**NEW ALCOHOL LIMIT**

Under the present law, a person may still drive a car with a blood alcohol of up to 50 mg/100 mL of blood.

A foolish young woman was found to have a blood alcohol content of

220 mg/100mL.

The rate at which the body can eliminate alcohol from the blood is proportional to the amount present in the blood.

After 2 hours, her blood alcohol content had reduced to 190 mg/100mL.

1. Find a formula for her blood alcohol content A at t hours.
2. Use the formula to find A at t = 6 hours
3. Find how long it will take for A to reduce to 50 mg/100mL
4. How long will it take for A to be less than 10 mg/100mL?

**SOLUTION.** Under the present law, a person may still drive a car with a blood alcohol of up to 50 mg/100 mL of blood.

The **rate** at which the body can eliminate alcohol from the blood is **proportional to the amount present** in the blood.

***dA = k A***

***dt***

***dA***

***A***

**∫ *=* ∫ *k dt***

**ln(A) = kt + c**

A foolish young woman was found to have a blood alcohol content of

220 mg/100mL. ***(t = 0, A = 220)***

***ln(220) = 0 + c***

***ln(A) – ln(220) = kt***

***ln( A / 220 ) = kt***

After 2 hours, her blood alcohol content had reduced to 190 mg/100mL.

( t = 2, A = 190)

***ln( 190*** */* ***220) = 2k***

***k = -0.0733***

1. Find a formula for her blood alcohol content A at t hours.

***ln (A / 220) = -0.0733t***

***A / 220 = e -0.0733t***

***A = 220 e -0.0733t***

1. Use the formula to find A at t = 6 hours

***Sub t = 6 A ≈ 140***

1. Find how long it will take for A to reduce to 50 mg/100mL

***Sub A = 50 in*** ***ln (A / 220) = -0.0733t***

***ln (50 / 220) = -0.0733t***

***t ≈ 20.2 hours***

1. How long will it take for A to be less than 10 mg/100mL?

***Sub A = 10 in*** ***ln (A / 220) = -0.0733t***

***ln (10 / 220) = -0.0733t***

***t ≈ 42 hours***