

Name _____

- 1) Differentiate: $(1 - 4e^x)x^2$ 1) _____
 A) $2x - 8xe^x - 4x^2e^x$ B) $-8e^x \cdot x$
 C) $-8e^x - 1$ D) $2x - 8xe^x - 4x^3e^x - 1$

- 2) Find the first and second derivatives of $f(x) = \frac{1 - 2x}{e^x}$. 2) _____
- A) $f'(x) = \frac{2x - 3}{e^x}$ B) $f'(x) = 4xe^x - 2e^x$
 $f''(x) = \frac{5 - 2x}{e^x}$ $f''(x) = 4xe^x + 2e^x$
- C) $f'(x) = \frac{3 - 2x}{e^x}$ D) $f'(x) = 2xe^x - 3e^x$
 $f''(x) = \frac{2x - 5}{e^x}$ $f''(x) = 2xe^x - e^x$

- 3) Find the equation of the tangent line to the curve $y = \frac{e^x}{1 + e^x}$ at $(0, \frac{1}{2})$. 3) _____

- 4) Differentiate: $\frac{e(3 - 2x)}{3}$ 4) _____
- A) $\frac{e^4 - 2x}{12}$ B) $-\frac{2(e^3 - 2x)}{3}$ C) $-\frac{e^3 - 2x}{6}$ D) e^{-2x}

- 5) Differentiate: $(6e^{2x} - x)^3$ 5) _____
- A) $3(6e^{2x} - x)^2(12e^{2x})$ B) $3(12xe^{2x} - 1 - 1)^2$
 C) $3(12e^x - 1)^2$ D) $3(6e^{2x} - x)^2(12e^{2x} - 1)$

- 6) Find the values of x at which the function $f(x) = e^{-2x} + 2x$ has a possible relative maximum or minimum point. 6) _____
- A) There are no relative maximum/minimum points.
 B) maximum at $x = \frac{e}{2}$
 C) maximum at $x = \frac{0.69}{2}$
 D) minimum at $x = 0$
 E) none of the above

7) Determine a function $y = f(x)$ such that $y' = \frac{1}{10}y$ and $f(0) = -3$? 7) _____

A) $y = \frac{1}{20}y^2 - 3$

B) $y = \frac{1}{10}e^{-3x}$

C) $y = -3e^{(1/10)x}$

D) $y = e^{(1/10)y} - 3$

E) none of the above

8) Which of the following functions $y = f(x)$ satisfy $y' = 32y$, $f(0) = \frac{1}{2}$? 8) _____

(I) $y = 32e^{1/2x}$

(II) $y = e^{16x}$

(III) $y = \frac{1}{2}e^{32x}$

(IV) $y = \frac{1}{2}x^{32}$

A) (I) only

B) (III) only

C) (I) and (II)

D) (IV) only

E) none of the above

9) Let $y = e^{2x} + 1$. What is $\frac{dy}{dx}$? 9) _____

A) ee^2

B) $e^{2x} + 1$

C) e^2

D) $2e^{2x} + 1$

E) none of the above

10) Differentiate: $f(x) = x^3 e^{-x^3}$. 10) _____

11) Find k such that $3^{-x/2} = e^{kx}$ for all x . 11) _____

A) $\ln 3$

B) $-\frac{1}{2} \ln 3$

C) $\ln -\frac{3}{2}$

D) $\frac{1}{2} \ln 3$

12) Solve the following equation for x : $e^{(x^2 + 9)} \cdot e^{(6x)} = 1$ 12) _____

A) $x = -3$

B) $x = \pm\sqrt{3}$

C) $x = 0$

D) $x = \ln \frac{1}{2}$

13) Simplify: $e^{\ln 3} + \ln(2x)$. 13) _____

14) Simplify: $\ln e^{2x} - \ln e^{-x/2}$. 14) _____

15) Simplify: $e^{\ln x} - 2 \ln y$. 15) _____

16) Solve for x : $4e^{3x} + 2 = 20$. 16) _____

17) Differentiate: $x^3 \ln x$ 17) _____
A) $x^2 \ln x + x^2$
B) $3x^2 \ln x$
C) $(3x^2 + 1) \ln x$
D) $3x^2 \ln x + x^2$
E) none of the above

