

## Exercises 7                      Quadratic function and equations

### Quadratic function, quadratic equations

#### Objectives

- be able to determine the position of the vertex out of the vertex form of a quadratic function.
- be able to graph a quadratic function out of the vertex form.
- know and understand the relation between a quadratic function and a quadratic equation.
- be able to solve a quadratic equation by applying the quadratic formula.

#### Problems

7.1 Graph the quadratic functions below:

- a)       $f: \mathbb{R} \rightarrow \mathbb{R}$   
          $x \rightarrow y = f(x) = (x + 2)^2$
- b)       $f: \mathbb{R} \rightarrow \mathbb{R}$   
          $x \rightarrow y = f(x) = -3x^2$
- c)       $f: \mathbb{R} \rightarrow \mathbb{R}$   
          $x \rightarrow y = f(x) = 2x^2 - 1$
- d)       $f: \mathbb{R} \rightarrow \mathbb{R}$   
          $x \rightarrow y = f(x) = -(x - 3)^2 + 4$

7.2 Each quadratic equation can be converted into the following general form:

$$ax^2 + bx + c = 0 \quad (a \neq 0) \quad (*)$$

Determine the number of solutions that a quadratic equation can have.

Hints:

- Compare the left hand side of (\*) with the general form of the formula of a quadratic function.
- Think of the graph of a quadratic function.

7.3 Solve the quadratic equations below. State the solution set for each equation.

- |  |                           |
|--|---------------------------|
| a) $x^2 + 10x + 24 = 0$                              | b) $x^2 + 22x + 121 = 0$  |
| c) $x^2 + 2x + 8 = 0$                                | d) $x^2 - 14x + 49 = 0$   |
| e) $2x^2 - 7x + 3 = 0$                               | f) $5x^2 + 8x - 4 = 0$    |
| g) $5x^2 - 8x + 4 = 0$                               | h) $24x^2 - 65x + 44 = 0$ |
| i) $\frac{1}{6}x^2 - \frac{5}{4}x + \frac{3}{2} = 0$ | j) $-9x^2 - 54x - 63 = 0$ |

7.4 Solve the equations below. State the solution set for each equation.

- |   |   |
|---|---|
| a) $9(x - 10) - x(x - 15) = x$                | b) $3(x^2 + 2) - x(x + 9) = 11$                   |
| c) $y^3 + 19 = (y + 4)^3$                     | d) $\frac{9x - 8}{4x + 7} = \frac{3x}{2x + 5}$    |
| e) $\frac{x^2}{x - 6} - \frac{6x}{6 - x} = 1$ | f) $\frac{8}{x^2 - 4} + \frac{2}{2 - x} = 3x - 1$ |

**Answers**

- 7.1 a) vertex  $V(-2|0)$ , parabola opens upwards  
b) vertex  $V(0|0)$ , parabola opens downwards  
c) vertex  $V(0|-1)$ , parabola opens upwards  
d) vertex  $V(3|4)$ , parabola opens downwards

7.2 ...

- 7.3 a)  $S = \{-6, -4\}$   
b)  $S = \{-11\}$   
c)  $S = \{ \}$   
d)  $S = \{7\}$   
e)  $S = \left\{ \frac{1}{2}, 3 \right\}$   
f)  $S = \left\{ -2, \frac{2}{5} \right\}$   
g)  $S = \{ \}$   
h)  $S = \left\{ \frac{4}{3}, \frac{11}{8} \right\}$   
i)  $S = \left\{ \frac{3}{2}, 6 \right\}$   
j)  $S = \{-3 - \sqrt{2}, -3 + \sqrt{2}\}$

- 7.4 a)  $S = \{5, 18\}$   
b)  $S = \{5, -1/2\}$   
c)  $S = \{-3/2, -5/2\}$   
d)  $S = \{2, -10/3\}$   
e)  $S = \{-2, -3\}$   
f)  $S = \left\{ -\frac{5}{3}, 0 \right\}$