Which of the following represents the volume of this region being rotated about the $x$–axis?

(a) $\int_{0}^{2} \pi \left[ 8 - (x^3)^2 \right] \, dx$

(b) $\int_{0}^{2} \pi (64 - x^6) \, dx$

(c) None of these.

(d) $\int_{0}^{8} \pi y^{2/3} \, dy$

(e) $\int_{0}^{2} \pi (8 - x^3)^2 \, dx$

11. Find average value of $f(x) = \sin(x)$ on the interval $[\pi, 2\pi]$.

(a) $-2$

(b) $\frac{2}{\pi}$

(c) $2$

(d) None of these.

(e) $-\frac{2}{\pi}$

12. Given $\int_{0}^{9} f(u) \, du = 12$, compute $\int_{0}^{3} 6xf(x^2) \, dx$.

(a) None of these

(b) $72$

(c) $36$

(d) $4$

(e) $2$
13. Consider the region bounded by the curves $x = -y^2 + 7y - 10$ and the $y$–axis. Which of the following represents the volume of this region being rotated about $y = 1$.

(a) $\int_2^5 2\pi(y + 1)(-y^2 + 7y - 10)\,dy$

(b) None of these

(c) $\int_2^5 2\pi y(-y^2 + 7y - 10)\,dy$

(d) $\int_2^5 2\pi(y - 1)(-y^2 + 7y - 10)\,dy$

(e) $\int_2^5 \pi \left((-y^2 + 7y - 10)^2 - 1^2\right)\,dx$

14. Which of the following represents the area between the curves $y = x^3$, $y = 8$, and $x = 1$?

(a) $\int_1^8 (\sqrt[3]{y} - 1)\,dy$

(b) $\int_1^2 (x^3 - 8)\,dx$

(c) $\int_1^8 (8 - x^3)\,dx$

(d) $\int_0^2 (8 - x^3)\,dx$

(e) $\int_1^8 (1 - \sqrt[3]{y})\,dy$
15. Compute \( \int_{0}^{\pi} x^2 \sin x \, dx \)

(a) \(-\pi^2 + 4\)
(b) \(\pi^2 + 4\)
(c) \(-\pi^2 - 4\)
(d) \(\pi^2 - 4\)
(e) None of these

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**PART II 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. (7 points) Compute \( \int \frac{\sin^3(4x)}{\sec^2(4x)} \, dx \)
17. (7 points) Compute \( \int \sec^4(2x) \tan^2(2x) \, dx \)

18. (5 points) Compute \( \int x^3 e^{x^2} \, dx \)
19. (7 points) Consider the region bounded by the curves the curves given below. Set up the integral(s) that will compute the volume when this region is rotated about \( x = -1 \).

\[
y = \sqrt{x}
\]

\[
y = 4 - \sqrt{x}
\]

\( y \)-axis

20. (7 points) Consider the region bounded by the curves the curves given below. Set up the integral(s) that will compute the volume when this region is rotated about \( y = -4 \).

\[
y = 4 - x^2
\]

\( x \)-axis
21. (7 points) A tank, whose ends are isosceles triangles, has the shape as shown below. The tank is 4 feet tall (not including the spout) and is 6 feet across at the top. The tank has a 3 foot spout and has a length of 10 feet. The depth of the water in the tank is 2 feet. Use the fact that water weighs 62.5 lb/ft³.

Set up (but do not evaluate) an integral that will compute the work required to pump all of the water out of the spout. Indicate on the picture where you are placing the axis and which direction is positive.