18) Differentiate: $\sqrt{\ln 3x}$ 18) _____
A) $\frac{1}{6x}$
B) $\frac{1}{3x\sqrt{\ln 3x}}$
C) $\frac{1}{6x\sqrt{\ln 3x}}$
D) $\frac{1}{2x\sqrt{\ln 3x}}$
E) none of the above

19) At what value of x could the function $f(x) = \frac{\ln x + x}{x}$ have a possible relative maximum or minimum? 19) _____
A) $x = e^2$
B) $x = e$
C) $x = 1$
D) $x = \frac{1}{e}$
E) none of the above

20) Differentiate: $\frac{\ln x}{x^3}$. 20) _____

21) Differentiate: $\frac{\ln 3x}{\ln x}$. 21) _____

22) Differentiate: $f(x) = \frac{\ln x}{e^x}$ at $x = 1$. 22) _____

- 23) Simplify $\ln \frac{x^4 - 5}{z^3 y^4}$. 23) _____
- A) $\ln(x^4 - 5) - 3\ln z - 4\ln y$
 B) $\ln(x^4 - 5) + 3\ln z + 4\ln y$
 C) $\ln(x^4 - 5) - 3\ln z + 4\ln y$
 D) $4\ln x - \ln 5 - 3\ln z - 4\ln y$
 E) $4\ln x - \ln 5 - 3\ln z + 4\ln y$
- 24) Simplify $\ln \frac{x^5 y^{-4}}{w^3 z^{-2}}$. 24) _____
- A) $5\ln x - 4\ln y - 3\ln w + 2\ln z$
 B) $5\ln x - 4\ln y - 3\ln w - 2\ln z$
 C) $5\ln x + 4\ln y - 3\ln w - 2\ln z$
 D) $5\ln x + 4\ln y - 3\ln w + 2\ln z$
 E) none of the above
- 25) Simplify: $\ln(x + 2) + \ln(x - 2)$. 25) _____
- 26) Simplify: $\ln xyz - \ln \left(\frac{y^2}{x} \right)$. 26) _____
- 27) A certain radioactive substance is decaying at a rate proportional to the amount present. If 100 grams decays to 13.5 grams in 4 years, how long will it take for 90 grams to decay to 30 grams? 27) _____
- A) 2.405 yrs B) 0.501 yrs
 C) 2.195 yrs D) Problem cannot be solved as stated.
- 28) Radioactive carbon 11 has a half-life of 20 minutes. If there are 200 grams present at the start of our experiment, how many grams will remain after 10 minutes? 28) _____
- A) 6.931 g B) 141.421 g C) 50 g D) 100 g
- 29) The population of a colony of bacteria triples in 3 days. Assuming that the rate of growth is proportional to the size of the population, how long did it take for the colony to double in size? 29) _____
- A) 2 days
 B) 1.9 days
 C) 4.9 days
 D) 6 days
 E) none of the above
- 30) How much money has to be invested now at 8% continuous interest in order to have \$1000 after 5 years? 30) _____
- A) \$461.56
 B) \$670.32
 C) \$18.32
 D) \$183.20
 E) none of the above

31) How long will it take for an investment to triple if interest is paid at 10%, compounded continuously? 31) _____
A) 11 years
B) 8.6 years
C) 3 years
D) 30 years
E) none of the above

32) \$1000 is invested at 6% interest compounded continuously. What is the value of the investment after 5 years? 32) _____
A) \$1338.23
B) \$6691.13
C) \$1349.86
D) \$1822.12
E) none of the above

33) What is $\int \left(\frac{6}{5}x^5 + 4e^{-2x} \right) dx$? 33) _____
A) $\frac{1}{5}x^6 - 2e^{-2x} + C$ B) $6x^4 - 8e^{-2x} + C$
C) $6x^6 - 2e^{-3x} + C$ D) $6x^6 - 2e^{-2x} + C$

