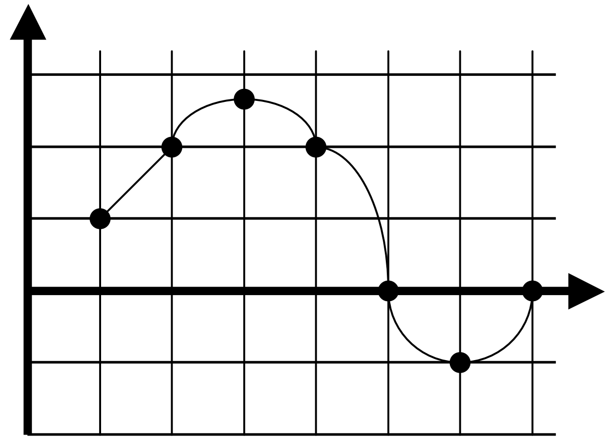
Integral as an accumulator CW



1995 (Calculator)

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

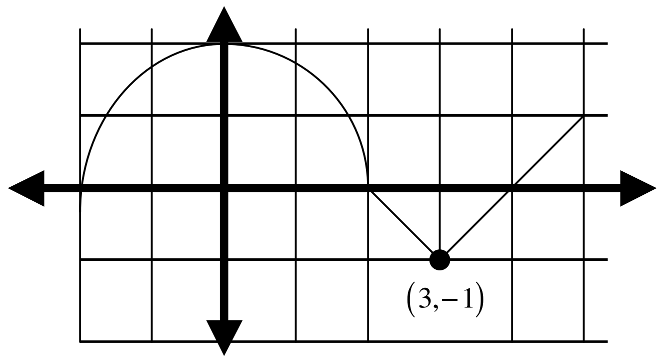
Let $h(x)=\int_1^x f(t)\,dt$ for $1 \le x \le 7$

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.



<u>1997</u> AB - 5, BC - 5

5) The graph of a function f consists of a semicircle and two line segments as shown above.

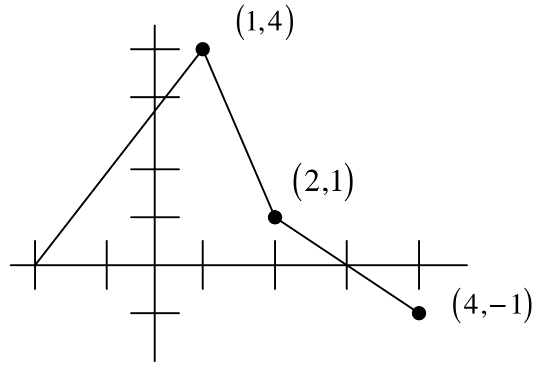
Let g be the function given by $g(x) = \int_0^x f(t)\,dt$.

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.



1999

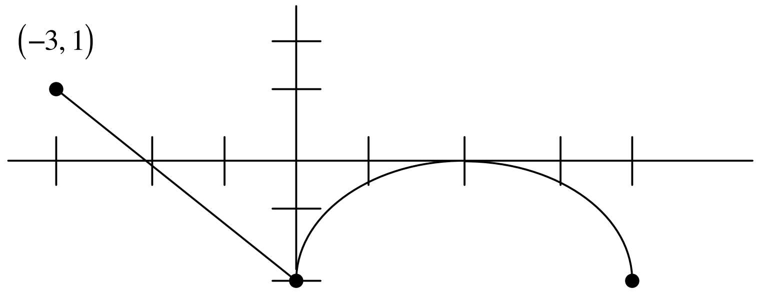
5) The graph of the function f, consisting of three line segments, is given above. Let $g(x)=\int_1^x f(t)\,dt$.

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.



