

## Computational Approach to School Mathematics



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Abstract—This book provides a collection of the international maths olympiad problems in algebra.

1. For what real values of x is

$$\sqrt{(x+\sqrt{2x-1})} + \sqrt{(x-\sqrt{2x-1})} = A$$
 (1.1)

given

- a)  $A = \sqrt{2}$ ,
- b) A = 1,
- c) A = 2

where only non-negative real numbers are admitted for square roots?

2. Let a, b, c be real numbers. Consider the quadratic equation in  $\cos x$ :

$$a\cos^2 x + b\cos x + c = 0.$$
 (2.1)

Using the numbers a, b, c, form a quadratic equation in  $\cos 2x$ , whose roots are the same as those of the original equation. Compare the equations in  $\cos x$  and  $\cos 2x$  for a = 4, b = 2, c = -1.

3. Find all real roots of the equation

$$\sqrt{x^2 - p} + 2\sqrt{x^2 - 1} = x \tag{3.1}$$

where p is a real parameter.

4. Find all solutions  $x_1, x_2, x_3, x_4, x_5$  of the system

$$x_5 + x_2 = yx_1 \tag{4.1}$$

$$x_1 + x_3 = yx_2 \tag{4.2}$$

$$x_2 + x_4 = yx_3 \tag{4.3}$$

$$x_3 + x_5 = yx_4 \tag{4.4}$$

$$x_4 + x_1 = yx_5 \tag{4.5}$$

where y is a parameter.

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