34) What is $\int \left(\frac{x^2}{4} - 4 \right) dx$? 34) _____
A) $\frac{x}{2} + C$
B) $\frac{x^3}{12} - 4x + C$
C) $\frac{x^2}{4} - 4 + C$
D) $\frac{3x^3}{4} - 4 + C$
E) none of the above

35) Find the value of k that makes the antidifferentiation formula true. 35) _____
 $\int x^{-7} dx = kx^{-6} + C$
A) 6 B) -6 C) $-\frac{1}{6}$ D) $\frac{1}{6}$

36) Find the value of k that makes the antidifferentiation formula true. 36) _____
 $\int (7-x)^{-1} dx = k \ln|7-x| + C$
A) $\frac{1}{7}$ B) 1 C) $-\frac{1}{7}$ D) -1

37) Find: $\int (2x + 1)^2 dx$. 37) _____

38) A rock is dropped from a balloon hovering at 4800 ft above the ground. Its velocity at time t seconds is $v(t) = -32t$ feet per second. Find how long it takes for the rock to reach the ground. Enter just a real number to 1 decimal place (no units). 38) _____

39) A ball is thrown upward with initial velocity of 144 feet per second. How high will the ball go? (Recall that from physics, it is known that the velocity at time t is $144 - 32t$ feet per second.) Enter just an integer (no units). 39) _____

40) Find: $\int \frac{1+x^2}{x^2} dx$. 40) _____

41) Find: $\int 2e^{-2x} dx$. 41) _____

42) Use a Riemann sum to approximate the area under the graph of $f(x)$ on the given interval. Use the right endpoints. 42) _____

$f(x) = x^2 + 1; -1 \leq x \leq 3, n = 6$

A) $\frac{440}{27} = 16.3$

B) $\frac{80}{27} = 2.96$

C) $\frac{296}{27} = 10.96$

D) $\frac{224}{27} = 8.3$

43) Use a Riemann sum to approximate the area under the graph of $f(x)$ on the given interval. Use the right endpoints. Enter just an integer. 43) _____

$f(x) = 2x + 1; 1 \leq x \leq 5, n = 4$

44) $\int_{-1}^1 e^{-2x} dx =$ 44) _____

A) $e^2 - e^2$

B) $\frac{1}{2}(e^2 - e^2)$

C) $-\frac{1}{2}e^{-2x} + C$

D) $\frac{1}{2}(e^2 - e^{-2})$

E) none of the above

45) $\int_0^1 \left(e^{3x} - \frac{1}{(x+1)^2} \right) dx =$ 45) _____

A) $\frac{1}{3}e^3 - e - \frac{1}{2}$

B) $\frac{1}{3}e + \frac{7}{6}$

C) $\frac{1}{3}e^3 - \frac{5}{6}$

D) $\frac{1}{3}e^3 + \frac{7}{6}$

E) none of the above

46) What is the area under the curve $f(x) = 3x^2 + 2x + 1$ from $x = -\frac{3}{2}$ to $x = -\frac{1}{2}$? 46) _____

A) $\frac{15}{4}$

B) $\frac{9}{4}$

C) $-\frac{15}{4}$

D) $\frac{51}{4}$

E) none of the above

47) Suppose that during a controlled experiment, the temperature in a test tube at time t is rising at a rate of $6t^2 + 2$ degrees centigrade per minute. If the initial temperature is 0°C , what is the temperature in the test tube after 10 minutes? 47) _____

A) 2020°

B) 120°

C) 602°

D) 524°

E) none of the above

48) A helicopter rises straight up in the air so that its velocity t seconds after take-off is 48) _____

$v(t) = t^{3/2} + \frac{1}{2}t^{1/2} + 1$ feet per second. If the landing pad is 100 feet above the ground, which of the

following gives the height of the helicopter at time t ?

