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Let $f(x)=\begin{cases} x^2-2, x<1 \\ -\frac{1}{2}x+1, x\geq 1 \end{cases}$

Find

(a) $\lim_{x\to 1^+} f(x)$ (b) $\lim_{x\to 1^-} f(x)$ (c) $\lim_{x\to 1} f(x)$

16. Let $y=f(x)$ be the function shown at right. Which of the following statements is false?

(A) $\lim_{x\to 1} f(x)=1$

(B) $\lim_{x\to 2^-} f(x)=2$

(C) $\lim_{x\to 0^+} f(x)=\lim_{x\to 0^-} f(x)$

(D) $\lim_{x\to -1} f(x)=2$

(E) $\lim_{x\to -1^+} f(x)=2$

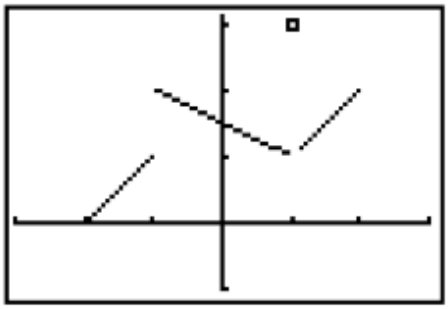

Figure 16

17. The graph of function *f* is shown at right. At which of the following points is *f* continuous?

(A) x = -3
(B) x = -1
(C) x = 1
(D) x= 3
(E) all of the above

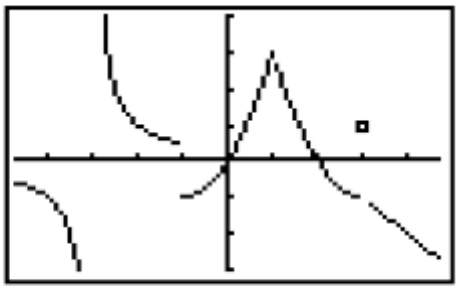

Figure 17

1998 AB 4

Let *f* be a function with *f*(1) = 4 such that for all points (x, y) on the graph of *f* the slope is given by $\frac{3x^2+1}{2y}$

(a) Find the slope of the graph of *f* at the point where x = 1

(b) Write an equation for the line tangent to the graph of *f* at x = 1 and use it to approximate f(1.2)

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1992 AB4

Consider the curve defined by $y + \cos y = x + 1 \qquad 0 \le y \le 2\pi$ for

(a) Find $\frac{dy}{dx}$ in terms of y.

(b) Write an equation for each vertical tangent to the curve.

(c) Find $\frac{d^2y}{dx^2}$ in terms of y.

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6) Given: $f(x) = x^3 - 5x^2 + 3x + 6$. Find the coordinates of all relative extrema. Find the x-coordinates of any points of inflection. Sketch the graph.

7) Given: $y = x^4 - 4x^3$. Find the coordinates of all relative maxima and minima and points of inflection. Discuss the concavity. Find the roots of the function. Sketch the graph.

8) A particle moves along the x-axis according to the law $s = 2t^3 - 9t^2 + 12t - 4$.

a) For what values of t is **s** increasing?
b) For what values of t is the velocity increasing?
c) Find the velocity when t = 3/2.
d) Find the acceleration when t = 2.

9. Let $f(x) = 12x^{2/3} - 4x$. (No calculator)
a) Find the coordinates for all critical points.
b) Determine whether the critical points found in part a) are extrema. Justify your answer.
c) Find the coordinates of all points of inflection.
d) For what values of x is f concave up.
e) Sketch the graph of f.

