

The Table of Integrals (pages 567-568 of the text) may be used. The Table of Integrals will be attached to the final exam.

- If  $f(x) = x^2 - 1$ , calculate  $f(\frac{1}{2})$  and  $\frac{1}{f(2)}$ .  
 A.  $f(\frac{1}{2}) = \frac{1}{3}$ ;  $\frac{1}{f(2)} = -\frac{3}{4}$  B.  $f(\frac{1}{2}) = -\frac{3}{4}$ ;  $\frac{1}{f(2)} = \frac{1}{3}$  C.  $f(\frac{1}{2}) = -\frac{3}{4}$ ;  $\frac{1}{f(2)} = -\frac{4}{3}$   
 D.  $f(\frac{1}{2}) = 3$ ;  $\frac{1}{f(2)} = \frac{1}{3}$  E. None of these.
- Find the slope of the line containing the points  $(-2, 4)$  and  $(6, -3)$ .  
 A. 4 B.  $-\frac{7}{8}$  C.  $\frac{1}{4}$  D.  $-\frac{8}{7}$  E.  $-\frac{1}{2}$
- Suppose 280 tons of corn were harvested in 5 days and 940 tons in 20 days. If the relationship between tons  $T$  and days  $d$  is linear, express  $T$  as a function of  $d$ .  
 A.  $T = 5d + 280$  B.  $T = -44d + 500$  C.  $T = 44d + 60$  D.  $T = 60d + 44$  E. None of these.
- Find the equilibrium point if the demand function  $D(p) = \frac{1}{2}(8 - p)$  and the supply function  $S(p) = p - 2$ .  
 A. 3 B. 12 C. 2 D. 0 E. 4
- If  $f(x) = \sqrt{x+1}$  and  $g(x) = x^2 + 7$  then  $f \circ g(-1) =$   
 A. 0 B. 3 C.  $\sqrt{7}$  D. 7 E. None of these.
- $\lim_{x \rightarrow 1} \frac{x^2 + 4x - 5}{x^2 - 1} =$   
 A.  $\infty$  B. 0 C. 3 D. -3 E. None of these.
- If  $f(x) = \frac{2}{x}$ , find a simplified form for the difference quotient  $\frac{f(x+h) - f(x)}{h}$ .  
 A.  $\frac{-2}{x^2}$  B.  $\frac{2}{x+h} - \frac{2}{x}$  C.  $\frac{2}{x(x+h)}$  D.  $\frac{-2}{x(x+h)}$  E. None of these.
- For what value of  $a$  does the function  $f(x) = x^2 + ax$  have a relative minimum at  $x = 1$ .  
 A. -2 B. 0 C. 2 D. -1 E. None of these.
- The derivative of  $\frac{x^2 + 1}{x + 5}$  is  
 A.  $\frac{(x+5)2x - (x^2+1)}{(x+5)^2}$  B.  $2x$  C.  $\frac{(x+5)}{(x^2+1)^2} \cdot 2x$   
 D.  $\frac{(x^2+1) + (x+5)2x}{(x+5)^2}$  E.  $\frac{(x^2+1) - (x+5)2x}{(x+5)^2}$
- If  $y = (3 - x^2)^3$  then  $\frac{d^2y}{dx^2} =$   
 A.  $-6x(3 - x^2)^2$  B.  $24x^2(3 - x^2) - 6(3 - x^2)^2$  C.  $6(3 - x^2)$   
 D.  $24x^2(3 - x^2)$  E. None of these.
- The line tangent to the graph of  $f(x) = x - \frac{1}{x}$  at  $x = 2$  has slope  
 A.  $\frac{5}{4}$  B.  $\frac{3}{4}$  C.  $\frac{3}{2}$  D. 0 E. None of these.
- A total cost function is given by  $C(x) = 1000\sqrt{x^2 + 2}$ . Calculate  $C'(10)$ . Give your answer correct to two decimal places.  
 A. 10,099.50 B. 990.15 C. 49.51 D. 99.01 E. None of these.

