



# MATHS

## NCERT - NCERT MATHS (GUJARATI ENGLISH)

### QUADRATIC EQUATIONS

#### Example

1. Represent the following situations with suitable mathematical equations.

The hypotenuse of a right triangle is 25 cm. We know that the difference in lengths of the other two sides is 5 cm. We would like to find out the length of the two sides?



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2. Check whether the following are quadratic equation:

$$(x - 2)^2 + 1 = 2x - 3$$



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3. Check whether the following are quadratic equation:

$$x(x + 1) + 8 = (x + 2)(x - 2)$$



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4. Check whether the following are quadratic equation:

$$x(2x + 3) = x^2 + 1$$



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5. Check whether the following are quadratic equation:

$$(x + 2)^3 = x^3 - 4$$



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6. Find the roots of the equation  $2x^2 - 5x + 3 = 0$ , by factorisation.



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7. Find the roots of the equation

$$x - \frac{1}{3x} = \frac{1}{6} (x \neq 0)$$



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8. Find the width of the space for spectators discussed in section 5.1.



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9. Find the roots of the equation  $5x^2 - 6x - 2 = 0$  by the method of completing the square.



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10. Find the roots of  $4x^2 + 3x + 5 = 0$  by the method of completing the square.



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**11.** Find two consecutive positive odd integers, sum of whose squares is 290.



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**12.** A rectangular park is to be designed whose breadth is 3 m less than its length. Its area is to be 4 square metres more than the area of a park that has already been made in the shape of an isosceles triangle with its base as the

breadth of the rectangular park and of altitude 12 m. Find its length and breadth.



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**13.** Find the real roots of the following quadratic equations, if they exist.

$$x^2 + 4x + 5 = 0$$



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**14.** Find the roots of the following quadratic equations, if they exist.

$$2x^2 - 2\sqrt{2}x + 1 = 0$$



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**15.** Find the roots of the equation

$$x + \frac{1}{x} = 3, x \neq 0$$



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**16.** Find the roots of the equation

$$\frac{1}{x} - \frac{1}{x-2} = 3, x \neq 0, 2$$



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**17.** A motor boat whose speed is 18 km/h in still water. It takes 1 hour more to go 24 km upstream than to return downstream to the same spot. Find the speed of the stream.



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**18.** Find the discriminant of the quadratic equation  $2x^2 - 4x + 3 = 0$ , and hence find the nature of its roots.



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**19.** A pole has to be erected at a point on the boundary of a circular park of diameter 13 metres in such a way that the differences of its distances from two diametrically opposite fixed gates A and B on the boundary is 7 metres. Is it possible to do so? If yes, at what

distances from the two gates should the pole be erected?



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**20.** Find the discriminant of the equation

$$3x^2 - 2x + \frac{1}{3} = 0 \text{ and hence find the nature}$$

of its roots. Find them, if they are real.



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**Try This**

1. Check whether the equations are quadratic or not?

$$x^2 - 6x - 4 = 0$$



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2. Check whether the equations are quadratic or not?

$$x^3 - 6x^2 + 2x - 1 = 0$$



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3. Check whether the equations are quadratic or not?

$$7x = 2x^2$$



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4. Check whether the equations are quadratic or not?

$$x^2 + \frac{1}{x^2} = 2(x \neq 0)$$



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5. Check whether the equations are quadratic or not?

$$(2x + 1)(3x + 1) = b(x - 1)(x - 2)$$



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6. Check whether the equations are quadratic or not?

$$3y^2 = 192$$



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7. Verify whether 1 and  $\frac{3}{2}$  are the roots of the equation  $2x^2 - 5x + 3 = 0$



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8. Explain the benefits of evaluating the discriminant of a quadratic equation before attempting to solve it. What does its value signify?



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9. Write three quadratic equations, one having two distinct real solutions, one having no real solution and one having exactly one real solution.