A) $h(t) = \frac{2}{3}t^{5/2} + \frac{1}{4}t^{3/2} + t + C$

B) $h(t) = \frac{2}{5}t^{5/2} + \frac{1}{3}t^{3/2} + t + 100$

C) $h(t) = \frac{3}{2}t^{1/2} + \frac{1}{4}t^{-1/2} + 100$

D) $h(t) = \frac{5}{3}t^{5/2} + \frac{3}{4}t^{3/2} + t - 100$

E) none of the above

49) Calculate: $\int_0^1 (e^{3x} - 1) dx$. 49) _____

50) Calculate: $\int_1^3 (x^3 + 3)x^2 dx$. 50) _____

51) Calculate: $\int_0^2 (3e^4 - 2x) dx$. 51) _____

52) Find the area of the region between $y = 3x - 1$, the y -axis and the lines $y = 2$ and $y = 5$. 52) _____

A) $\frac{9}{2}$

B) $\frac{26}{3}$

C) $\frac{19}{2}$

D) $\frac{17}{2}$

E) none of the above

53) Set up an integral or sum of integrals and then find the area bounded by $y = x^2 + 3$ and $y = -5x - 3$ 53) _____

A) $\int_{-3}^{-2} [(x^2 + 3) - (-5x - 3)] dx = -\frac{1}{6}$

B) $\int_2^3 [(-5x - 3) - (x^2 + 3)] dx = -\frac{149}{6}$

C) $\int_2^3 [(x^2 + 3) - (-5x - 3)] dx = \frac{149}{6}$

D) $\int_{-3}^{-2} [(-5x - 3) - (x^2 + 3)] dx = \frac{1}{6}$

E) none of the above

54) Find the area of the region bounded by the curve $y = -x^2 + 3$ and the line $y = 2x$. 54) _____

55) Determine the average value of $f(x) = x - x^2$ over the interval from $x = 0$ to $x = 1$. 55) _____

56) A region is bounded above by the graph of $y = x - x^3$ and below by the x -axis on the interval from $x = 0$ to $x = 1$. Find the volume of the solid of revolution generated by revolving the region about the x -axis. 56) _____

57) Differentiate: $(\sin x)^7$ 57) _____

A) $7(\cos x)^6 \sin x$

B) $7(\sin x)^6 \cos x$

C) $7(\cos x)^6$

D) $7(\sin x)^6$

- 58) Differentiate: $\sin x^5$ 58) _____
 A) $5 \sin x^4$ B) $5x^4 \cos x^5$ C) $5(\sin x)^4 \cos x$ D) $5x \cos x^5$
- 59) Differentiate: $\sin \sqrt{x^4 - 1}$ 59) _____
 A) $\frac{2x^3 \cos \sqrt{x^4 - 1}}{\sqrt{x^4 - 1}}$ B) $4x^3 \sin \frac{1}{\sqrt{x^4 - 1}}$
 C) $\cos \sqrt{x^4 - 1}$ D) $\frac{1}{2} \sin \frac{1}{\sqrt{x^4 - 1}}$
- 60) Find the indefinite integral: $\int \sin 2t \, dt$ 60) _____
 A) $-2 \cos 2t + C$ B) $-\cos t + C$ C) $-\frac{1}{2} \cos t + C$ D) $-\frac{1}{2} \cos 2t + C$
- 61) Differentiate $\frac{\sin x}{\cos x}$. 61) _____
 A) $\frac{\sin^2 x}{\cos^2 x}$ B) $\frac{1}{\cos^2 x}$ C) 1 D) $-\frac{\cos x}{\sin x}$
- 62) Differentiate $\cos 2t \cos 3t$ 62) _____
 A) $-2\sin 2t \cos 3t - 3\cos 2t \sin 3t$ B) $2\sin 2t \cos 3t + 3\cos 2t \sin 3t$
 C) $-\sin 2t \cos 3t - \cos 2t \sin 3t$ D) none of the above
- 63) Find the tangent line to the graph of $f(x) = \sin x + \cos x$ at $(\pi, -1)$. 63) _____
 A) $y = \pi$
 B) $y = x + \pi$
 C) $y = -x + \pi - 1$
 D) $y = -x + 1$
 E) none of the above
- 64) Differentiate: $\sin 3x$. 64) _____
- 65) Find the equation of the tangent line tangent to the graph of $y = \cos 3x + 2 \sin x$ at $x = \frac{\pi}{2}$. 65) _____
 Enter your answer in standard point-slope form.
- 66) Differentiate: $f(x) = e^{x^3} \cdot \tan 2x$. form: 66) _____

