1981 AB 1 Calculator allowed for PART C ONLY

1. Let f be the function defined by $f(x) = x^4 - 3x^2 + 2$.

(a) Find the zeros of f.
(b) Write an equation of the line tangent to the graph of f at the point where $x = 1$.
(c) Find the x –coordinate of each point at which the line tangent to the graph of f is parallel to the line $y = -2x + 4$.

1981 AB 6—BC 4 Calculator allowed

2. A particle moves along the x-axis so that at time t its position is given by $x(t) = \sin(\pi t^2)$ for $-1 \le t \le 1$.

(a) Find the velocity at time t.
(b) Find the acceleration at time t.
(c) For what values of t does the particle change direction?
(d) Find all values of t for which the particle is moving left.

1990 AB 1 Calculator allowed

3. A particle initially at rest moves along the x-axis so that its acceleration at any time $t \ge 0$ is given by $a(t) = 12t^2 - 4$. The position of the particle when $t = 1$ is $x(1) = 3$.

(a) Find the values of t for which the particle is at rest.
(b) Write an expression for the position $x(t)$ of the particle at any time $t \ge 0$.
(c) Find the total distance traveled by the particle from $t = 0$ to $t = 2$.

1988 AB 5 Calculator allowed

4. Let R be the region in the first quadrant under the graph of $y = \dfrac{x}{x^2+2}$ for $0 \le x \le \sqrt{6}$.

(a) Find the area of R.
(b) If the line $x = k$ divides R into two regions of equal area, what is the value of k?
(c) What is the average value of $y = \dfrac{x}{x^2+2}$ on the interval $0 \le x \le \sqrt{6}$?

1997 AB 3 No Calculator

5. Let f be the function given by $f(x) = \sqrt{x-3}$.

(a) Sketch the graph of f and shade the region R enclosed by the graph of f, the x-axis, and the vertical line $x = 6$.
(b) Find the area of the region R described in part (a).
(c) Rather than using the line $x = 6$ as in part (a), consider the line $x = w$, where w can be any number greater than 3. Let $A(w)$ be the area of the region enclosed by the graph of f, the x-axis, and the vertical line $x = w$. Write an integral expression for $A(w)$.
(d) Let $A(w)$ be described in part (c). Find the rate of change of A with respect to w when $w = 6$.

1991 AB 5

6. Let f be a function that is <u>even</u> and continuous on the closed interval [-3, 3]. The function f and its derivatives have the properties indicated in the table below.

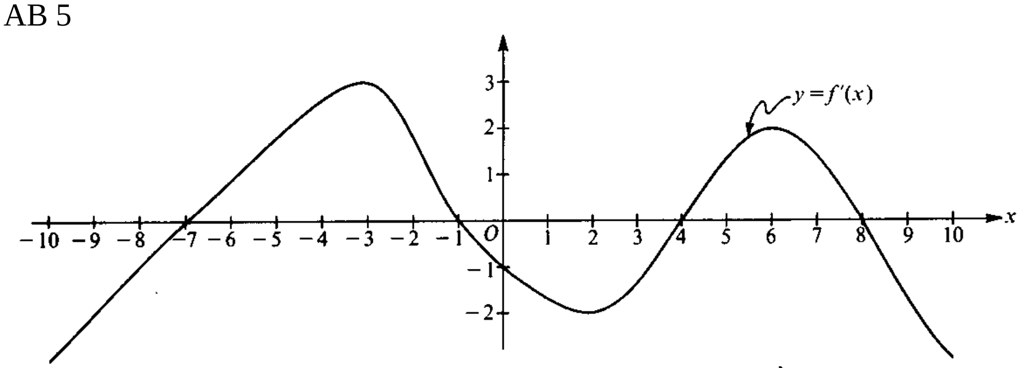
x	0	$0 < x < 1$	1	$1 < x < 2$	2	$2 < x < 3$
$f(x)$	1	Positive	0	Negative	-1	Negative
$f'(x)$	Undefined	Negative	0	Negative	Undefined	Positive
$f''(x)$	Undefined	Positive	0	Negative	Undefined	Negative

(a) Find the x-coordinate of each point at which f attains an absolute maximum value or an absolute minimum value. For each x-coordinate you give, state whether f attains an absolute maximum or an absolute minimum.