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**Do This**

1. Find the roots of the equation using factorisation method.

$$x^2 + 5x + 6 = 0$$



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2. Find the roots of the equation using factorisation method.

$$x^2 - 5x + 6 = 0$$



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3. Find the roots of the equation using factorisation method.

$$x^2 + 5x - 6 = 0$$



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4. Find the roots of the equation using factorisation method.

$$x^2 - 5x - 6 = 0$$



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5. Solve the equations by completing the square

$$x^2 - 10x + 9 = 0$$



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6. Solve the equations by completing the square

$$x^2 - 5x + 5 = 0$$



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7. Solve the equations by completing the square

$$x^2 + 7x - 6 = 0$$



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## Exercise 5 1

1. Chek whether the following are quadratic equation:

$$(x + 1)^2 = 2(x - 3)$$



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2. Chek whether the following are quadratic equation:

$$x^2 - 2x = (-2)(3 - x)$$



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3. Check whether the following are quadratic equations:

$$(x - 2)(x + 1) = (x - 1)(x + 3)$$



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4. Check whether the following are quadratic equations:

$$(x - 3)(2x + 1) = x(x + 5)$$



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5. Chek whether the following are quadratic equation:

$$(2x - 1)(x - 3) = (x + 5)(x - 1)$$



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6. Chek whether the following are quadratic equation:

$$x^2 + 3x + 1 = (x - 2)^2$$



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7. Chek whether the following are quadratic equation:

$$(x + 2)^3 = 2x(x^2 - 1)$$



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8. Chek whether the following are quadratic equation:

$$x^3 - 4x^2 - x + 1 = (x - 2)^3$$



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**9.** Represent the following situations in the form of quadratic equation:

The area of a rectangular plot is  $528 \text{ m}^2$ . The length of the plot is one metre more than twice its breadth. We need to find the length and breadth of the plot.



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**10.** Represent the following situations in the form of quadratic equation:

The product of two consecutive positive integers is 306. We need to find the integers.



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**11.** Represent the following situations in the form of quadratic equation:

Rohan's mother is 26 years older than him. The product of their ages after 3 years will be 360 years. We need to find Rohan's present age



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**12.** Represent the following situations in the form of quadratic equation:

A train travels a distance of 480 km at a uniform speed. If the speed had been 8 km/h less, then it would have taken 3 hours more to cover the same distance. We need to find the speed of the train



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**Exercise 5 2**

1. Find the roots of the quadratic equations by factorisation:

$$x^2 - 3x - 10 = 0$$



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2. Find the roots of the quadratic equations by factorisation:

$$2x^2 + x - 6 = 0$$



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3. Find the roots of the quadratic equations by factorisation:

$$\sqrt{2}x^2 + 7x + 5\sqrt{2} = 0$$



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4. Find the roots of the quadratic equations by factorisation:

$$2x^2 - x + \frac{1}{8} = 0$$



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5. Find the roots of the quadratic equations by factorisation:

$$100x^2 - 20x + 1 = 0$$



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6. Find the roots of the quadratic equations by factorisation:

$$x(x + 4) = 12$$



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7. Find the roots of the quadratic equations by factorisation:

$$3x^2 - 5x + 2 = 0$$



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8. Find the roots of the quadratic equations by factorisation:

$$x - \frac{3}{x} = 2(x \neq 0)$$



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**9.** Find the roots of the quadratic equations by factorisation:

$$3(x - 4)^2 - 5(x - 4) = 12$$



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**10.** Find two numbers whose sum is 27 and product is 182.



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**11.** Find two consecutive positive integers, sum of whose squares is 613.



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**12.** The altitude of a right triangle is 7 cm less than its base. If the hypotenuse is 13 cm, find the other two sides.



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**13.** A cottage industry produces a certain number of pottery articles in a day. It was observed on a particular day that the cost of production of each article (in rupees) was 3 more than twice the number of articles produced on that day. If the total cost of production on that day was Rs 90, find the number of articles produced and the cost of each article.



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**14.** Find the dimensions of a rectangle whose perimeter is 28 meters and whose area is 40 square meters.



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**15.** The base of a triangle is 4cm longer than its altitude. If the area of the triangle is 48 sq.cm then find its base and altitude.



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**16.** Two trains leave a railway station at the same time. The first train travels towards west and the second train towards north. The first train travels 5 km/hr faster than the second train. If after two hours they are 50 km. apart, find the average speed of each train.



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**17.** In a class of 60 students, each boy contributed rupees equal to the number of

girls and each girl contributed rupees equal to the number of boys. If the total money then collected was D1600. How many boys were there in the class?



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**18.** A motor boat heads upstream a distance of 24 km in a river whose current is running at 3 km per hour. The trip up and back takes 6 hours. Assuming that the motor boat

maintained a constant speed, what was its speed in still water?