67) Find the tangent line to the graph of $f(x) = \tan x$ at $\left(\frac{\pi}{4}, 1\right)$. 67) _____

A) $y = 2x + 1 - \frac{\pi}{2}$

B) $y = 2x + \frac{\pi}{2}$

C) $y = 2x - 1$

D) $y = 2x - \frac{\pi}{2}$

E) none of the above

68) Determine the integral using the substitution $u = \ln 5x$. 68) _____

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

A) $\frac{1}{2}(\ln 5x)^2 + C$

B) $\frac{1}{2}(\ln x)(\ln 5x)^2 + C$

C) $\frac{5}{2}(\ln 5x)^2 + C$

D) $\frac{1 - \ln 5x}{x^2} + C$

E) none of the above

69) Determine the integral by making an appropriate substitution $\int \frac{(\ln x)^5}{x} dx$ 69) _____

70) Determine the integral by making an appropriate substitution $\int xe^{x^2} dx$ 70) _____

71) Determine the integral using the substitution $u = \ln \sqrt{x}$. 71) _____

$$\int \frac{\ln \sqrt{x}}{x} dx$$

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

B) $\frac{(\ln x)^2}{4} + C$

C) $2(\ln \sqrt{x})^2 + C$

D) $(\ln x)^2 + C$

E) none of the above

72) $\int \frac{5}{\cos^2 3x} dx = ?$ 72) _____

73) Differentiate $(\sin x + \cos x)^5$

73) _____

A) $(\cos x - \sin x)^5$

B) $5(\sin x + \cos x)^5$

C) $5(\sin x + \cos x)^4(\cos x - \sin x)$

D) $5(\sin x + \cos x)^4$

E) none of the above

74) $\int \sin(3t + 2)dt = ?$

74) _____

75) $\int \sin t \cos t dt = ?$

75) _____

76) Find the indefinite integral $\int \cos(2x + 1)dx$.

76) _____

A) $2\cos(2x + 1) + C$

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

C) $-\cos(2x + 1) + C$

D) $\sin(2x + 1) + C$

E) none of the above

Answer Key

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1) A

2) A

3) $y = \frac{1}{4}x + \frac{1}{2}$

4) B

5) D

6) D

7) C

8) B

9) E

10) $e^{-x^3}(-3x^5 + 3x^2)$

11) B

12) A

13) $6x$

14) $\frac{5}{2}x$

15) y^{-2x}

16) $x = \frac{\ln 5 - 2}{3}$

17) D

18) D

19) B

20) $\frac{1 - 3 \ln x}{x^4}$

21) $\frac{-\ln 3}{x(\ln x)^2}$

22) e^{-1}

23) A

24) A

25) $\ln(x^2 - 4)$

26) $\ln \frac{x^2z}{y}$

27) C

28) B

29) B

30) B

31) A

32) C

33) A

34) B

35) C

36) D

37) $\frac{4}{3}x^3 + 2x^2 + x + C$

38) 17.3

39) 324

40) $-x^{-1} + x + C$

Answer Key

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41) $-e^{-2x} + C$

42) C

43) 32

44) D

45) C

46) B

47) A

48) B

49) $\frac{1}{3}(e^2 - e^{-1})$

50) $\frac{442}{3}$

51) $\frac{3}{2}(-1 + e^4)$

52) A

53) D

54) $\frac{32}{3}$

55) $\frac{1}{6}$

56) $\frac{8\pi}{105}$

57) B

58) B

59) A

60) D

61) B

62) A

63) C

64) $3 \cos 3x$

65) $y - 2 = 3\left(x - \frac{\pi}{2}\right)$

66) $e^{x^3}(3x^2 \tan 2x + 2 \sec 2x)$

67) A

68) A

69) $\frac{1}{6}(\ln x)^6 + C$

70) $\frac{1}{2}e^{x^2} + C$

71) B

72) $\frac{5}{3} \tan 3x + C$

73) C

74) $-\frac{1}{3} \cos(3t + 2) + C$

Answer Key

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75) $-\frac{1}{2}\cos^2 t + C$

76) B