1. Compute $\int_0^1 \cos(\pi x)dx$.

2. Compute $\int_1^2 \frac{3x}{\sqrt[4]{2x^2+7}}dx$.

3. Compute $\int_4^{16} \frac{1-\sqrt{u}}{\sqrt{u}}du$ two different ways.

4. Compute $\int_0^1 t\sqrt[3]{t^2+2}dt$.

5. Compute $D_x \int_x^{x^2} 3t\cos\sqrt{t}dt$.

6. Compute $\frac{d}{dt}\int_{-t}^{2t} x^2 \frac{x-3}{x^2+1}dx$.

7. Find the area bounded between the x-axis and the function $f(x) = x^3 - 6x^2 + 8x$.

8. Find the area bounded between the function $f(x) = 2(x^3 - x)$ and the function $f(x) = x^3$.

9. Find the area bounded between the graphs of $y = 2\sin x$ and $y = \sin(2x)$ where $0 \le x \le \pi$.

10. Write Simpson's rule for $\int_0^\pi \sin x^2 dx$ using $n = 6$. Find an n that according to the error estimate on Simpson's rule gives you an error of at most 0.000005 for this integral.

11. Write the trapezoid rule for $\int_0^\pi \sin x^2 dx$ using $n = 6$. Find an n that according to the error estimate on the trapezoid rule gives you an error of at most 0.000005 for this integral.

12. How large does n have to be in order to compute $\int_1^2 \frac{1}{x}dx$ within an accuracy of 0.0001 using the Trapezoid method? Using Simpson's method?

13. Explain how the error estimate shows that Simpson's rule give the exact answer for the integral of any polynomial of degree at most three. Use Simpson's rule with $n = 2$ on the integral $\int_0^{10} x^3 - 3x^2 - 5dx$ and compute the integral as an example.

14. Solve the initial value problem by first writing your answer as a definite integral and then evaluating: $\frac{dy}{dx} = \left(x + \frac{1}{x}\right)^2$, $y(1) = 1$.

15. Derive the volume of a cone with height h and base radius r using both the disk method and the cylindrical shell method.

16. Derive the volume of a sphere with radius r using both the disk method and the cylindrical shell method.

17. A building has a circular floor with radius 25 feet. The ceiling is a plane that varies in height from 10 feet to 20 feet. Find the volume of the building.

18. A wedge is cut from a solid cylindrical rod of radius 1. The wedge is formed using two planar cuts. One is perpendicular to the axis of the cylinder and the other is a cut that intersects the first along a diameter at an angle 45 degrees. Find the volume of the wedge.

19. Find the volume of the intersection of two perpendicular cylinders whose cross sections are circles of radius 1.

20. Find the volume of the solid of revolution that is obtianed by rotating the area between the x-axis, the function $f(x) = \frac{\sqrt{x^3+x}}{(x^2+1)^2}$, $x = 0$, and $x = 1$ about the x-axis.

21. Find the volume of the solid of revolution that is obtianed by rotating the "triangular" region bounded by $y = \frac{4}{x^3}$, and the lines $x = 1$ and $y = \frac{1}{2}$ about the x-axis. Then compute the volume if rotated about the y-axis.

22. Find the volume of the solid of revolution that is obtained by rotating the area between the x-axis and the function $f(x) = x^2 - 2x$ about the x-axis.

23. Find the volume generated by rotating the area between the x-axis and the curve $y = \sin(x^2)$ for $0 \leq x \leq \sqrt{\pi}$ about the y-axis. Why did you pick the method you used instead of the other "standard" method?

24. Find the volume of the solid of revolution obtained by rotating the region in the plane bounded by $x = y^2$ and $y = 6 - x$ about the $x-$axis.

25. Find the volume of the solid of revolution obtained by rotating the region in the plane bounded by $x = y^2$ and $y = 6 - x$ about the $y-$axis.

26. Find the volume generated by rotating the area between the x-axis and the curve $y = \sqrt{\sin x}$ for $0 \leq x \leq \pi$. Why did you pick the method you used instead of the other "standard" method?

27. Explicitely compute a limit of Riemann sums to evaluate $\int_1^3 x^2\,dx$. Use right end points.

28. Explicitely compute a limit of Riemann sums to evaluate $\int_{-1}^2 2x - x^2\,dx$. Use left end points.

29. Find the length of the graph of $f(x) = \dfrac{x^3}{6} + \dfrac{1}{2x}$, $2 \leq x \leq 3$.

30. Find the length of the curve given parametrically by $x = \dfrac{t^2}{2}$, $y = \frac{(2t+1)^{3/2}}{3}$, and $0 \leq t \leq 4$.

31. Set up, but do not evaluate, an integral that gives the length of the parabola $y = x^2$ for $-1 \leq x \leq 1$.

32. True of False. There is a function whose derivative is $\sin(x^2)$. Either give a formula for the function, explain how you know there is such a function, or explain how you know there isn't.