

Exercise 34

After alcohol is fully absorbed into the body, it is metabolized with a half-life of about 1.5 hours. Suppose you have had three alcoholic drinks and an hour later, at midnight, your blood alcohol concentration (BAC) is 0.6 mg/mL.

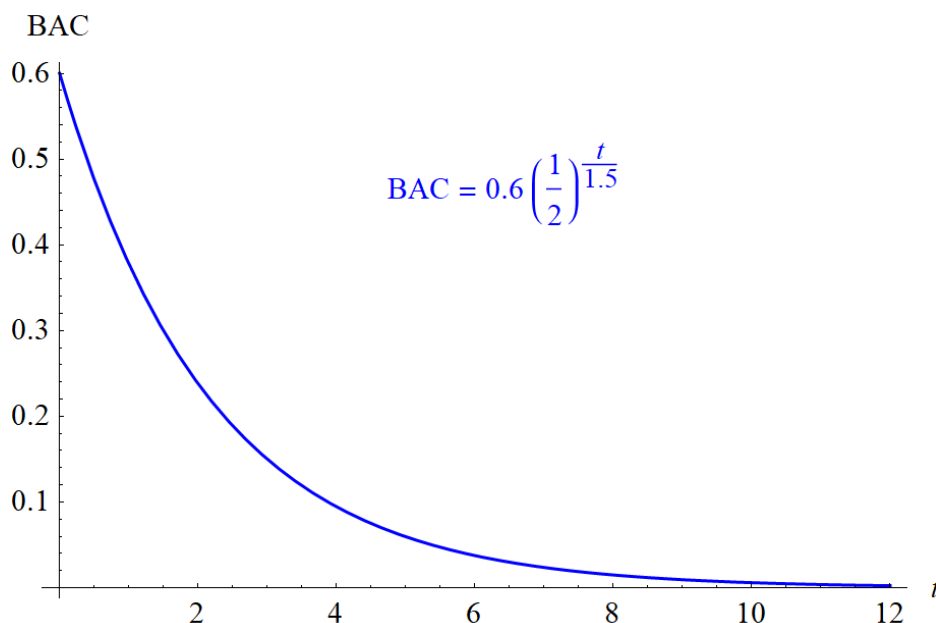
- Find an exponential decay model for your BAC t hours after midnight.
- Graph your BAC and use the graph to determine when you can drive home if the legal limit is 0.08 mg/mL.

Source: Adapted from P. Wilkinson et al., “Pharmacokinetics of Ethanol after Oral Administration in the Fasting State,” *Journal of Pharmacokinetics and Biopharmaceutics* 5 (1977): 207–24.

Solution

The BAC (in mg/mL) after t hours is given by

$$\text{BAC} = 0.6 \left(\frac{1}{2} \right)^{\frac{t}{1.5}}.$$



Judging from the graph, the BAC reaches 0.08 mg/mL at $t \approx 4.3$ hours, or 4 hours and 18 minutes after midnight.