A box with a square base and a volume of 1000 cubic inches is to be constructed. The material for the top and bottom of the box costs $3 per 100 square inches, and the material for the sides costs $1.25 per 100 square inches.

(a) If x is the length of a side of the base, express the cost of constructing the box as a function of x.

A certain company has fixed costs of $40,000 and variable costs of $2.60 per unit.

(a) Let x be the number of units produced. Find the rule of the average cost function. [The average cost is the cost of the units divided by the number of units.]

(c) Find the horizontal asymptote of the average cost function. Explain what the asymptote means in this situation. [How low can the average cost possibly be?]

A salesperson finds that her sales average 40 cases per store when she visits 20 stores a week. Each time she visits an additional store per week, the average sales per store decreases by 1 case. How many stores should she visit each week if she wants to maximize her sales?

A rope is to be stretched at uniform height from a tree to a 35-foot-long fence, which is 20 feet from the tree, and then to the side of a building at a point 30 feet from the fence, as shown in the figure.

(a) If 53 feet of rope is to be used, how far from the building wall should the rope meet the fence?

Pure alcohol is being added to 50 gallons of a coolant mixture that is 40% alcohol.

(a) Find the rule of the concentration function c(x) that expresses the percentage of alcohol in the resulting mixture as a function of the number x of gallons of pure alcohol that are added.

(b) How many gallons of pure alcohol should be added to produce a mixture that is at least 60% alcohol and no more than 80% alcohol?

(c) Determine algebraically the exact amount of pure alcohol that must be added to produce a mixture that is 70% alcohol.

When a basketball team charges $4 per ticket, average attendance is 500 people. For each 20¢ decrease in ticket price, average attendance increases by 30 people. What should the ticket price be to ensure maximum income?

A rectangular garden next to a building is to be fenced on three sides. Fencing for the side parallel to the building costs $80 per foot, and material for the other two sides costs $20 per foot. If $1800 is to be spent on fencing, what are the dimensions of the garden with the largest possible area?

A power plant is located on the bank of a river that is \( \frac{1}{4} \) mile wide. Wiring is to be laid across the river and then along the shore to a substation 8 miles downstream, as shown in the figure. It costs $12,000 per mile for underwater wiring and $8000 per mile for wiring on land. If $72,000 is to be spent on the project, how far from the substation should the wiring come to shore?

You have 5 grams of carbon-14, whose half-life is 5730 years.

(a) Write the rule of the function that gives the amount of carbon-14 remaining after x years. [See the box preceding Example 8.]

(b) How much carbon-14 will be left after 4000 years? After 8000 years?

(c) When will there be just 1 gram left?

A student leaves the university at noon, bicycling south at a constant rate. At 12:30 P.M., a second student leaves the same point and heads west, bicycling 7 mph faster than the first student. At 2:00 P.M., they are 30 miles apart. How fast is each one going?
1) Students in a precalculus class were given a final exam. Each month thereafter, they took an equivalent exam. The class average on the exam taken after $t$ months is given by

$$F(t) = 82 - 8 \cdot \ln (t + 1).$$

(a) What was the class average after six months?  
(b) After a year?  
(c) When did the class average drop below 55?

12) A homemade loaf of bread turns out to be a perfect cube. Five slices of bread, each .6 inch thick, are cut from one end of the loaf. The remainder of the loaf now has a volume of 235 cubic inches. What were the dimensions of the original loaf?

13) A 13-foot-long ladder leans on a wall, as shown in the figure. The bottom of the ladder is 5 feet from the wall. If the bottom is pulled out 3 feet farther from the wall, how far down the wall does the top of the ladder move?