

1969 AB2/BC2

A particle moves along the x -axis in such a way that its position at time t is given by $x = 3t^4 - 16t^3 + 24t^2$ for $-5 \leq t \leq 5$.

- (a) Determine the velocity and acceleration of the particle at time t .
- (b) At what values of t is the particle at rest?
- (c) At what values of t does the particle change direction?
- (d) What is the velocity when the acceleration is first zero?

1970 AB4

A right circular cone and a hemisphere have the same base, and the cone is inscribed in the hemisphere. The figure is expanding in such a way that the combined surface area of the hemisphere and its base is increasing at a constant rate of 18 square inches per second. At what rate is the volume of the cone changing at the instant when the radius of the common base is 4 inches? Show your work.

Note: The surface area of a sphere of radius r is $S = 4\pi r^2$ and the volume of a right circular cone of height h and base radius r is $V = \frac{1}{3}\pi r^2 h$.

1971 AB3

Consider $f(x) = \cos^2 x + 2 \cos x$ over one complete period beginning with $x = 0$.

- (a) Find all values of x in this period at which $f(x) = 0$.
- (b) Find all values of x in this period at which the function has a minimum. Justify your answer.
- (c) Over what intervals in this period is the curve concave up?

1971 AB4/BC1

Find the area of the largest rectangle (with sides parallel to the coordinate axes) that can be inscribed in the region enclosed by the graphs of $f(x) = 18 - x^2$ and $g(x) = 2x^2 - 9$.

