

1) 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 .

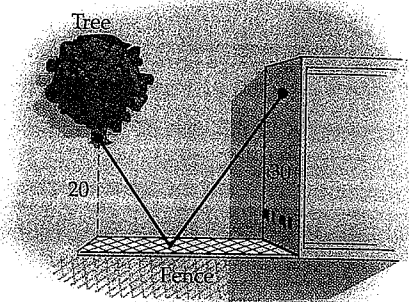
3) A certain company has fixed costs of \$40,000 and variable costs of \$2.60 per unit.

- (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?]

5) 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?

7) 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 63 feet of rope is to be used, how far from the building wall should the rope meet the fence?



9) 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?

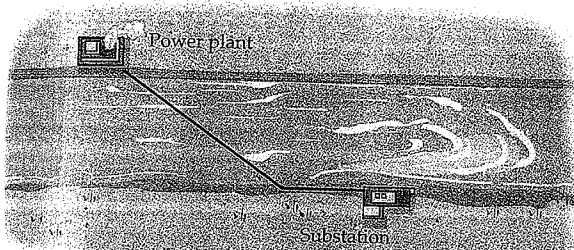
2) Pure alcohol is being added to 50 gallons of a coolant mixture that is 40% alcohol.

- (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.

4) 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?

6) 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?

8) A power plant is located on the bank of a river that is $\frac{1}{2}$ 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?



10) 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?

- 11) 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 does the top of the ladder move down the wall?