Graph of f'

2003 (No Calculator)

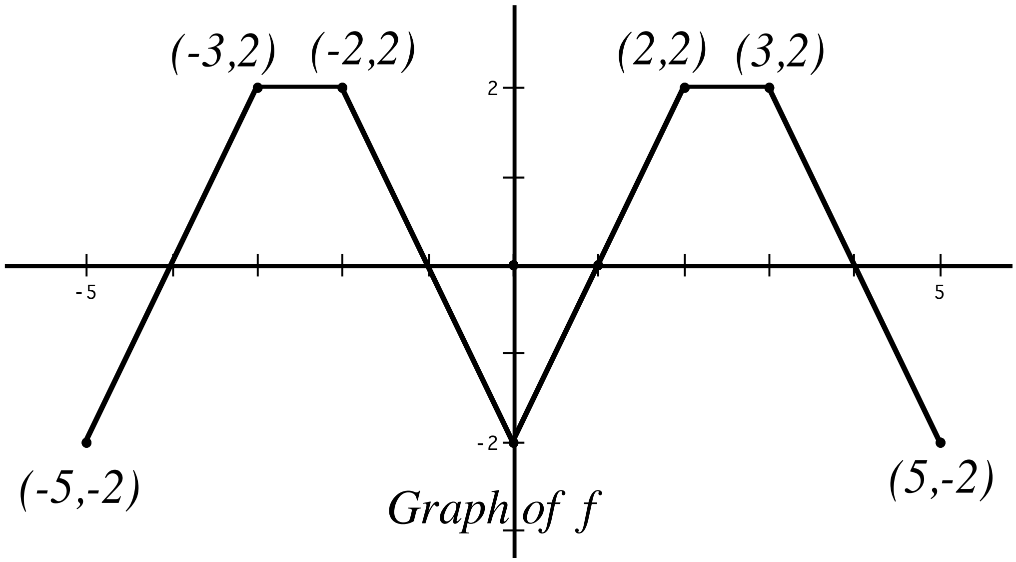
4) Let f be a function defined on the closed interval $-3 \le x \le 4$ with $f(0) = 3$. The graph of f', the derivative of f, consists of one line segment and a semicircle, as shown above.

a) On what intervals, if any, is f increasing? Justify your answer.

b) Find the x-coordinate of each point of inflection of the graph of f on the open interval $-3 < x < 4$. Justify your answer.

c) Find an equation for the line tangent to the graph of f at the point $(0,3)$.

d) Find $f(-3)$ and $f(4)$. Show the work that leads to your answers.



2006 (Calculator)

3) The graph of the function f shown above consists of six line segments. Let g be the function given by $g(x)=\int_{0}^{x} f(t)\,dt$.

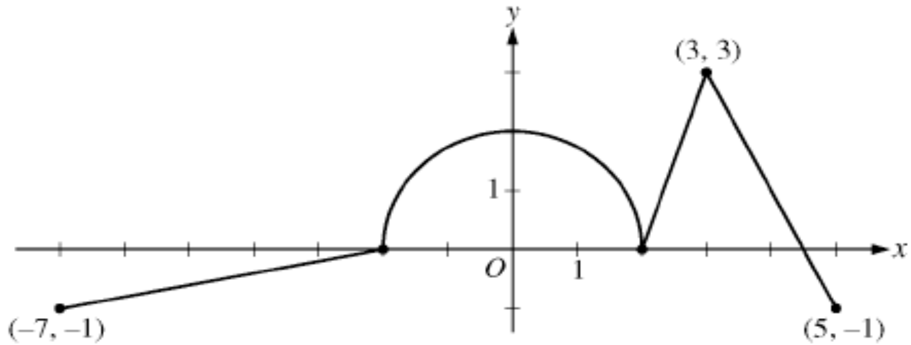
a) Find $g(4)$, $g'(4)$ and $g''(4)$.

b) Does g have a relative minimum, a relative maximum, or neither at $x=1$? Justify your answer.

c) Suppose that f is defined for all real numbers x and is periodic with a period of length 5. The graph above shows two periods of f. Given that $g(5)=2$, find $g(10)$ and write an equation for the line tangent to the graph of g at $x=108$.

2010 (No Calculator)

Question 5



Graph of g'

The function g is defined and differentiable on the closed interval $[-7, 5]$ and satisfies $g(0) = 5$. The graph of $y = g'(x)$, the derivative of g, consists of a semicircle and three line segments, as shown in the figure above.

(a) Find $g(3)$ and $g(-2)$.

(b) Find the x-coordinate of each point of inflection of the graph of $y = g(x)$ on the interval $-7 < x < 5$. Explain your reasoning.

(c) The function h is defined by $h(x) = g(x) - \frac{1}{2}x^2$. Find the x-coordinate of each critical point of h, where $-7 < x < 5$, and classify each critical point as the location of a relative minimum, relative maximum, or neither a minimum nor a maximum. Explain your reasoning.