MA 22400 **EXAM 1** **Form A**

NAME______________________________INSTRUCTOR______________________________

INSTRUCTIONS

1. Fill in your name and your instructor's name above.
2. You must use a #2 pencil on the scantron answer sheet.
3. Fill in your name, your four digit section number, and your student identification number. Make sure to blacken in the appropriate spaces. If you do not know your section number, ask your instructor. (Leave the test/quiz number blank.) Sign your name.
4. There are 15 questions. Blacken in your choice of the correct answer in the spaces provided on the scantron answer sheet. **Only the scantron answer sheet will be graded. When you have completed the exam, turn in the scantron answer sheet only. You may take the exam booklet with you.**
5. **The exam is self-explanatory. Do not ask your instructor any questions about the exam problems.**
6. **Only one-line calculators (any brand) are allowed. Cell phones and PDA's may not be used as a calculator and must be put away during the exam. NO BOOKS OR PAPERS ARE ALLOWED. Use the back of the test pages for scrap paper.**

CONSUMERS' AND PRODUCERS' SURPLUS

$$\textbf{CS} = \int_0^{q_0} D(q)dq - p_0q_0$$

$$\textbf{PS} = p_0q_0 - \int_0^{q_0} S(q)dq$$

VOLUME & SURFACE AREA

Right Circular Cylinder

$V = \pi r^2 h$

$$SA = \begin{cases} 2\pi r^2 + 2\pi r h \\ \pi r^2 + 2\pi r h \end{cases}$$

Sphere

$V = \frac{4}{3}\pi r^3$

$SA = 4\pi r^2$

Right Circular Cone

$V = \frac{1}{3}\pi r^2 h$

$SA = \pi r\sqrt{r^2 + h^2} + \pi r^2$

1. Find the indicated integral $\displaystyle\int \frac{(\ln x)^2}{x}\, dx$

   A. $(\ln x)^2 + C$

   B. $\dfrac{1}{3}(\ln x)^3 + C$

   C. $\dfrac{1}{3}\ln(x^3) + C$

   D. $\dfrac{1}{3}\, x^3 + C$

   E. $\dfrac{(\ln x)^3}{3x} + C$

2. Find the indicated integral $\displaystyle\int (6t^2 - \sqrt{2t}\; + 3e^{-3t})\, dt$

   A. $6t^3 - \sqrt{2}\, t^{3/2} + 3e^{-3t} + C$

   B. $2t^3 - \frac{2\sqrt{2}}{3}\, t^{3/2} + 3e^{-3t} + C$

   C. $2t^3 - \frac{2\sqrt{2}}{3}\, t^{3/2} - e^{-3t} + C$

   D. $2t^3 - \frac{\sqrt{2}}{2}\, t^2 - e^{-3t} + C$

   E. $2t^3 - \frac{3\sqrt{2}}{2}\, t^2 - e^{-3t} + C$

3. A study indicates that t months from now the population of a certain town will be growing at a rate of $P'(t) = 2te^{t^2-1}$. At time $t = 0$, the population is 50 people. What will the population be in 2 months? (Round your answer to the nearest person.)

   A. 140 people

   B. 196 people

   C. 80 people

   D. 70 people

   E. 51 people

4. Evaluate

$$\int_0^1 \frac{1}{2}\left(e^{3y} + e^{-3y}\right)\, dy.$$

A. $\frac{1}{2}\left(e^{3/2} - e^{-3/2}\right) - 1$

B. $\frac{1}{2}\left(e^{3} + e^{-3}\right) - 1$

C. $\frac{3}{2}\left(e^{3} - e^{-3}\right)$

D. $\frac{1}{6}\left(e^{3/2} - e^{-3/2}\right) - \frac{1}{3}$

E. $\frac{1}{6}\left(e^{3} - e^{-3}\right)$

5. Consider the following:

$$f(x) = \int \frac{3 - xe^x}{x}\, dx$$

If the integration constant, C , is zero, then the value of $f(1)$ is

A. $3 - e$

B. e

C. 0

D. 1

E. $-e$

6. Find the area of the region under the curve

$$y = \frac{2}{3-x}$$

over the interval $1 \leq x \leq 5/2$.