13. Find all open intervals on which the function  $f(x) = 2x^3 - 3x^2 - 12x + 12$  is increasing.  
A.  $(-1, 2)$  B.  $(\infty, -1)$  C.  $(2, \infty)$  D.  $(-\infty, -1)$  and  $(2, \infty)$  E. None of these.
14. If the concentration  $C(t)$  of a certain drug remaining in the bloodstream  $t$  minutes after it is injected is given by  $C(t) = t/(5t^2 + 125)$ , then the concentration is a maximum when  $t =$   
A. 25 B. 15 C. 5 D. There is no maximum E. None of these.
15. If  $f(x) = 2x^4 - 6x^2$  then which one of the following is true?  
A.  $f$  has a relative max. at  $x = \pm\sqrt{3/2}$  and a relative min at  $x = 0$ .  
B.  $f$  has a relative max. at  $x = 0$  and a relative min. at  $x = \pm\sqrt{3/2}$ .  
C.  $f$  has a relative max. at  $x = -\sqrt{3/2}$  and a relative min. at  $x = \sqrt{3/2}$ .  
D.  $f$  has no relative max. points, but has relative min. at  $x = \pm\sqrt{3/2}$ .  
E. None of these.
16. The derivative of a function  $f$  is  $f'(x) = x^2 - \frac{8}{x}$ . Then at  $x = 2$ ,  $f$  has  
A. an inflection point B. a relative maximum C. a vertical tangent  
D. a vertical asymptote E. a relative minimum
17. If  $f(x) = \frac{1}{3}x^3 - 9x + 2$ . Then on the closed interval  $0 \leq x \leq 4$ ,  
A.  $f$  has an absolute max. at  $x = 3$  and an absolute min. at  $x = 0$ .  
B.  $f$  has an absolute max. at  $x = 4$  and an absolute min. at  $x = 3$ .  
C.  $f$  has an absolute max. at  $x = 0$  and an absolute min. at  $x = 4$ .  
D.  $f$  has an absolute max. at  $x = 0$  and an absolute min. at  $x = 3$ .  
E. None of these.
18. A total-cost function is given by  $C(x) = 1000\sqrt{x^3 + 1}$ . Find the marginal cost when  $x = 2$ .  
A. \$166.67 B. \$333.33 C. \$4000 D. \$2000 E. None of these.
19. A display case is in the shape of a rectangular box with a square base and open top. Suppose the volume is 21 cubic ft. If  $x$  is the length of one side of the base, what value should  $x$  have to minimize the surface area? Give your answer correct to two decimal places.  
A. 2.78 ft. B. 3.48 ft. C. 4.58 ft. D. 6.48 ft. E. 9.17 ft.
20. A manufacturer determines that in order to sell  $x$  units of a product, the price per unit must be  $p = 1000 - x$ . The manufacturer also determines that the total cost of producing  $x$  units is  $C(x) = 3000 + 20x$ . Calculate the maximum profit.  
A. \$490 B. \$237,100 C. \$121,500 D. \$23,000 E. There is no maximum.
21. If  $y = e^{x^2}$  then  $\frac{dy}{dx} =$   
A.  $e^{x^2}$  B.  $x^2e^{x^2-1}$  C.  $2xe^{x^2-1}$  D.  $2xe^{x^2}$  E. None of these.
22. If  $y = \ln(1 - x^2)$  then  $\frac{dy}{dx} =$   
A.  $\frac{1}{1-x^2}$  B.  $\frac{2x}{\sqrt{1-x^2}}$  C.  $\frac{-2x}{1-x^2}$  D.  $\frac{1}{2(1-x^2)}$  E. None of these.
23. Find the amount in a savings account after 4 years from an initial investment of \$100 at interest rate of 10%, compounded continuously. ( $P = P_0e^{kt}$ )  
A. \$149.18 B. \$5459.82 C. \$1491.82 D. \$442.07 E. None of these

