

Calculus

Algebra

- A utility company burns coal to generate electricity. The cost C in dollars of removing $p\%$ of the air pollutants emissions is $C = \frac{90,000p}{100-p}$, $0 \leq p < 100$. Find the cost of removing (a) 10%, (b) 25%, and (c) 75% of the pollutants. Find the limit of C as $p \rightarrow 100^-$.
- A management company is planning to build a new apartment complex. Knowing the maximum number of apartments the lot can hold and given a function for the maintenance costs, determine the number of apartments that will minimize the maintenance costs.
- The velocity v of the flow of blood at a distance r from the central axis of an artery of radius R is $v = k(R^2 - r^2)$ where k is the constant of proportionality. Find the average rate of flow of blood along a radius of the artery. (Use 0 and R as the limits of integration.)

Data Analysis and Probability

- The average data entry speeds S (words per minute) of a business student after t weeks of lessons are recorded in the following table.

t	5	10	15	20	25	30
S	28	56	79	90	93	94

A model for the data is $S = \frac{100t^2}{65+t}$, $t > 0$. Do you think that there is a limiting speed? If so, what is the limiting speed? If not, why?

- Identify a real life situation that involves quantities that change over time and develop a method to collect and analyze related data. Develop a continuous function to model the data and generalize the results to make a conclusion.
- A sheet of typing paper is ruled with parallel lines that are 2 inches apart. A two-inch needle is tossed randomly onto the sheet of paper. The probability that the needle will touch a line is $P = \frac{2}{\pi} \int_0^{\frac{\pi}{2}} \sin \theta \, d\theta$ where θ is the acute angle between the needle and any one of the parallel lines. Find the probability.

Geometry

- The radius of a right circular cylindrical balloon is given by $\sqrt{t+2}$ and its height is $\frac{1}{2}\sqrt{t}$, where t is time in seconds and the dimensions are in inches. Find the rate of change of the volume with respect to time.
- Given 50 meters of framing material, construct a window that will let in the most light if the middle of the window is a rectangle and the top and bottom of the window are semi-circles.
- The graph of f consists of the three line segments joining the points $(0,0)$, $(2,-2)$, $(6,2)$, and $(8,3)$. The function F is defined as follows $F = \int_0^x f(t)dt$. Find the total enclosed areas generated by f and the x -axis. Determine the points of inflection of F on the interval $(0,8)$.