Sec 2.2.4
Difference Quotients

*when you calculate a difference quotient you are actually finding a first derivative, the basis for Calculus, and something you will repeat if you take Calculus I/II.

Given $f(x) = 2x^2 - x + 3$

Determine $f(x+h)$

$$2(x+h)^2 - (x+h) + 3$$

$$2(x^2 + 2xh + h^2) - x - h + 3$$

$$2x^2 + 4xh + h^2 - x - h + 3$$

Given $f(x) = 2x^2 - x + 3$

Determine $\dfrac{f(x+h) - f(x)}{h}$

$$\frac{2(x+h)^2-(x+h)+3-(2x^2-x+3)}{h}$$

$$\frac{2(x^2+2xh+h^2)-x-h+3-2x^2+x-3}{h}$$

$$\frac{2x^2+4xh+2h^2-x-h+3-2x^2+x-3}{h}$$

$$= \frac{4xh+2h^2-h}{h} = \frac{h(4x+2h-1)}{h} = 4x+2h-1$$

Given $f(x) = -2x^2 + x + 5$

Determine $\dfrac{f(x+h) - f(x)}{h}$

$$= \frac{-2(x+h)^2 + (x+h) + 5 - (-2x^2 + x + 5)}{h}$$

$$= \frac{-2(x^2 + 2xh + h^2) + x + h + 5 + 2x^2 - x - 5}{h}$$

$$= \frac{-2x^2 - 4xh - 4h^2 + x + h + 5 + 2x^2 - x - 5}{h}$$

$$= \frac{-4xh - 4h^2 + h}{h} = \frac{h(-4x - 4h + 1)}{h}$$

$$= -4x - 4h + 1$$

Suggested Practice

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#'s 61-69, odds

61. $2x+h-4$

63. $4x+2h+1$

65. $-2x-h+2$

67. $-4x-2h+5$

69. $-4x-2h-1$