

1986 - AB1

1. Let f be the function defined by $f(x) = 7 - 15x + 9x^2 - x^3$ for all real numbers x .

(a) Find the zeros of f .

(b) Write an equation of the line tangent to the graph of f at $x = 2$.

(c) Find the x -coordinates of all points of inflection of f . Justify your answer.

1986 - AB2

2. Let f be the function given by $f(x) = \frac{9x^2 - 36}{x^2 - 9}$.

(a) Describe the symmetry of the graph of f .

(b) Write an equation for each vertical and each horizontal asymptote of f .

(c) Find the intervals on which f is increasing.

(d) Using the results found in parts (a), (b), and (c), sketch the graph of f on the axes below.

1986 - AB3, BC1

3. A particle moves along the x -axis so that at any time $t \geq 1$ its acceleration is given by $a(t) = \frac{1}{t}$.

At time $t = 1$, the velocity of the particle is $v(1) = -2$ and its position is $x(1) = 4$.

(a) Find the velocity $v(t)$ for $t \geq 1$.

(b) Find the position $x(t)$ for $t \geq 1$.

(c) What is the position of the particle when it is farthest to the left?

1986 - AB4

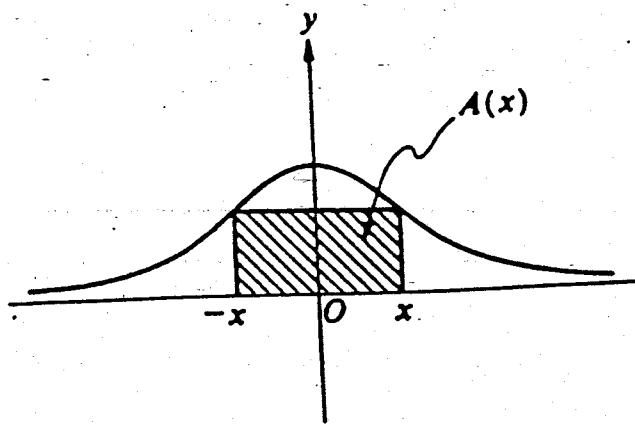
4. Let f be the function defined as follows.

$$f(x) = \begin{cases} |x - 1| + 2, & \text{for } x < 1 \\ ax^2 + bx, & \text{for } x \geq 1, \text{ where } a \text{ and } b \text{ are constants.} \end{cases}$$

(a) If $a = 2$ and $b = 3$, is f continuous for all x ? Justify your answer.

(b) Describe all values of a and b for which f is a continuous function.

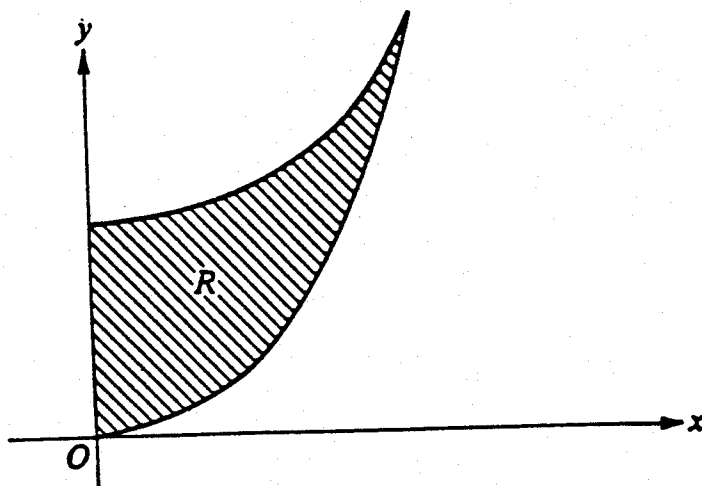
(c) For what values of a and b is f both continuous and differentiable?



1986-AB5, BC2

5. Let $A(x)$ be the area of the rectangle inscribed under the curve $y = e^{-2x^2}$ with vertices at $(-x, 0)$ and $(x, 0)$, $x \geq 0$, as shown in the figure above.

- Find $A(1)$.
- What is the greatest value of $A(x)$? Justify your answer.
- What is the average value of $A(x)$ on the interval $0 \leq x \leq 2$?



1986-AB6, BC3

6. The shaded region R shown in the figure above is enclosed by the graphs of $y = \tan^2 x$, $y = \frac{1}{2} \sec^2 x$, and the y -axis.

- Find the area of region R .
- Set up, but do not integrate, an integral expression in terms of a single variable for the volume of the solid formed by revolving region R about the x -axis.

EXPAND Around $x=3$ $y=2$
 $x=-2$ $y=-6$

1986 - BC 4

4. Given the differential equation $\frac{dy}{dx} = 2y - 5 \sin x$.

(a) Find the general solution.

(b) Find the particular solution whose tangent line at $x = 0$ has slope 7.