

Please show **all** your work! Answers without supporting work will not be given credit.
Write answers in spaces provided.

Name: _____

1. Which derivative rule is undone
by integration by substitution?

- (A) Power Rule
- (B) Quotient Rule
- (C) Product Rule
- (D) Chain Rule
- (E) Constant Rule
- (F) None of these

2. Which derivative rule is undone
by integration by parts?

- (A) Power Rule
- (B) Quotient Rule
- (C) Product Rule
- (D) Chain Rule
- (E) Constant Rule
- (F) None of these

3. What would be the best substitution to make the solve the given integral?

$$\int e^{2x} \cos(e^{2x}) \sin^3(e^{2x}) dx$$

$u =$ _____

4. What would be the best substitution to make the solve the given integral?

$$\int \sec^2(5x) e^{\tan(5x)} dx$$

$u =$ _____

5. What would be the best substitution to make the solve the given integral?

$$\int \tan(5x) \sec(5x) e^{\sec(5x)} dx$$

$u =$ _____

6. Find the area under the curve $y = 14e^{7x}$ for $0 \leq x \leq 4$.

Area = _____

7. Evaluate the definite integral.

$$\int_0^2 (5e^{2x} + 8) dx$$

$$\int_0^2 (5e^{2x} + 8) dx = \underline{\hspace{2cm}}$$

8. Evaluate the indefinite integral.

$$\int 64x^7 \sin(x^8) dx$$

$$\int 64x^7 \sin(x^8) dx = \underline{\hspace{10em}}$$

9. Evaluate the indefinite integral.

$$\int 9x^3 e^{-x^4} dx$$

$$\int 9x^3 e^{-x^4} dx = \underline{\hspace{10em}}$$

10. Evaluate the indefinite integral.

$$\int \frac{28x}{x^2 + 11} dx$$

$$\int \frac{28x}{x^2 + 11} dx = \underline{\hspace{10em}}$$

11. Evaluate the indefinite integral

$$\int \frac{\ln(5x)}{x} dx$$

$$\int \frac{\ln(5x)}{x} dx = \underline{\hspace{10em}}$$

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14. It is estimated that t -weeks into a semester, the average amount of sleep a college math student gets per day $S(t)$ changes at a rate of

$$\frac{-4t}{e^{t^2}}$$

hours per day. When the semester begins, math students sleep an average of 8.2 hours per day. What is $S(t)$, 2 weeks into the semester?

Answer: _____

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15. A biologist determines that, t hours after a bacterial colony was established, the population of bacteria in the colony is changing at a rate given by

$$P'(t) = \frac{5e^t}{1 + e^t}$$

million bacteria per hour, $0 \leq t \leq 5$.

If the bacterial colony started with a population of 1 million, how many bacteria, in millions are present in the colony after the 5-hour experiment?

Answer: _____

16. Evaluate

$$\int 3x \ln(x^7) dx$$

$$\int 3x \ln(x^7) dx = \underline{\hspace{10cm}}$$

17. Evaluate the indefinite integral.

$$\int 4x \sin(7x) dx$$

$$\int 4x \sin(7x) dx = \underline{\hspace{10cm}}$$

18. The velocity of a cyclist during an hour-long race is given by the function

$$v(t) = 166te^{-2.2t} \text{ mi/hr}, \quad 0 \leq t \leq 1$$

Assuming the cyclist starts from rest, what is the distance in miles he traveled during the first hour of the race?

Answer: _____

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19. Which of the following is a partial fraction decomposition of the rational expression show? Do not explicitly solve for the constant.

$$f(x) = \frac{3x + 1}{x^2(x + 1)^2(x^2 + 1)}$$

(A)

$$\frac{A}{x^2} + \frac{B}{(x + 1)^2} + \frac{C}{x^2 + 1}$$

(B)

$$\frac{A}{x} + \frac{B}{x^2} + \frac{C}{x + 1} + \frac{D}{(x + 1)^2} + \frac{E}{x^2 + 1}$$

(C)

$$\frac{A}{x} + \frac{B}{x^2} + \frac{C}{x + 1} + \frac{D}{(x + 1)^2} + \frac{Ex + F}{x^2 + 1}$$

(D)

$$\frac{A}{x} + \frac{Bx + C}{x^2} + \frac{D}{x + 1} + \frac{Ex + F}{(x + 1)^2} + \frac{Gx + H}{x^2 + 1}$$

(E)

$$\frac{A}{x} + \frac{B}{(x + 1)^2} + \frac{C}{x^2 + 1}$$

20. Determine the partial fraction decomposition of

$$\frac{7x^2 + 9}{x^3 + 3x}$$

Answer: _____

21. Determine the partial fraction decomposition of

$$\frac{4x - 11}{x^2 - 7x + 10}$$

Answer: _____

22. Evaluate $\int \frac{5x^2 + 9}{x^3 + 3x^2} dx$

$$\int \frac{5x^2 + 9}{x^3 + 3x^2} dx = \underline{\hspace{10em}}$$

23. Evaluate $\int \frac{x^2 + 2}{x^3 + 3x^2 + 2x} dx$

$$\int \frac{x^2 + 2}{x^3 + 3x^2 + 2x} dx = \underline{\hspace{4cm}}$$