24. Evaluate  $\int_0^4 3\sqrt{2x+1} dx$ .  
 A. 27 B. 48 C. 52 D. 26 E. None of these.
25. Evaluate  $\int (\frac{2}{x} - \sqrt{x}) dx$ .  
 A.  $\ln x - 2/\sqrt{x} + C$  B.  $-2/x^2 - x^{-1/2}/2 + C$  C.  $2 \ln x - 2x^{3/2}/3 + C$ .  
 D.  $-2/x^2 - 2x^{3/2}/3 + C$  E. None of these.
26. Evaluate  $\int (3x-1)^{-4} dx$ .  
 A.  $(-12)(3x-1)^{-5} + C$  B.  $-\frac{1}{9}(3x-1)^{-3} + C$  C.  $(3x-1)^{-3} + C$   
 D.  $-\frac{1}{3}(3x-1)^{-3} + C$  E. None of these.
27. Evaluate  $\int e^{3-2x} dx$ .  
 A.  $-2e^{3-2x} + C$  B.  $-\frac{1}{2}e^{3-2x} + C$  C.  $\frac{e^{4-2x}}{4-2x}$  D.  $\frac{1}{3}e^{3-2x} + C$  E. None of these.
28. Evaluate  $\int_1^2 \frac{dx}{3x+1}$ . Give your answer correct to four decimal places.  
 A. 0.5596 B. 0.6486 C. 1.9459 D. 0.0810 E. 0.1865
29. Evaluate  $\int_0^1 x(x^2+1)^5 dx$ .  
 A.  $\frac{21}{4}$  B.  $\frac{16}{3}$  C.  $\frac{21}{2}$  D.  $\frac{32}{3}$  E. None of these
30. The area of the region bounded by the curves  $y = x^2 + 1$  and  $y = 3x + 5$  is  
 A.  $\frac{125}{6}$  B.  $\frac{56}{3}$  C.  $\frac{27}{2}$  D.  $\frac{25}{6}$  E. None of these.
31. Use the attached table to evaluate  $\int 2x \ln x dx$ .  
 A.  $x^2 \ln x - x^2/2 + C$  B.  $\frac{1}{2}x^2 \ln x - \frac{1}{2}x + C$  C.  $\frac{1}{2}x^2 \ln x - \frac{1}{6}x^3 + C$   
 D.  $x \ln x^2 + 1/x + C$  E. None of these.
32. Use the attached table to evaluate  $\int \frac{dx}{\sqrt{x^2-9}}$ .  
 A.  $\frac{1}{6} \ln \left| \frac{x-3}{x+3} \right| + C$  B.  $\ln |x + \sqrt{x^2-9}| + C$  C.  $\ln |x - \sqrt{x^2-9}| + C$  D.  $\ln |x - \sqrt{x^2+9}| + C$   
 E. None of these.
33. Find the average value of  $f(x) = x^2$  over the interval  $1 \leq x \leq 4$ .  
 A.  $\frac{17}{2}$  B.  $\frac{15}{2}$  C. 21 D.  $\frac{65}{3}$  E. None of these.
34. A company determines that the marginal cost  $C'$  of producing the  $x$ th unit of a certain product is  $C'(x) = x^3 - x$ . Find the total cost function  $C$ , assuming fixed costs to be \$200.  
 A.  $C(x) = 3x^2 - 1$  B.  $C(x) = 3x^2 + 200$  C.  $C(x) = \frac{1}{4}x^4 - \frac{1}{2}x^2$  D.  $C(x) = \frac{1}{4}x^4 - \frac{1}{2}x^2 + 200$   
 E. None of these.

35. Find the amount of a continuous money flow in which \$2000 per year is being invested at 8%, compounded continuously, for 15 years. Give your answer to the nearest cent. (Amount =  $\int_0^T R(t)e^{kt} dt$ .)  
 A. \$83,002.93 B. \$4,640.23 C. \$58,002.92 D. \$187,500.00 E. \$100,200.00
36. Calculate, if possible, the following improper integral  $\int_0^{\infty} xe^{-x^2} dx$   
 A.  $-\frac{1}{2}$  B. 1 C.  $\frac{1}{2}$  D. The integral diverges. E. None of these.
37. Find the value of  $k$  so that  $f(x) = k(3 - x)$  for  $0 \leq x \leq 3$  is a probability density function. (Assume  $f(x) = 0$  if  $x$  is not in the interval  $0 \leq x \leq 3$ .)  
 A.  $k = \frac{1}{9}$  B.  $k = -\frac{2}{3}$  C.  $k = -\frac{1}{3}$  D.  $k = \frac{2}{9}$  E. None of these.
38. Find the general solution of the differential equation  $y' = 2x - xy$ , assume  $y < 2$ .  
 A.  $-\ln(2 - y) = \frac{1}{2}x^2 + C$  B.  $\ln(2 - y) = \frac{1}{2}x^2 + C$  C.  $y = x^2 - \frac{1}{2}x^2y + C$   
 D.  $y = x^2 - \frac{1}{2}xy^2 + C$  E.  $2 - y = \frac{1}{2}x^2 + C$
39. Find the particular solution of the differential equation  $\frac{dy}{dx} = 4x^3y^2$ ;  $y = 1$  when  $x = 0$ .  
 A.  $y = \frac{1}{3}x^4y^3 + 1$  B.  $-\frac{1}{y} = x^4 - 1$  C.  $-\frac{1}{y} = x^4$  D.  $y = x^4y^2 + \frac{1}{3}x^3y^3 + 1$  E. None of these
40. The probability density function for the life span of light bulbs manufactured by a certain company is  $f(t) = 0.01e^{-0.01t}$  where  $t$  denotes the life span in hours of a randomly selected bulb,  $0 \leq t < \infty$ . What is the probability that the life span of a randomly selected bulb is less than or equal to 10 hours? Give your answer correct to three decimal places.  
 A. 0.009 B. 0.095 C. 0.905 D. 0.090 E. None of these.

### Answers

1. B; 2. B; 3. C; 4. E; 5. B; 6. C; 7. D; 8. A; 9. A; 10. B; 11. A; 12. B; 13. D; 14. C; 15. B;  
 16. E; 17. D; 18. D; 19. B; 20. B; 21. D; 22. C; 23. A; 24. D; 25. C; 26. B; 27. B; 28. E; 29. A;  
 30. A; 31. A; 32. B; 33. E(7); 34. D; 35. C; 36. C; 37. D; 38. A; 39. B; 40. B