

Safe Driving

You will need:

graph paper



There is no safe way to drive after drinking. Alcohol reaches a person's brain very soon after it has been absorbed into the bloodstream, and it impairs vision, hearing, muscular coordination, judgment, and self-control.

A person can begin to show mild effects from drinking alcohol when the blood alcohol concentration (BAC) is as low as 0.02%. Most people do not experience impairment until the BAC is about 0.05%, but each situation is different. A person who is tired or sick, or has taken drugs or medicines, may experience impairment with a lower BAC. In any case, a BAC of 0.10% is very unsafe for driving.

A FORMULA

Blood alcohol concentration depends on many factors, but it can be estimated by using a person's weight and the amount of alcohol consumed, using this formula.

$$B = \frac{7.6 \cdot A}{W}$$

B = blood alcohol level, or BAC (in %).

A = alcohol consumed (in ounces).

W = body weight (in pounds).

The number 7.6 in the formula was derived by taking into account physiological factors (such as the percentage of alcohol that will be absorbed into the blood) and conversion of units.

Definition: We say that y is *inversely proportional* to x if the product of x and y is constant. Expressed algebraically

$$xy = k \text{ or } y = k/x \text{ for some constant } k.$$

- In the formula is B
 - directly or inversely proportional to W ?
 - directly or inversely proportional to A ?
- Use the formula to estimate the blood alcohol concentration of:
 - a 152-pound person who consumed one ounce of alcohol;
 - a 190-pound person who consumed two ounces of alcohol.
- Solve the formula for W in terms of the other two variables.
 - Use your equation to estimate the weight a person would have to be in order to have a blood alcohol concentration of 0.05 after drinking three ounces of alcohol.
- Solve the formula for A in terms of the other two variables.
 - Estimate the amount of alcohol a person probably consumed if he or she weighed 170 lbs. and had a BAC of 0.10.

GRAPHING BAC vs. ALCOHOL

The formula has three variables, so we cannot graph it on a two-dimensional Cartesian coordinate system. However, we can use two-dimensional graphs to study this problem by fixing the value of one variable and graphing the resulting function.

5. a. Substitute 152 for W in the formula to find the function that expresses how BAC depends on the amount of alcohol consumed for a 152-pound person.
 - b. Make a graph of the function you wrote in part (a). Label the y -axis *BAC (%)* and the x -axis *Alcohol (oz)*.
 - c. Label your graph so people can see what it refers to.
6. Repeat problem 5 for three other reasonable weights. Use the same axes for all four graphs.
 7.  Describe the four graphs you drew. For a given body weight, is BAC directly proportional or inversely proportional to the amount of alcohol consumed? Explain.

GRAPHING BAC vs. WEIGHT

8. a. Substitute 1 for A in the formula to find the function that expresses how BAC depends on weight for people who have consumed one ounce of alcohol.
 - b. Make and label the graph of the function you wrote in part (a).
9. Repeat problem 8 for three other amounts of alcohol (between two ounces and eight ounces). Use the same axes for all four graphs.
 10.  Describe the four graphs you drew. For a given amount of alcohol, does the BAC vary directly or inversely as the weight of the person? Explain.

THE EFFECT OF TIME

Alcohol does not stay in a person's blood forever. The amount remaining as time passes depends on many factors. A rule of thumb is that 40 minutes after drinking, blood alcohol starts to decrease at the rate of 0.01% per 40 minutes. In using this rule, you must remember to account for the first 40 minutes.

Example: Using the formula, a woman's blood alcohol level was estimated to be about 0.06%. Eighty minutes later she might expect it to be about 0.05%.

11. A man's blood alcohol concentration was estimated to be about 0.09%. How long would he have to wait for his BAC to drop below 0.02%?
12. A woman's blood alcohol concentration was estimated to be about 0.12%. How long until her BAC was below 0.04%?

SAFE DRIVING GUIDELINES

13. A 115-pound woman had two ounces of alcohol to drink. Her 240-pound companion drank three ounces. Two hours later, do you think either person could drive safely? If so, which one? Explain your answer.
14. People know how much they have had to drink, but they do not know how much alcohol they have consumed. Calculate the amount of alcohol in each of these drinks.
 - a. 12 ounces of beer that is 4% alcohol
 - b. 4 ounces of wine that is 12% alcohol
 - c. 6 ounces of wine that is 12% alcohol
 - d. 4 ounces of a drink that is 20% alcohol
15.  A woman drank two 12-ounce beers. She weighs about 120 pounds. How long should she wait before driving? Explain.
16. **Report** Write a report that will give information to people to help them use good judgment in driving if they have been drinking. Include the following components in your report:
 - Summarize what you learned about blood alcohol concentration in your investigation. You may wish to include graphs or tables.

- Make a chart or diagram that you think will help give people information about blood alcohol concentration. They should be able to look up their weight and the amount they have had to drink in your table and estimate their BAC. Include information on the amount of alcohol in some typical drinks.

are different for people under age 18 or 21. You may want to find statistics about the relationship between BAC and the chance of being involved in an accident.

- Summarize what you find out about DUI laws.
- Give your own opinion about the DUI laws in your state.

17. **Research** Find out about the DUI (driving under the influence of alcohol or drugs) laws in your state. In some states the laws

REVIEW COMPARING FRACTIONS

Explorations

18. Find several values of x for which:

a. $\frac{x}{40} > \frac{40}{x}$ b. $\frac{x}{40} < \frac{40}{x}$

19. Which is greater?

a. $\frac{x}{40}$ or $\frac{x}{45}$ b. $\frac{40}{x}$ or $\frac{45}{x}$

20. Which is greater?

a. $\frac{d}{40} - \frac{d}{45}$ or $\frac{d}{40} - \frac{d}{50}$

b. $\frac{d}{40} - \frac{d}{45}$ or $\frac{d}{45} - \frac{d}{50}$