

Name: _____
PC: More Difference Quotients

Date: _____
Ms. Loughran

Do Now: #1

Find $\frac{f(x+h) - f(x)}{h}$ for each of the following.

1. $f(x) = x^2 - 5x - 1$

$$\frac{(x+h)^2 - 5(x+h) - 1 - (x^2 - 5x - 1)}{h}$$

$$\frac{\cancel{x^2} + 2xh + h^2 - \cancel{5x} - 5h - 1 - \cancel{x^2} + \cancel{5x} + 1}{h}$$

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

$$2x+h-5, h \neq 0$$

2. $f(x) = 3x^2 - 4x$

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

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

$$\frac{\cancel{3x^2} + 6xh + 3h^2 - \cancel{4x} - 4h - \cancel{3x^2} + \cancel{4x}}{h}$$

$$\frac{6xh + 3h^2 - 4h}{h} = \frac{h(6x + 3h - 4)}{h} = 6x + 3h - 4, h \neq 0$$

$$3. f(x) = 2x^2 + 3x - 1$$

$$\frac{2(x+h)^2 + 3(x+h) - 1 - (2x^2 + 3x - 1)}{h}$$

$$\frac{2(x^2 + 2xh + h^2) + 3x + 3h - 1 - 2x^2 - 3x + 1}{h}$$

$$\frac{\cancel{2x^2} + 4xh + 2h^2 + \cancel{3x} + 3h - \cancel{1} - \cancel{2x^2} - \cancel{3x} + \cancel{1}}{h}$$

$$\frac{4xh + 2h^2 + 3h}{h} = \frac{h(4x + 2h + 3)}{h} \quad h \neq 0$$

$$4. f(x) = 3x^2 + x - 5$$

$$\frac{3(x+h)^2 + (x+h) - 5 - (3x^2 + x - 5)}{h}$$

$$\frac{3(x^2 + 2xh + h^2) + x + h - 5 - 3x^2 - x + 5}{h}$$

$$\frac{\cancel{3x^2} + 6xh + 3h^2 + \cancel{x} + h - \cancel{5} - \cancel{3x^2} - \cancel{x} + \cancel{5}}{h}$$

$$\frac{6xh + 3h^2 + h}{h} = \frac{h(6x + 3h + 1)}{h}$$

$$6x + 3h + 1, h \neq 0$$

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

5. $f(x) = x^3 - 4x^2 + 5x$

$$\frac{(x+h)^3 - 4(x+h)^2 + 5(x+h) - (x^3 - 4x^2 + 5x)}{h}$$

$$\frac{x^3 + 3x^2h + 3xh^2 + h^3 - 4(x^2 + 2xh + h^2) + 5x + 5h - x^3 + 4x^2 - 5x}{h}$$

$$\frac{\cancel{x^3} + 3x^2h + 3xh^2 + h^3 - \cancel{4x^2} - 8xh - 4h^2 + \cancel{5x} + 5h - \cancel{x^3} + \cancel{4x^2} - \cancel{5x}}{h}$$

$$\frac{3x^2h + 3xh^2 + h^3 - 8xh - 4h^2 + 5h}{h} = \frac{h(3x^2 + 3xh + h^2 - 8x - 4h + 5)}{h}$$

6. $f(x) = \frac{1}{x}$

$h \neq 0$

$$\frac{\frac{1}{\cancel{x+h}} - \frac{1}{\cancel{x}}}{h(x+h)x}$$

$$\frac{x - (x+h)}{xh(x+h)} = \frac{\cancel{x} - \cancel{x} - h}{xh(x+h)} = \frac{-h}{xh(x+h)}$$

$$\frac{-1}{x(x+h)} \quad \begin{matrix} x \neq -h, 0 \\ h \neq 0 \end{matrix}$$

Homework

Find $\frac{f(x+h)-f(x)}{h}$ for each of the following.

1. $f(x) = 3x + 2$

2. $f(x) = x^2 + 1$

3. $f(x) = x^2 + 3x - 4$

4. $f(x) = 2x^2 - 5x + 3$

5. $f(x) = 3 - 5x + 4x^2$

6. $f(x) = x^3 - 6x^2 + 12x - 8$

Homework 10-10

Name: Key
PreCalculus More Difference Quotient Homework

Date: _____

Find $\frac{f(x+h)-f(x)}{h}$ for each of the following.

1. $f(x) = 4x - 1$

2. $f(x) = 3x^2 - 2x - 7$

3. $f(x) = 2x^3 - 4x^2 - 3x - 2$

$$\textcircled{1} \frac{4(x+h) - 1 - (4x - 1)}{h}$$

$$\frac{\cancel{4x} + 4h - \cancel{4x} + 1 - \cancel{4x} + 1}{h}$$

$$\frac{4h}{h}$$

$$4 \quad h \neq 0$$

$$\textcircled{2} \frac{3(x+h)^2 - 2(x+h) - 7 - (3x^2 - 2x - 7)}{h}$$

$$\frac{\cancel{3x^2} + 6xh + 3h^2 - \cancel{2x} - 2h - 7 - \cancel{3x^2} + \cancel{2x} + 7}{h}$$

$$\frac{6xh + 3h^2 - 2h}{h} = 6x + 3h - 2 \quad h \neq 0$$

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

$$f(x) = 2x^3 - 4x^2 - 3x - 2$$

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

h

$$\frac{\cancel{2x^3} + 6x^2h + 6xh^2 + 2h^3 - \cancel{4x^2} - 8xh - 4h^2 - \cancel{3x} - 3h - \cancel{2} - \cancel{2x^3} + \cancel{4x^2} + \cancel{3x} + \cancel{2}}{h}$$

h

$$\frac{6x^2h + 6xh^2 + 2h^3 - 8xh - 4h^2 - 3h}{h}$$

h

$$6x^2 + 6xh + 2h^2 - 8x - 4h - 3 \quad h \neq 0$$