

## MATH 193 PRACTICE QUESTIONS

1. Evaluate  $\int_0^1 \frac{e^{9x}}{2+4e^{9x}} dx$ .
2. Evaluate  $\int_0^{\frac{\pi}{4}} \sqrt[4]{\tan x} \sec^2 x dx$
3. Evaluate  $\int \frac{x}{\sqrt{4-x^2}} dx$
4. Evaluate  $\int \frac{4 dx}{\sec x e^{\sin x}}$
5. Evaluate  $\int \frac{x}{\sqrt{1+x}} dx$
6. Evaluate  $\int \frac{e^{-x} dx}{1+e^{-2x}}$
7. Evaluate  $\int_0^{\frac{\pi}{4}} \frac{5-8 \sin(2x)}{\cos^2 x} dx$
8. Evaluate  $\int \frac{\ln x}{x^2} dx$
9. Evaluate  $\int \frac{3}{x^2-25} dx$
10. Evaluate  $\int \frac{5 dx}{x^2+8x+17}$
11. Evaluate  $\int \frac{y^3+1}{y^3+5y^2+4y} dy$
12. Let  $f(x, y) = e^x \cos y + e^{-2x} \tan y$ . Find  $\frac{\partial f}{\partial x}$ ,  $\frac{\partial f}{\partial y}$  and  $\frac{\partial^2 f}{\partial x \partial y}$ .
13. Evaluate  $\int_1^2 \int_x^{x^2} x^2 y dy dx$
14. Find the first-octant volume below the surface  $z = xy$  and bounded by  $y = x^2$  and  $y = x$ .
15. Show that  $y = \sqrt{Cx - x^2}$  solves the following DE:  $2xyy' + x^2 = y^2$ .
16. Find an implicit solution to the following DE if  $y = 1$  when  $x = \pi$ :  
 $(\sin x)dy = x^3(\sin^2 x)dx + \frac{3y \sin x}{x} dx$

17. Solve the following DE explicitly for  $y$ :

$$6xydx + (x^2 + 7)dy = 0$$

18. A cup of coffee is sitting on the counter in a  $20^\circ\text{C}$  room. The coffee's temperature is initially  $90^\circ\text{C}$ , and takes 5 minutes to reach  $80^\circ\text{C}$ . What is the coffee's temperature after 15 minutes? Show all your work, starting with an appropriate differential equation.

19. Consider  $y'' + 8y' + ky = 0$ . Solve it for:

- a)  $k = 7$
- b)  $k = 16$
- c)  $k = 18$

20. The following DE's have complementary solution  $y_C = C_1 \sin x + C_2 \cos x$ . State the form of the particular solution  $y_P$  for each DE.

- a)  $y'' + y = 9x^2$
- b)  $y'' + y = 5 \cos x$
- c)  $y'' + y = e^{7x}$
- d)  $y'' + y = x^2 e^{4x}$

21. Solve  $y'' + 7y' + 12y = \sin 2x$  given  $y(0) = 4$  and  $y'(0) = -3$ .

22. A 2 kg mass is attached to a spring with spring constant 12 N/m. There is a damping force equal to 10 times the velocity, as well as an external force  $f(t) = \sin 3t$ . The mass is initially 20 cm below the equilibrium position with an upwards velocity of 30 cm/s. Find the equation of motion. Start with an appropriate DE and show all your work.

23. Consider the following sample of temperature readings (in  $^\circ\text{C}$ ):

$$7, 4, -4, -2, 3, 1$$

- a) Compute the mean
- b) Compute the median
- c) Compute the standard deviation
- d) If we added 1.5 to every measurement in the sample, what would the new variance be?

24. In a class of 45 students, 8 live alone and 31 have a part-time job. Of those who have a part-time job, 3 live alone. What is the probability that a student doesn't live alone and doesn't have a part-time job?

25. A network password consists of 8 symbols chosen from the symbol set  $a, \dots, z, A, \dots, Z$ . Find the probability that a password:

- a) ends with  $yZ$
- b) doesn't start with  $b$
- c) starts with  $C$  or ends with  $C$

26. Project A has a 65% chance of earning \$8,000, a 15% chance of earning \$3,000, and a 20% chance of earning -\$5,000 (that is, losing \$5,000).

- a) Find the expected earnings of Project A.
- b) Find the standard deviation of Project A's earnings.
- c) Consider Project B. The standard deviation of Project B's earnings is \$6,200. Which project's earnings are more uncertain, Project A or Project B?

27. In a shipment of 30 parts, 2 are defective. Five parts are randomly selected from the shipment. Find the probability that at least one defective part is selected.

28. A switchboard receives an average of 1.8 calls per minute. Find the probability that the switchboard receives at least 3 calls in the next two minutes.

29. A multiple-choice quiz has 3 questions, each of which has 4 possible answers. A student guesses randomly on each question. Find the probability distribution for the number of questions the student gets right.

30. The time to complete an assignment (in hours) has probability density

$$\text{function } f(x) = \begin{cases} \frac{x^2}{20}, & 0 \leq x \leq 3 \\ \frac{33(x+x^2)}{2440}, & 3 < x \leq 5 \\ 0, & \text{otherwise} \end{cases}$$

Find the probability that an assignment takes:

- a) exactly 2.5 hours
- b) between 2.5 and 4.5 hours
- c) more than 4.5 hours

31. In a certain town, the weights of adult males are normally distributed with a mean of 168 pounds. 30.23% of adult males in the town weigh between 148 and 168 pounds. Find the standard deviation of the weights.

32. A large class writes a test. The average test mark is 71 with a standard deviation of 6. Find the probability that 35 randomly-selected tests have an average mark of less than 68 or more than 73.