2.2 Exercises

Exercise 2.1

For each of the following functions,

a) $f(x) = 3x + 1$ b) $f(x) = x^2 - x$ c) $f(x) = \sqrt{x^2 - 9}$
d) $f(x) = \frac{1}{x}$ e) $f(x) = \frac{x-5}{x+2}$ f) $f(x) = -x^3$

calculate the function values

i) $f(3)$ ii) $f(5)$ iii) $f(-2)$ iv) $f(0)$ v) $f(\sqrt{13})$
vi) $f(\sqrt{2}+3)$ vii) $f(-x)$ viii) $f(x+2)$ ix) $f(x)+h$ x) $f(x+h)$

Exercise 2.2

Let f be the piecewise defined function

$$f(x) = \begin{cases} x - 5 & \text{, for } -4 < x < 3 \\ x^2 & \text{, for } 3 \leq x \leq 6 \end{cases}$$

a) State the domain of the function.
Find the function values

b) $f(2)$ c) $f(5)$ d) $f(-3)$ e) $f(3)$

Exercise 2.3

Let f be the piecewise defined function

$$f(x) = \begin{cases} |x| - x^2 & \text{, for } x < 2 \\ 7 & \text{, for } 2 \leq x < 5 \\ x^2 - 4x + 1 & \text{, for } 5 < x \end{cases}$$

a) State the domain of the function.
Find the function values

b) $f(1)$ c) $f(-2)$ d) $f(3)$
e) $f(2)$ f) $f(5)$ g) $f(7)$

Exercise 2.4

Find the difference quotient $\frac{f(x+h)-f(x)}{h}$ for the following functions:

a) $f(x) = 5x$
b) $f(x) = 2x - 6$
c) $f(x) = x^2$
d) $f(x) = x^2 + 5x$
e) $f(x) = x^2 - 7$
f) $f(x) = x^2 + 3x + 4$
g) $f(x) = x^2 + 4x - 9$
h) $f(x) = 3x^2 - 2x$
i) $f(x) = 4x^2 + 6x$
j) $f(x) = 2x^2 - 8x - 3$
k) $f(x) = -5x^2 + 3$
l) $f(x) = x^3$

Exercise 2.5

Find the difference quotient $\frac{f(x)-f(a)}{x-a}$ for the following functions:

a) $f(x) = 3x$
b) $f(x) = 4x - 7$
c) $f(x) = x^2 - 3x$
d) $f(x) = x^2 + 4x - 5$
e) $f(x) = 7x^2 + 2x$
f) $f(x) = \frac{1}{x}$

Exercise 2.6

Find the domains of the following functions.

a) $f(x) = x^2 + 3x + 5$
b) $f(x) = |x - 2|$
c) $f(x) = \sqrt{x - 2}$
d) $f(x) = \sqrt{8 - 2x}$
e) $f(x) = \sqrt{|x + 3|}$
f) $f(x) = \frac{1}{x+6}$
g) $f(x) = \frac{x-5}{x-7}$
h) $f(x) = \frac{x+1}{x^2-7x+10}$
i) $f(x) = \frac{x}{|x-2|}$
j) $f(x) = \begin{cases} |x| & \text{for } 1 < x < 2 \\ 2x & \text{for } 3 \leq x \end{cases}$
k) $f(x) = \frac{\sqrt{x}}{x-9}$
l) $f(x) = \frac{5}{\sqrt{x+4}}$