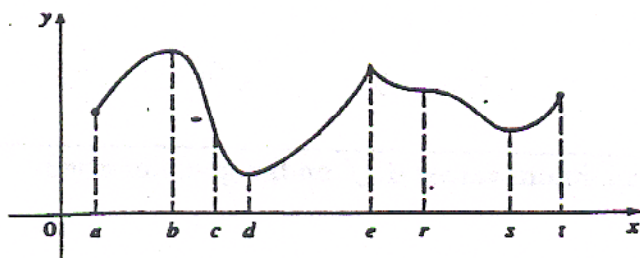


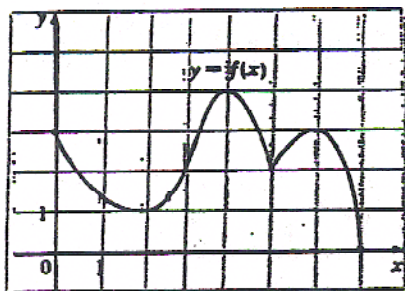
CALCULUS
WORKSHEET ON EXTREMA

Work the following on notebook paper.

1. Explain the difference between an absolute minimum and a local minimum.
2. Suppose f is a continuous function defined on a closed interval $[a, b]$.
 - (a) What theorem guarantees the existence of an absolute maximum value and an absolute minimum value for f ?
 - (b) What steps would you take to find those maximum and minimum values?
3. For each of the numbers $a, b, c, d, e, r, s,$ and t , state whether the function whose graph is shown has an absolute maximum or minimum, a local maximum or minimum, or neither a maximum nor a minimum.



4. Use the graph to state the absolute and local maximum and minimum values of the function.



5. Sketch the graph of a function f that is continuous on $[0, 3]$ and has the given properties: absolute maximum at 0 , absolute minimum at 3 , local minimum at 1 , local maximum at 2
6. (a) Sketch the graph of a function that has a local maximum at 2 and is differentiable at 2 .
(b) Sketch the graph of a function that has a local maximum at 2 and is continuous but not differentiable at 2 .

Find the absolute maximum and minimum points if possible. Sketch a graph for each problem.

7. $f(x) = 8 - 3x, -1 \leq x \leq 4$

8. $f(x) = x^2, 0 < x \leq 2$

9. $f(x) = \frac{1}{x}, 0 < x \leq 2$

10. $f(x) = \begin{cases} 2x & \text{if } 0 \leq x < 1 \\ 2-x & \text{if } 1 \leq x \leq 2 \end{cases}$

Find the critical numbers.

11. $f(x) = 5 + 6x - 2x^3$

12. $f(x) = \frac{x}{x^2 + 4}$

13. $f(x) = |2x + 3|$

14. $f(x) = 5x^{2/3} + x^{5/3}$

15. $f(x) = \sin^2(2x), 0 \leq x < 2\pi$

Find the absolute maximum and absolute minimum values of f on the given interval.

16. $f(x) = x^3 - 3x + 1, [0, 3]$

17. $f(x) = 4x^3 + x^2 - 4x + 1, [-1, 2]$

18. $f(x) = 4x^3 + 7x^2 - 10x + 3, [-2, 1]$

19. $f(x) = \sin x + \cos x, \left[0, \frac{\pi}{3}\right]$

20. $f(x) = x - 2\cos x, [-\pi, \pi]$