Quadratic Equations through Baudhayana Sulbasutra

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***Abstract*—This manual uses the Baudhayana sulbasutra to introduce quadratic equations and verify the solution by measuring the sides of a right angled triangle.**

Problem 1. Given that ΔABC in Fig. 1, right angled, use the Baudhayana Sulbasutra

$$AC^2 = AB^2 + BC^2 \tag{1.1}$$

to obtain a quadratic equation in x.

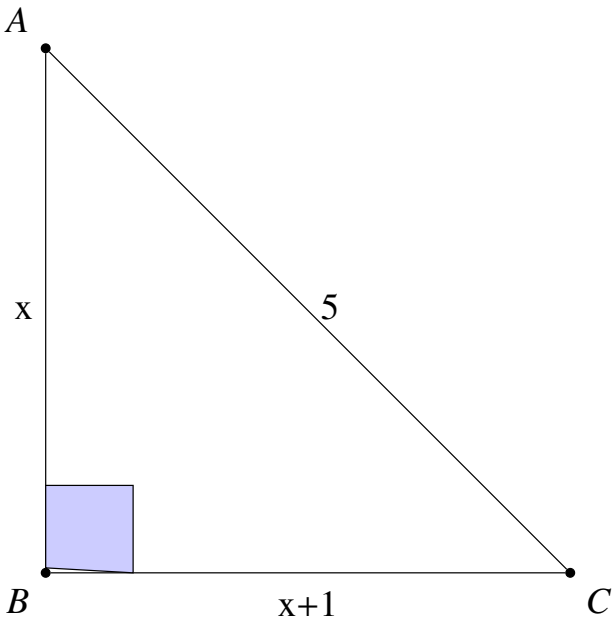

Fig. 1: Right angled triangle.

Solution: From (1.1) and Fig. 1,

$$x^2 + (x+1)^2 = 5^2 \tag{1.2}$$
$$\implies 2x^2 + 2x - 24 = 0 \tag{1.3}$$
$$\implies x^2 + x - 12 = 0 \tag{1.4}$$

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Problem 2. The possible solutions to the quadratic equation

$$ax^2 + bx + c = 0 \tag{2.1}$$

are

$$x = \frac{-b + \sqrt{b^2 - ac}}{2a} \text{ and } \quad x = \frac{-b - \sqrt{b^2 - ac}}{2a} \tag{2.2}$$

Use this to find the solution to (1.4).

Solution: Using (2.2), the possible solutions to (1.4) are

$$x = \frac{-1 + \sqrt{49}}{2} = 3 \text{ and} \tag{2.3}$$
$$x = \frac{-1 - \sqrt{49}}{2} = -4 \tag{2.4}$$

Since x is the side of a triangle, $x > 0$. Hence, $x = 3$.

Problem 3. Verify your solution by drawing the right angled triangle with sides $x, x+1$ and 5, where $x = 3$.

Problem 4. Repeat the above exercises by considering the sides to be $x, 2x + 1$ and 5. Verify your result by drawing the right angled triangle.