(b) Find the x-coordinate of each point of inflection on the graph of f. Justify your answer.

(c) Sketch the graph of a function with all the given characteristics of f.

1989 AB 5



<u>Note:</u> This is the graph of the <u>derivative</u> of f, <u>not</u> the graph of f

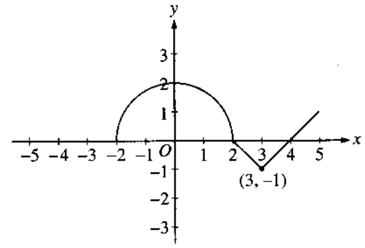
7. The figure above shows the graph of f', the derivative of a function f. The domain of f is the set of all real numbers x such that $-10 \le x \le 10$.

(a) For what values of x does the graph of f have a horizontal tangent?

(b) For what values of x in the interval (-10, 10) does f have a relative maximum? Justify your answer.

(c) For what values of x is the graph of f concave downward? Justify your answer.

1997 AB 5 No Calculator



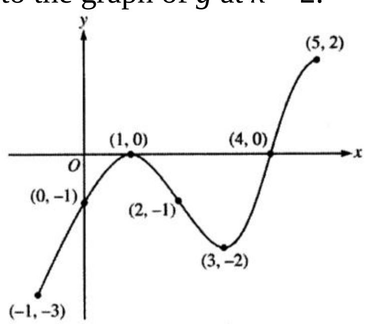
8. The graph of the function f consists of a semicircle and two line segments as shown above. Let g be the function given by $g(x) = \int_0^x f(t)\,dt$.

(a) Find $g(3)$.
(b) Find all values of x on the open interval (-2, 5) at which g has a relative maximum. Justify your answer.
(c) Write an equation for the line tangent to the graph of g at $x = 3$.
(d) Find the x-coordinate of each point of inflection of the graph of g on the open interval (-2, 5). Justify your answer.

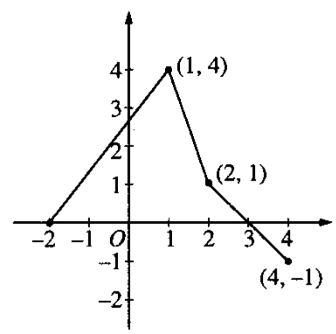
2004 AB 4 (Form B)

9. The figure below shows the graph of f', the derivative of the function f, on the closed interval $-1 \le x \le 5$. The graph of f' has horizontal tangent lines at $x = 1$ and $x = 3$. The function f is twice differentiable with $f(2) = 6$.

(a) Find the x –coordinate of each of the points of inflection of the graph of f. Give a reason for your answer.
(b) At what value of x does f attain its absolute minimum value on the closed interval $-1 \le x \le 5$? At what value of x does f attain its absolute maximum value on the closed interval $-1 \le x \le 5$? Justify your answers.
(c) Let g be the function defined by $g(x) = xf(x)$. Find an equation for the line tangent to the graph of g at $x = 2$.



Graph of f'



1999 AB 5

10. The graph of the function f, consisting of three line segments, is given above. Let $g(x) = \int_1^x f(t)\,dt$.

(a) Compute $g(4)$ and $g(-2)$.
(b) Find the instantaneous rate of change of g, with respect to x at $x = 1$.
(c) Find the absolute minimum value of g on the closed interval [-2, 4]. Justify your answer.
(d) The second derivative of g is not defined at $x = 1$ and $x = 2$. How many of these values are x-coordinates of points of inflection of the graph of g? Justify your answer.