

Exercise 49

The table shows world average daily oil consumption from 1985 to 2010 measured in thousands of barrels per day.

Years since 1985	Thousands of barrels of oil per day
0	60,083
5	66,533
10	70,099
15	76,784
20	84,077
25	87,302

Source: US Energy Information Administration

- (a) Compute and interpret the average rate of change from 1990 to 2005. What are the units?
- (b) Estimate the instantaneous rate of change in 2000 by taking the average of two average rates of change. What are its units?

Solution**Part (a)**

Calculate the average rate of growth over $[5, 20]$.

$$[5, 20] : \frac{B(20) - B(5)}{20 - 5} = \frac{84,077 - 66,533}{15} = 1169.6 \frac{\text{thousand barrels per day}}{\text{year}}$$

On average the rate of consumption of oil increases by 1,169,600 barrels per day each year from 1990 to 2005.

Part (b)

Calculate the average rate of growth over $[10, 15]$ and $[15, 20]$.

$$[10, 15] : \frac{B(15) - B(10)}{15 - 10} = \frac{76,784 - 70,099}{5} = 1337 \frac{\text{thousand barrels per day}}{\text{year}}$$

$$[15, 20] : \frac{B(20) - B(15)}{20 - 15} = \frac{84,077 - 76,784}{5} = 1458.6 \frac{\text{thousand barrels per day}}{\text{year}}$$

Take the average of these average rates to get the best estimate for the instantaneous rate in 2000.

$$\frac{1337 + 1458.6}{2} = 1397.8 \frac{\text{thousand barrels per day}}{\text{year}}$$