AP Calculus Worksheet – Average Rates of Change

186. Find a formula for the average rate of change of the area of a circle as its radius r changes from 3 to some number x. Then determine the average rate of change of the area of a circle as the radius r changes from

   a) 3 to 3.5   b) 3 to 3.2   c) 3 to 3.1   d) 3 to 3.01

187. Find a formula for the average rate of change of the volume of a cube as its side length s changes from 2 to some number x. Then determine the average rate of change of the volume of a cube as the side length s changes from

   a) 2 to 3   b) 2 to 2.5   c) 2 to 2.2   d) 2 to 2.1

188. A car is stopped at a traffic light and begins to move forward along a straight road when the light turns green. The distance s, in feet, traveled by a car in t seconds is given by $s(t) = 2t^2$ $(0 \le t \le 30)$. What is the average rate of change of the car from

   a) $t = 0$ to $t = 5$ b) $t = 5$ to $t = 10$ c) $t = 0$ to $t = 10$ d) $t = 10$ to $t = 10.1$

IN THE FOLLOWING SIX PROBLEMS, FIND A FORMULA FOR THE AVERAGE RATE OF CHANGE OF EACH FUNCTION FROM $x = 1$ TO SOME NUMBER $x = c$.

189. $f(x) = x^2 + 2x$ **192.** $g(t) = 2t - 6$
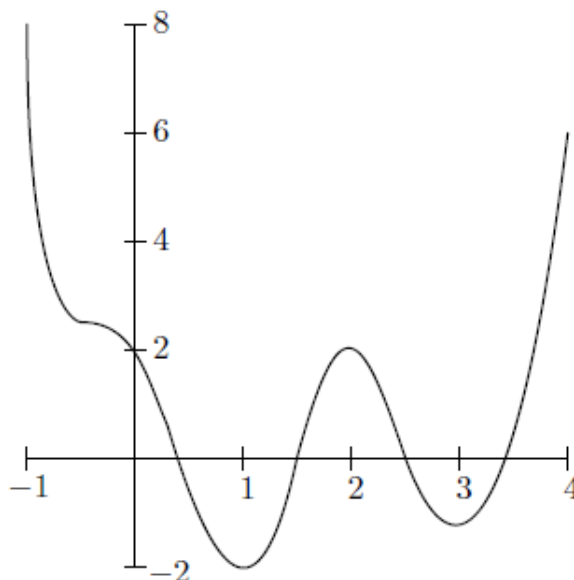
190. $f(x) = \sqrt{x}$ **193.** $p(x) = \dfrac{3}{x}$

191. $f(x) = 2x^2 - 4x$ **194.** $F(x) = -2x^3$

207. The position $p(t)$ is given by the graph at the right.

  a) Find the average velocity of the object between times $t = 1$ and $t = 4$.

  b) Find the equation of the secant line of $p(t)$ between times $t = 1$ and $t = 4$.

  c) For what times t is the object's velocity positive? For what times is it negative?

208. Suppose $f(1) = 2$ and the average rate of change of f between 1 and 5 is 3. Find $f(5)$.

209. The position $p(t)$, in meters, of an object at time t, in seconds, along a line is given by $p(t) = 3t^2 + 1$.

    a) Find the change in position between times $t = 1$ and $t = 3$.

    b) Find the average velocity of the object between times $t = 1$ and $t = 4$.

    c) Find the average velocity of the object between any time t and another time $t + \Delta t$.

210. Let $f(x) = x^2 + x - 2$.

    a) Find the average rate of change of $f(x)$ between times $x = -1$ and $x = 2$.

    b) Draw the graph of f and the graph of the secant line through $(-1, -2)$ and $(2, 4)$.

    c) Find the slope of the secant line graphed in part b) and then find an equation of this secant line.

    d) Find the average rate of change of $f(x)$ between any point x and another point $x + \Delta x$.

FIND THE AVERAGE RATE OF CHANGE OF EACH FUNCTION OVER THE GIVEN INTERVALS.

211. $f(x) = x^3 + 1$ over a) $[2, 3]$; b) $[-1, 1]$

212. $R(x) = \sqrt{4x + 1}$ over a) $[0, \frac{3}{4}]$; b) $[0, 2]$

213. $h(t) = \dfrac{1}{\tan t}$ over a) $[\frac{\pi}{4}, \frac{3\pi}{4}]$; b) $[\frac{\pi}{6}, \frac{\pi}{3}]$

214. $g(t) = 2 + \cos t$ over a) $[0, \pi]$; b) $[-\pi, \pi]$