

## Data Based Cola Problem

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What can we do with data?

How can we approximate a derivative?

How can we approximate a definite integral?

The rate of consumption of cola in the US,  $S(t)$ , is given in the table below, where  $S$  is measured in billions of gallons per year and  $t$  is measured in years from the beginning of 1980.

Time (from 1980)	0	2	4	6	8	10	12	14	16
$S(t)$ Billions of gallons per year	6	7.9	10.4	13.8	18.2	24	31.7	41.8	55.1

- Using the data in the table, determine the average rate of increase in the rate of soda consumption for the ten year period beginning in 1980.
- Using the data in the table, approximate the rate of increase in the rate of soda consumption at  $t = 10$ .
- Using the data in the table and a midpoint Riemann sum with 4 subintervals, approximate the value of the definite integral  $\int_0^{16} S(t) dt$ .
- Using correct units, explain the meaning of your answer in c.
- A student proposes that the equation  $C(t) = 6 e^{(.139 t)}$  models the data well. Find the value of  $C'(10)$  and explain its meaning in the context of the problem.
- Write the equation of a line tangent to  $C(t)$  at  $t = 10$  and use it to approximate  $C(11)$ .
- By comparing your tangent line approximation to the actual value of  $C(11)$ , what can you conclude about  $C''(11)$ ?
- Using the student's equation find the value of the definite integral  $\int_0^{16} C(t) dt$ .
- Using the student's equation find the average rate of consumption of cola over the 10-year period beginning January 1, 1984. Indicate units of measure.