1. Let f be the function defined by $f(x) = (1 + \tan x)^{3/2}$ for $-\frac{\pi}{4} < x < \frac{\pi}{2}$
   a. Write an equation for the line tangent to the graph of f at the point where x=0
   b. Using the equation found in part (a), approximate f(0.02)

2001 AB6

1. The function f is differentiable for all real numbers. The point (3, ¼) is on the graph of y =f(x), and the slope at each point (x,y) is given by $\frac{dy}{dx} = y^2(6 - 2x)$

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a. Find $\frac{d^2y}{dx^2}$ and evaluate it at the point (3, ¼)

1997 AB4

1. Let f be the function given by $f(x) = x^3 - 6x^2 + 2$, where p is an arbitrary constant.

   a. Write an expression for f'(x) and use it to find the relative maximum and minimum values. Show the analysis that lead to our conclusion.

   b. Determine the concavity of the graph. Justify your answer

   c. Sketch the graph of f, f' and f''

2001 AB4

1. Let h be a function defined for all $x \neq 0$ such that h(4)=-3 and the derivative of h is given by $h'(x) = \frac{x^2 - 2}{x}, x \neq 0$

   a. Find all values of x for which the graph of h has a horizontal tangent and determine whether h has a local maximum, a local minimum, or neither at each of these values. Justify your answer.
   b. On what intervals, if any, is the graph of h concave up? Justify your answer.
   c. Write an equation for the line tangent to the graph of h at x = 4
   d. Does the line tangent to the graph of h at x = 4 lie above or below the graph of h for x>4? Why?

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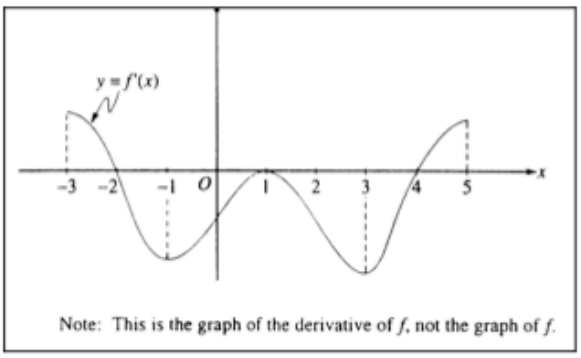
1996 AB1

The figure below shows the graph of f', the derivative of *f*, The domain is the set of all real values of *x* such that $-3 \le x \le 5$.



Note: This is the graph of the derivative of *f*, not the graph of *f*.

96 AB1

a) For what values of *x* does *f* have a relative maximum? Why?
b) For what values of *x* does *f* have a relative minimum? Why?
c) On what intervals is the graph of *f* concave upward? Use f' to justify your answer.
d) Suppose that $f(1) = 0$. Draw a sketch that shows the general shape of the graph of the function *f* on the open interval $0 < x < 2$.

1. A balloon is rising vertically over a point A at the rate of 15ft/sec. A point B on the ground is level with point A and is 30 ft. from A. At what rate is the distance between B and the balloon changing when the balloon is 40 ft high?

1990 AB4

The radius r of a sphere is increasing at a constant rate of 0.04 cm/s (The volume of a sphere is given by $V = \frac{4}{3}\pi r^3$)

a. At the time when radius of the sphere is 10 cm, what is the rate of the increase of its volume?

b. At the time when the volume and the radius of the sphere are increasing at the same numerical rate, what is the radius?

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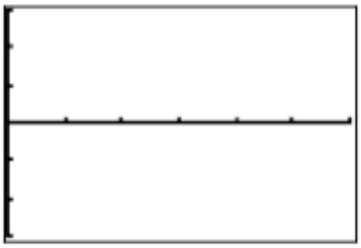
1. Let R be the region enclosed between the graph of $y = -\frac{1}{2}x^2 + 3x - \frac{5}{2}$ *x*-axis on the closed interval [1,5].



[0,6] by [-3,3]

Use the Midpoint Rectangular Approximation method with four rectangles of equal width to estimate the area. Sketch the graph and the rectangles. Indicate coordinates Show your steps.

8) $f(x) = \ln(x^{3/2} + 2x^{3/5} - 4x^{4/7})$

9) $f(x) = \frac{1}{\sqrt[4]{x^2+2x+3}}$

10) $g(x) = \sqrt[3]{\frac{3x+4}{2x+3}}$

11) $F(x) = \arctan(4x + 3)$

12) $f(x) = \sin^3(3x^2)\, e^{-4x}$

13) $f(x) = \cot 3x \sec^4 2x$

14) $\sin(\tan(2x+1))$