A. $4\ln(2)$

B. $\ln(2)$

C. $8\ln(2)$

D. $2\ln(2)$

E. $6\ln(2)$

7. A manufacturer estimates that the rate of change of the cost of producing q thousand wooden spoons is:

$$C'(q) = 3q^2 - 20q + 40 \qquad \text{dollars per thousand units.}$$

If the cost of producing 6 thousand spoons is 8096, what is the cost of producing 10 thousand spoons ?

A. \$ 8000

B. \$ 8080

C. \$ 8120

D. \$ 8240

E. \$ 8400

8. We want to find the area of the region bounded by the curves $y = x^2 + 2x + 20$, and $y = -x^2 - 2x + 180$. Which of the following is the correct integral to calculate the area?

   A. $\displaystyle\int_{-10}^{8} (-2x^2 - 4x + 160)\ dx$

   B. $\displaystyle\int_{-10}^{8} (2x^2 + 4x - 160)\ dx$

   C. $\displaystyle\int_{-8}^{10} 200\ dx$

   D. $\displaystyle\int_{-8}^{10} (-2x^2 - 4x + 160)\ dx$

   E. $\displaystyle\int_{-8}^{10} (2x^2 + 4x - 160)\ dx$

9. The temperature of a chemical reaction, t seconds after the reaction starts, is given by:

$$T(t) = 20 + 5.25t^{0.75}\ {}^\circ\mathrm{F},$$

   What is the average temperature during the whole process, if the reaction lasts for 4 minutes and 16 seconds ?

   A. 0.98 °F

   B. 1.39 °F

   C. 49.17 °F

   D. 212.00 °F

   E. 356.00 °F

10. Consider the function $f(x)$ defined as an indefinite integral

$$f(x) = \int (9x-3)(3x^2-2x+4)^5 dx$$

with integration constant $C = 0$, what is the value of $f(0)$?

A. $\dfrac{3^5}{4}$

B. $\dfrac{3^6}{10}$

C. $\dfrac{6 \times 4^4}{5}$

D. 4^5

E. $\dfrac{6 \times 4^5}{5}$

11. The empty gas tank of certain car can be filled in exactly one minute. In order to avoid overfilling the tank, the pumper reduces the amount of gas that enters the car as it is getting filled. After t minutes the amount of gas in the car is changing at a rate of

$$F'(t) = 25 - t(t^2+4)^2 \text{ per minute.}$$

Find the change of the amount of gas in the tank during the interval between 20 seconds and 40 seconds after the initial time ($t = 0$).

A. 4.9

B. 2.7

C. 4.2

D. 6.1

E. 5.3

12. Compute the area of the triangular region bounded by the y-axis and the lines $y = -x$ and $y = -5x + 12$.

    A. 3

    B. 16

    C. 18

    D. 32

    E. 54

13. Let $f(x) = \dfrac{6}{\sqrt{x}} + ax$ where a is a real number. If the average value of $f(x)$ over the interval $1 \le x \le 9$ is 100, then what is a?

    A. -7.9

    B. 0.1

    C. 9.6

    D. 17.6

    E. 19.4

14. Evaluate the definite integral

$$\int_{-\frac{4}{3}}^{-\frac{1}{3}} (x+2)\sqrt{3x+5}\; dx$$

A. $\frac{8}{3}$

B. $\frac{545}{126}$

C. 0

D. $\frac{256}{135}$

E. $2\sqrt{2}$

15. The demand function for an item is $p = \frac{16}{x+2} - 3$, where p is the price in dollars and x (in thousands) is the quantity demanded each week. The supply function for the same item is $p = \frac{x+1}{3}$, where x (in thousands) is the quantity available each week. Which expression represents the producers' surplus if the market price is set at the equilibrium price?

A. $2 - \int_0^1 \frac{x+1}{3} dx$

B. $2 - \int_0^2 \left(\frac{16}{x+2} - 3 \right) dx$

C. $2 - \int_0^1 \left(\frac{16}{x+2} - 3 \right) dx$

D. $2 - \int_0^2 \frac{x+1}{3} dx$

E. $2 - \int_0^1 \left(\frac{16}{x+2} - 3 - \frac{x+1}{3} \right) dx$