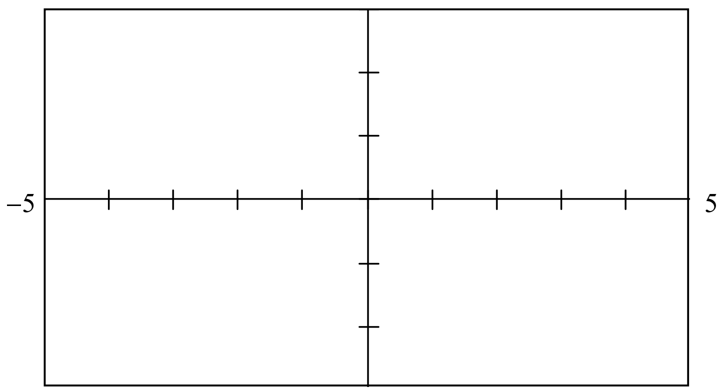
1995 AB1

Let f be the function given by $f(x) = \dfrac{2x}{\sqrt{x^2 + x + 1}}$.

(a) Find the domain of f. Justify your answer.

(b) In the viewing window provided below, sketch the graph of f.



Viewing Window
$[-5, 5] \times [-3, 3]$

(c) Write an equation for each horizontal asymptote of the graph of f.

(d) Find the range of f. Use $f'(x)$ to justify your answer.

<u>Note:</u> $f'(x) = \dfrac{x + 2}{(x^2 + x + 1)^{\frac{3}{2}}}$

1995 AB2

A particle moves along the y-axis so that its velocity at any time $t \geq 0$ is given by $v(t) = t \cos t$. At time $t = 0$, the position of the particle is $y = 3$.

(a) For what values of t, $0 \leq t \leq 5$, is the particle moving upward?

(b) Write an expression for the acceleration of the particle in terms of t.

(c) Write an expression for the position $y(t)$ of the particle.

(d) For $t > 0$, find the position of the particle the first time the velocity of the particle is zero.

1995 AB3

Consider the curve defined by $-8x^2 + 5xy + y^3 = -149$.

(a) Find $\frac{dy}{dx}$.

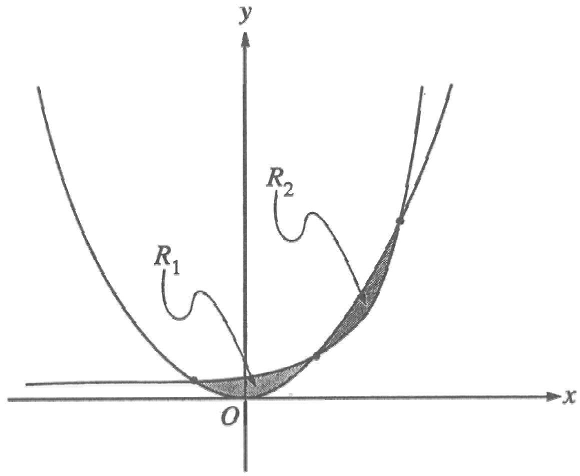
(b) Write an equation for the line tangent to the curve at the point $(4, -1)$.

(c) There is a number k so that the point $(4.2, k)$ is on the curve. Using the tangent line found in part (b), approximate the value of k.

(d) Write an equation that can be solved to find the actual value of k so that the point $(4.2, k)$ is on the curve.

(e) Solve the equation found in part (d) for the value of k.

1995 AB4/BC2



Note: Figure not drawn to scale.

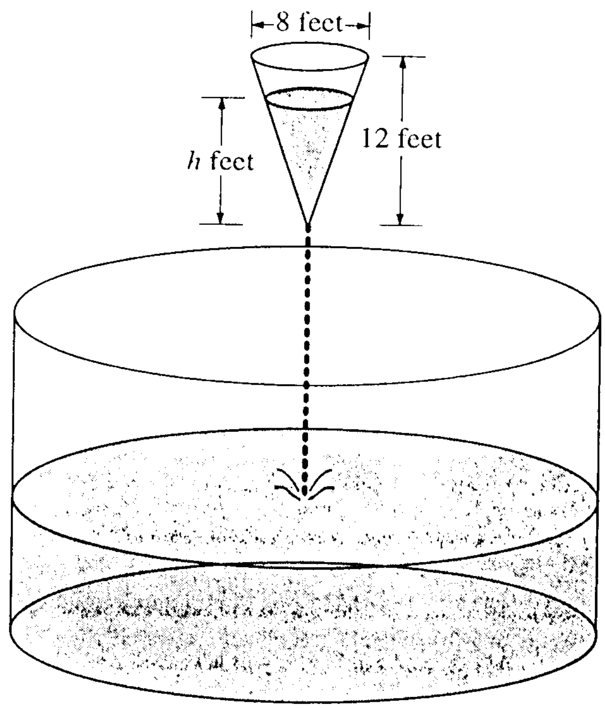
The shaded regions R_1 and R_2 shown above are enclosed by the graphs of $f(x) = x^2$ and $g(x) = 2^x$.

(a) Find the x- and y-coordinates of the three points of intersection of the graphs of f and g.

(b) Without using absolute value, set up an expression involving one or more integrals that gives the total area enclosed by the graphs of f and g. Do not evaluate.

(c) Without using absolute value, set up an expression involving one or more integrals that gives the volume of the solid generated by revolving the region R_1 about the line $y = 5$. Do not evaluate.

1995 AB5/BC3



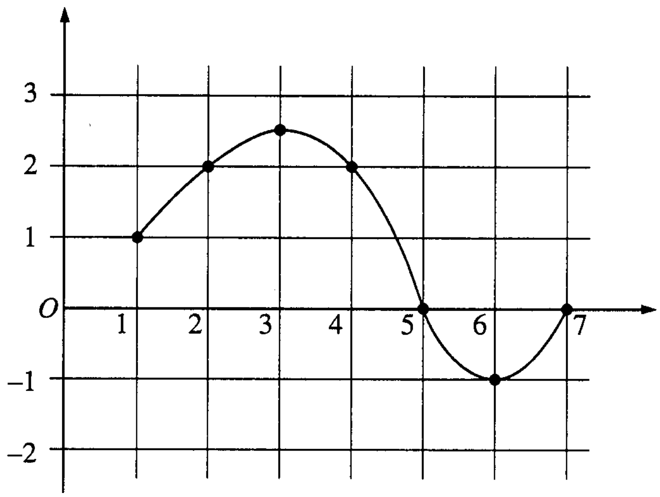
As shown in the figure above, water is draining from a conical tank with height 12 feet and diameter 8 feet into a cylindrical tank that has a base with area 400π square feet. The depth h, in feet, of the water in the conical tank is changing at the rate of $(h-12)$ feet per minute. (The volume V of a cone with radius r and height h is $V = \frac{1}{3}\pi r^2 h$.)

(a) Write an expression for the volume of water in the conical tank as a function of h.

(b) At what rate is the volume of water in the conical tank changing when $h = 3$? Indicate units of measure.

(c) Let y be the depth, in feet, of the water in the cylindrical tank. At what rate is y changing when $h = 3$? Indicate units of measure.

1995 AB6



The graph of a differentiable function f on the closed interval $[1,7]$ is shown above.

Let $h(x) = \int_1^x f(t)\,dt$ for $1 \le x \le 7$.

(a) Find $h(1)$.

(b) Find $h'(4)$.

(c) On what interval or intervals is the graph of h concave upward? Justify your answer.

(d) Find the value of x at which h has its minimum on the closed interval $[1,7]$. Justify your answer.