

Math 115
Practice Problems for Difference Quotient

If $f(x) = 3x^2 - 2x$ ← line 1
then $f(3) = 3!^2 - 2!$



Whatever is in this position becomes the **exact replacement** for x each place it appears in the right side of the $f(x)$ rule on line 1.

1. If $g(x) = x^2 + 3$ with domain of all real numbers, find:

- a. $g(a)$ b. $g(a) + g(b)$ c. $g(x + h)$ d. $\frac{g(x + h) - g(x)}{h}$

2. Let $g(x) = 3x^2 + x - 4$. Find:

- a. $g(-3)$ b. $g(k)$ c. $g(-t^3)$ d. $g(k + 1)$

3. If $f(x) = x^2 - 2x$, then evaluate and simplify:

- a. $f(2)$ b. $f(0)$ c. $f(a + 1)$ d. $\frac{f(x + h) - f(x)}{h}$

4. Let $f(x) = 2x^2 - 3x$. If h represents any nonzero number, then the quotient

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

represents the slope of the line through $(x, f(x))$

and $(x + h, f(x + h))$. This expression is called a difference quotient and is used in calculus to determine the steepness of a curve at a point. Find and simplify the difference quotient.

5. Find $\frac{f(a + h) - f(a)}{h}$ for each of the following functions:

- a. $f(x) = x^2 + 6$ b. $f(x) = 2x^2 + 3x - 4$ c. $f(x) = \frac{1}{x}$