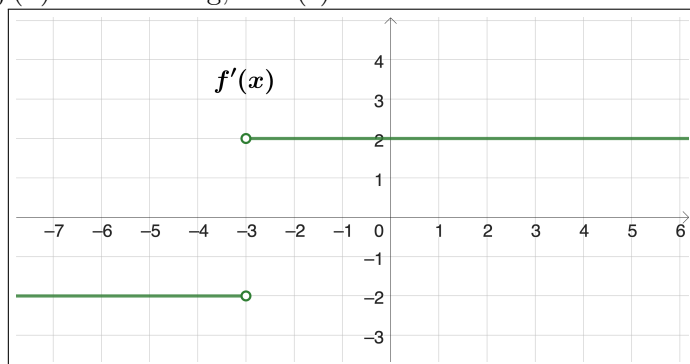




SESSION 6: SECTIONS 2-6 (RELATED RATES) AND 3-1

- (1) Two ships leave the same port at the same time. After one hour, ship A is 3 miles north of port traveling north at 6 miles per hour. Ship B is 4 miles east of port traveling back to port at 7 miles per hour. At what rate is the distance between the two ships decreasing?
- (2) The base of a right triangle is growing at a rate of 3 inches per hour, and its height is shrinking at a rate of 3 inches per hour. When the base of the triangle has a length of 12 inches and the height is 16 inches,
  - (a) how fast is the area of the triangle changing?
  - (b) how fast is the perimeter of the triangle changing?
  - (c) how fast is the length of the triangle's hypotenuse changing?
- (3) The volume  $V$  of a cube with sides length  $x$  inches is changing with respect to time. At a certain instant of time, the sides of the cube are 5 inches long and increasing at a rate of 0.1 inches/second. How fast is the volume of the cube changing at this instant of time?
- (4) A manufacturer determines the relationship between the demand and price for an item is given by  $3x^2 + 3xp + 40p^2 = 160,000$ , where  $x$  is the number of items demanded each month at a price of  $p$  dollars each. If the number of items demanded is decreasing at a rate of 10 items per month, find the rate of change of the price with respect to time when demand is 200 items each month.
- (5) Given  $f'(x) = (x - 4)^2(x - 1)(x + 2)^3(x + 5)$  and that the domain of  $f(x)$  is  $(-\infty, \infty)$ , find all (a) partition numbers, (b) critical values, (c) the intervals where  $f(x)$  is increasing, (d) the intervals where  $f(x)$  is decreasing, and (e) all local extrema.
- (6) Given  $f(x) = x^{2/3} - x^2$ , find all (a) partition numbers, (b) critical values, (c) the intervals where  $f(x)$  is increasing, (d) the intervals where  $f(x)$  is decreasing, and (e) all local extrema.
- (7) Given  $f(x) = \frac{(x - 1)^2}{x + 2}$ , find all (a) partition numbers, (b) critical values, (c) the intervals where  $f(x)$  is increasing, (d) the intervals where  $f(x)$  is decreasing, and (e) all local extrema.
- (8) Given  $g(x) = e^{x^2+2x+1}$ , find all (a) partition numbers, (b) critical values, (c) the intervals where  $f(x)$  is increasing, (d) the intervals where  $f(x)$  is decreasing, and (e) all local extrema.

- (9) Given the graph of  $f'(x)$  below and that the domain of  $f(x)$  is  $(-\infty, \infty)$ , find all (a) partition numbers, (b) critical values, (c) the intervals where  $f(x)$  is increasing, (d) the intervals where  $f(x)$  is decreasing, and (e) all local extrema.



- (10) Given the graph of  $f'(x)$  below and that the domain of  $f(x)$  is  $(-\infty, -3) \cup (-3, \infty)$ , find all (a) partition numbers, (b) critical values, (c) the intervals where  $f(x)$  is increasing, (d) the intervals where  $f(x)$  is decreasing, and (e) all local extrema.

