Sections 2.1-2.2: Tangent Lines & Derivatives

5. If a particle moves at constant velocity, what can you say about its position versus time curve?

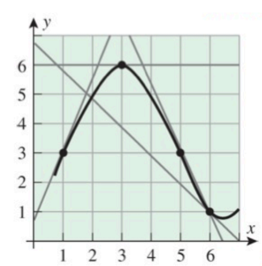
Sketch a curve and a line L satisfying the satisfying the stated condition.
7. L is tangent to the curve and intersects the curve in at least two points.
9. L is tangent to the curve at two different points.

11. For the function $f(x) = 2x^2$ and values of $x_0 = 0$ and $x_1 = 1$
  a. Find the average rate of change of *y* with respect to *x* over the interval $[x_0, x_1]$.
  b. Find the instantaneous rate of change of *y* with respect to *x* at $x_0 = 0$.
  c. Find the instantaneous rate of change of *y* with respect to *x* at an arbitrary x_0.
  d. The average rate of change in part (a) is the slope of a certain secant line, and the instantaneous rate of change in part (b) is the slope of a certain tangent line. Sketch the graph of $y = f(x)$ together with these two lines.

27. During the first 40 sec. of a rocket flight, the rocket is propelled straight up so that in *t* seconds it reaches a height of $s = 0.3t^3$ft.
  a. How high does the rocket travel in 40 sec?
  b. What is the average velocity of the rocket during the first 40 sec?
  c. What is the average velocity of the rocket during the first 1000 ft of its flight?
  d. What is the instantaneous velocity of the rocket at the end of 40 sec?

29. A robot moves in the positive direction along a straight line so that after *t* minutes its distance is $s = 6t^4$ feet from the origin.
  a. Find the average velocity of the robot over the interval [2, 4].
  b. Find the instantaneous velocity at $t = 2$.

1. Use the graph of $y = f(x)$ in the accompanying figure to estimate the values of f'(1), f'(3), f'(5), and f'(6).

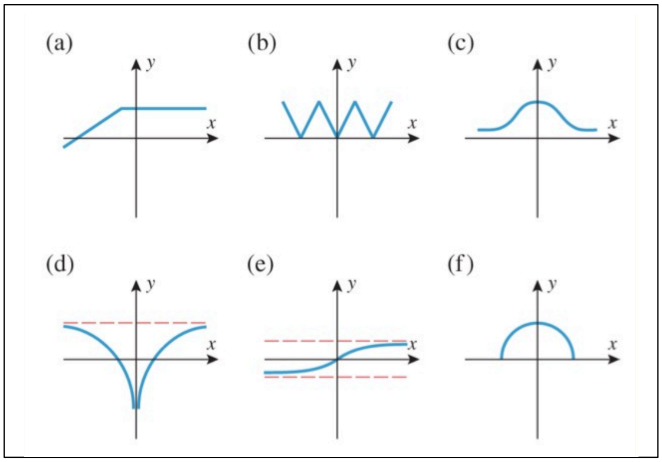


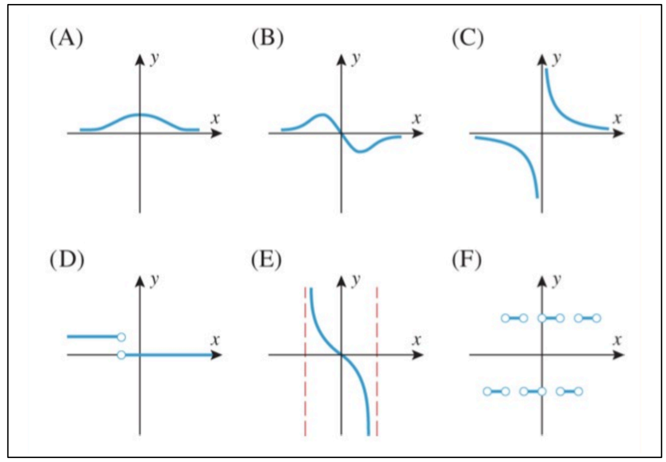
Use the Definition of Derivatives to find f'(x), and then find the tangent line to the graph of y=f(x) at x=a.

9. $f(x) = 2x^2; a = 1$ 10. $f(x) = \frac{1}{x^2}; a = -1$ 11. $f(x) = x^3; a = 0$ 13. $f(x) = \sqrt{x+1}; a = 8$

22. Find $\frac{dV}{dr}$ if $V = \frac{4}{3}\pi r^3$

23. Match the graphs of the functions shown in (a)-(f) with the graphs of their derivatives in (A)-(F).





35. Find an equation for the line that is tangent to the curve $y = x^3 - 2x + 1$ at the point (0, 1), and use a graphing utility to graph the curve and its tangent line on the same screen.

47. Show that $f(x) = \begin{cases} x^2 + 1, & x \leq 1 \\ 2x, & x > 1 \end{cases}$ is continuous and differentiable at $x = 1$. *Justify*.