5.2 10/27/04

Problem 4.

$$f'(x) = \lim_{h\to 0} \frac{f(x+h)-f(x)}{h} = \lim_{h\to 0} \frac{(x+h)^3 - x^3}{h} = \lim_{h\to 0} \frac{3x^2h + 3xh^2 + h^3}{h} = \lim_{h\to 0} 3x^2 + 3xh + h^2 = 3x^2$$

Problem 11.

From problem 2, we have $f'(x) = 2x$. $f'(0) = 2(0) = 0$; $f'(2) = 2(2) = 4$; $f'(-1) = 2(-1) = 2$.

Problem 13.

$f(x) = \frac{x+\pi}{2} = \frac{1}{2}x + \frac{\pi}{2}$. From problem 1, we have $f'(x) = \frac{1}{2}$. $f'(0) = \frac{1}{2}$; $f'(2) = \frac{1}{2}$; $f'(-1) = \frac{1}{2}$.

Problem 17.

(a) The graph of $\sqrt{x-1}$ is an one-unit horizontal shift to the right of the graph of $\sqrt{x}$.

(b) The graph of the derivative of $\sqrt{x-1}$ is an one-unit horizontal shift to the right of the graph of the derivative of $\sqrt{x}$.

(c) The equation holds because the graph of the derivative of $\sqrt{x-1}$ is an one-unit horizontal shift to the right of the graph of the derivative of $\sqrt{x}$.

(d) $$f'(5) = \lim_{x\to 5} \frac{f(x)-f(5)}{x-5} = \lim_{x\to 5} \frac{\sqrt{x-1} - \sqrt{5-1}}{x-5} = \lim_{x\to 5} \frac{(x-1)-4}{(x-5)(\sqrt{x-1}+2)} = \lim_{x\to 5} \frac{1}{\sqrt{x-1}+2} = \frac{1}{4}.$$