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### Exercise 5 3

1. Find the roots of the following quadratic equations, if they exist.

$$2x^2 + x - 4 = 0$$



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2. Find the roots of the following quadratic equations, if they exist.

$$4x^2 + 4\sqrt{3}x + 3 = 0$$



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3. Find the roots of the following quadratic equations, if they exist.

$$5x^2 - 7x - 6 = 0$$



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4. Find the roots of the following quadratic equations, if they exist.

$$x^2 + 5 = -6x$$



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5. Find the roots of the following equations:

$$x - \frac{1}{x} = 3, x \neq 0$$



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6. Find the roots of the following equations:

$$\frac{1}{x+4} - \frac{1}{x-7} = \frac{11}{30}, x \neq -4, 7$$



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7. The sum of the reciprocals of Rehman's ages, (in years) 3 years ago and 5 years from now is  $\frac{1}{3}$ . Find his present age.



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**8.** In a class test, the sum of Moulika's marks in Mathematics and English is 30. If she got 2 marks more in Mathematics and 3 marks less in English, the product of her marks would have been 210. Find her marks in the two subjects.



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**9.** The diagonal of a rectangular field is 60 metres more than the shorter side. If the

longer side is 30 metres more than the shorter side, find the sides of the field.



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**10.** The difference of squares of two numbers is 180. The square of the smaller number is 8 times the larger number. Find the two numbers



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**11.** A train travels 360 km at a uniform speed. If the speed had been 5 km/h more, it would have taken 1 hour less for the same journey. Find the speed of the train.



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**12.** Two water taps together can fill a tank in  $9\frac{3}{8}$  hours. The tap of larger diameter takes 10 hours less than the smaller one to fill the tank

separately. Find the time in which each tap can separately fill the tank.



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**13.** An express train takes 1 hour less than a passenger train to travel 132 km between Mysore and Bangaluru (without taking into consideration the time they stop at intermediate stations). If the average speed of the express train is 11km/h more than that of

the passenger train, find the average speed of the two trains.



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**14.** Sum of the areas of two squares is  $468 \text{ m}^2$ .  
If the difference of their perimeters is 24 m,  
find the sides of the two squares.



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**15.** An object is thrown upwards with an initial velocity of 17 m/sec from a building with 12 m height. It is at a height of  $S = 12 + 17t - 5t^2$  from the ground after a flight of 't' seconds. Find the time taken by the object to touch the ground.



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**16.** If a polygon of 'n' sides has  $\frac{1}{2}n(n - 3)$  diagonals. How many sides are there in a

polygon with 65 diagonals? Is there a polygon with 50 diagonals?



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## Exercise 5 4

1. Find the nature of the roots of the quadratic equations. If real roots exist, find them

$$2x^2 - 3x + 5 = 0$$



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2. Find the nature of the roots of the quadratic equations. If real roots exist, find them

$$3x^2 - 4\sqrt{3}x + 4 = 0$$



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3. Find the nature of the roots of the quadratic equations. If real roots exist, find them

$$2x^2 - 6x + 3 = 0$$



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4. Find the values of  $k$  for each of the quadratic equations, so that they have two equal roots.

$$2x^2 + kx + 3 = 0$$



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5. Find the values of  $k$  for each of the quadratic equations, so that they have two

equal roots.

$$kx(x - 2) + 6 = 0 (k \neq 0)$$



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**6.** Is it possible to design a rectangular mango grove whose length is twice its breadth, and the area is  $800 \text{ m}^2$ ? If so, find its length and breadth.



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7. The sum of the ages of two friends is 20 years. Four years ago, the product of their ages in years was 48. Is the above situation possible? If so, determine their present ages.



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8. Is it possible to design a rectangular park of perimeter 80 m and area  $400 \text{ m}^2$ ? If so, find its length and breadth. Comment on your answer.



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## Optional Exercise

1. Some points are plotted on a plane such that any three of them are non collinear. Each point is joined with all remaining points by line segments. Find the number of points if the number of line segments are 10.



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2. A two digit number is such that the product of its digits is 8. When 18 is added to the number they interchange their places. Determine the number



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3. A piece of wire 8 m. in length is cut into two pieces, and each piece is bent into a square. Where should the cut in the wire be made if

the sum of the areas of these squares is to be  $2m^2$ ?



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4. Vinay and Praveen working together can paint the exterior of a house in 6 days. