

College of the Redwoods
Mathematics Department
Math 30–College Algebra

The Difference Quotient

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Directions: Place the solution to each of the following exercises on good paper. Show all of your work.

EXERCISE 1. For each of the following questions, simplify the difference quotient

$$\frac{f(x+h) - f(x)}{h}.$$

(a) $f(x) = 2x^2 + 3x$

(b) $f(x) = x^2 + 4x + 5$

(c) $f(x) = \frac{1}{x+2}$

(d) $f(x) = \frac{x}{x-3}$

EXERCISE 2. If $f(x) = \sqrt{x}$, show that

$$\frac{f(x+h) - f(x)}{h} = \frac{1}{\sqrt{x+h} + \sqrt{x}}.$$

EXERCISE 3. For each of the following functions, simplify the difference quotient

$$\frac{f(x) - f(a)}{x - a}.$$

(a) $f(x) = x^2 + 3x$

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

(c) $\frac{1}{x-1}$

(d) $\frac{x+2}{x-1}$

EXERCISE 4. If

$$f(x) = \frac{1}{2\sqrt{x}},$$

show that

$$\frac{f(x) - f(a)}{x - a} = \frac{-1}{2\sqrt{xa}(\sqrt{a} + \sqrt{x})}.$$

Solutions to Exercises

Exercise 1(a) $4x + 2h + 3$

□

Exercise 1(b) $2x + h + 4$

□

Exercise 1(c) $\frac{-1}{(x+h+2)(x+2)}$

□

Exercise 1(d) $\frac{-3}{(x+h-3)(x-3)}$

□

Exercise 2.

Exercise 2

Exercise 3(a) $x + a + 3$

□

Exercise 3(b) $2x + 2a + 2$

□

Exercise 3(c) $\frac{-1}{(x-1)(a-1)}$

□

Exercise 3(d) $\frac{-3}{(x-1)(a-1)}$

□

Exercise 4.