I.

1. Consider the integral
   $\int_1^4 x^2 - 1\,dx$
   Evaluate the integral by dividing the interval into 4 equal subintervals and express the integral as a sum.

2. Consider the integral $\int_1^5 x^2 + 1\,dx$ Evaluate the integral by dividing the interval into 4 equal subintervals and approximate the integral by a sum.

3. For $f(x) = \sin(x)$ on $[0\ ,\pi]$,

   divide the interval into 4 equal subintervals and approximate the integral by a sum.

4. Given that $f'(x) = 3x - 4$ and that $f(0) = 3$. Find $f(x)$.

5. Find the solution of $y' = 2x + 3$ satisfying $y = 2$ when $x = 0$

II. Integrate each of the following:

1. $\int_1^2 \frac{2\ dx}{(x)^5}$ is:

2. $\int (4x^2 - 2)^4 8x\ dx$ is:

3. $\int \frac{x^3+6}{x^2}\ dx$.

   Hint: divide out.

4. $\int_1^6 \sqrt{x}\ dx$

5. $\int \frac{dx}{(x+4)^2}$

6. $\int_1^3 x\sqrt{x^2-1}\ dx$

7. $\int_0^{\frac{1}{4}} \cos(\pi x)\ dx$

8. $\int \sin^2(x)\cos(x)\,dx$

9. $\int \frac{x^3+7x^2+5}{x^2}\ dx$

10. $\int_0^1 \frac{3x}{\sqrt{(6x^2+1)}}\ dx$

11. $D_x \int_0^x \sqrt{t^2+1}dt$

12. $D_x \int_0^{\sin(x)} \sqrt{t^3+1}dt$

III.

13. Find the area bounded by the $y-axis$, and $y = x^2 - 1$ and $x - axis$.

14. The area of the region bounded by the graphs of $y = \sqrt{x},\ x = 0$, and $y = 2$.

15. A ball is thrown vertically into the air from a height of 160 feet above the ground and with an initial velocity of 48 ft/sec. Find the details of this flight. e.g. max ht, spedd upon impact.

16. $\int_0^1 4x(4x^2-2)^2\ dx$ is:

17. $\int \frac{x^3+7x^2+5}{x^2}\ dx$ is:

18. $\int_{-7}^{-2} \sqrt{2-x}\ dx$ is:

19. If $f(x) = \int_4^x \sqrt{t^2-7}\ dt,$ then $f'(4)$

20. $\int_2^1 \dfrac{2\ dx}{(x)^3}$ is:

21. $\int_0^1 (4x^2-2)^4 6x\ dx$ is:

22. $\int \frac{x^2+6}{x^2}\ dx$.
Hint: divide out.

23. $\int_1^6 \sqrt{3+x}\ dx$

24. $\int_{-2}^{-1} \frac{dx}{(x+4)^2}$

25. $\int_1^3 x\sqrt{x^2-1}\ dx$

26. $\int_0^1 x^3\sqrt{x^4+1}\ dx$

27. $\int_0^{\frac{1}{4}} \sin(\pi x)\ dx$

28. $\int \sin^3(x)\cos(x)\,dx$

29. $\int \sin(x)\cos(x)\,dx$

30. $D_x \int_x^{15} \sqrt{(t^3+1)}\ dt$

31. $\int_0^1 (4x^2-2)^4 6x\ dx$ is:

32. $\int_1^6 \sqrt{3+x}\ dx$ is:

33. $\int_{-2}^{-1} \frac{dx}{(x+4)^2}$ is:

34. $\int_1^3 x\sqrt{x^2-1}\ dx$ is:

35. $\int_0^{\pi} \frac{1-\sin^2 x}{\cos x}\ dx$ is:

36. $D_x \int_{15}^{x} \sqrt{t^3+1}\ dt$

37. $\int_0^1 4x(x^2+2)^3 dx$ is:

38. $\int_0^1 x^3\sqrt{x^4+1}\ dx$

39. The solution of $y' = 2x+3$ satisfying $y=2$ when $x=0$ is

40. The solution to $y' = 2x^2+6x+2$ satisfying $y=1$ when $x=0$ is:

41. $\int_3^1 \frac{dx}{(x+1)^3}$ is:

42. $\int_0^2 x^2\sqrt{2x^3+1} dx$ is:

43. $D_x \int_4^x \sqrt{t^2-7} dt$ is:

44. $\int_0^1 (x^2+1)^7 x\ dx$ is:

45. $\int_{-7}^{-2} \sqrt{2-x}\ dx$ is:

46. $\int_0^1 \dfrac{2\ dx}{(x+1)^3}$ is:

47. $\int_0^1 4x(4x^2-2)^2\ dx$ is:

48. $\int \dfrac{x^3+7x^2+5}{x^2}\ dx$ is:

49. $\int_{-2}^{2} \sqrt{2-x}\ dx$ is:

50. $\int_0^1 x^2\sqrt{2x^3+2}\ dx$ is:

51. $\int_0^{\infty} \dfrac{x}{\sqrt{x^2+1}}\ dx$ is:

52. The solution of $y' = 8x - 3$ satisfying $y = 0$ when $x = 1$ is

53. $\int_{-2}^{-1} \frac{dx}{(x+4)^2}$ is:

54. $\int_1^3 x\sqrt{x^2-1}\, dx$ is:

55. $D_x \int_{15}^{x} \sqrt{t^3+1}\, dt$

56. $\int_0^1 \frac{2\, dx}{(x)^3}$ is:

57. $\int_0^1 (4x^2-2)^4 6x\, dx$ is:

58. $\int \frac{x^2+6}{x^2}\, dx$.
Hint: divide out.

sectionrelated rates

1. Air is leaking out of a ballon at a rate of $2\frac{m^3}{min}$. Find the rate at which the radius is changing when the radius is 4 m.($V = \frac{4}{3}\pi r^3$)

2. A ladder 15 ft long rests against a vertical wall. If the bottom of the ladder slides away from the wall at the rate 1 ft/s, how fast is the top of the ladder sliding down when the bottom of the ladder is 9 ft.from the wall?

3. Two cars start moving from the same point. One travels south at 50MPH, and the other travels east at 25MPH. You wish to find the rate at which the distance between them increasing 3 hours later.

   (a) Draw a picture, labeling your variables.

   (b) What rate(s) are you given?

   (c) What rate do you wish to find at what instance in time?

   (d) How can you relate your variables in parts (b) and (c)?

4. Suppose that a liquid is to be cleared of sediment by pouring it through a cone shaped filter. Assume that the height of the cone is 16 inches and that the diameter of the cone is 8 inches. If the liquid is flowing out of the cone at a rate of 2 in^3/min, when the level is 8 inches deep, how fast is the depth of the liquid changing at that instant? (The volume of a cone is given by $V = \frac{1}{3}\pi r^2 h$.)

5. A right circular cylinder is to be designed to hold 22 cubic inches of coca-cola (approximately 12 fluid ounces). To keep the costs down, we want to use a minimum of material in the construction. (The volume of a cylinder is given by $V = \pi r^2 h$.)

   (a) Draw a picture of this container, labeling your variables.

   (b) Write down function you wish to optimize:

   (c) Find the constraint equation that relates your variables.

   (d) Express the function you found in part (b) as a function of only one variable (no need to simplify).

   (e) Explain how to find the dimensions of the container that will minimize the cost to construct the container.