

## THE DIFFERENCE QUOTIENT

The following is the difference quotient.

**Evaluate:**  $\frac{f(x+h) - f(x)}{h}, \quad h \neq 0$

Here are some basic examples. Perform the function operation indicated.

1) Given:  $f(x) = 5x - 8$

2) Given:  $f(x) = 12$

Evaluate:  $\frac{f(x+h) - f(x)}{h}$ ,  $h \neq 0$

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

4) Given:  $f(x) = \frac{1}{x}$

This is an example of the most difficult question you will face this year.

$$\text{Evaluate: } \frac{f(x+h) - f(x)}{h}, \quad h \neq 0$$

$$\text{Given: } f(x) = 3x^2 - 5x + 2$$

$$= \frac{\left[ 3(x+h)^2 - 5(x+h) + 2 \right] - (3x^2 - 5x + 2)}{h}$$

$$= \frac{\left[ 3(x^2 + 2xh + h^2) - 5x - 5h + 2 \right] - 3x^2 + 5x - 2}{h}$$

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

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

$$= \frac{h(6x - 5 + 3h)}{h}$$

$$= 6x - 5 + 3h, \quad h \neq 0$$

Now we will try another together.

Evaluate:  $\frac{f(x+h) - f(x)}{h}$ ,  $h \neq 0$

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