

Show all steps.

You do not need to simplify your arithmetic.

1. (14 pts.) Evaluate  $\int_2^3 (\sin x)(4 + 7 \cos x)^5 dx$ .
2. (14 pts.) Evaluate  $\int x \sqrt[3]{x-1} dx$ .
3. (18 pts.) (a) Write out the sum for the midpoint approximation  $M_4$  of the integral  $I = \int_1^3 \sqrt{1 + \ln x} dx$ .  
(b) Is  $L_4$  an underestimate for  $I$ , an overestimate for  $I$ , or do we not have enough information to tell? Justify your answer.  
(c) Find the value of  $n$  such that  $R_n$  is within 0.05 of the true value of  $I$ , according to the formula  $\frac{K_1(b-a)^2}{2n}$ .
4. (12 pts.) Set up (but do not evaluate) an integral that computes the arc length of the graph of  $y = x^3$  between the points  $(2, 8)$  and  $(5, 125)$ .
5. (14 pts.) The base of a solid object is the region bounded between the curves  $y = x^4$  and  $y = 6$ . Cross-sections perpendicular to the  $y$ -axis are squares. Set up (but do not evaluate) an integral that computes the volume of the object.
6. (14 pts.) The region bounded between the curves  $y = 3x$  and  $y = x^2$  is revolved about the line  $y = -1$ . Set up (but do not evaluate) an integral that computes the volume of the resulting solid.
7. (14 pts.) If  $dy/dx = x/y^2$  and  $y(1) = 0$ , find the formula for  $y(x)$ .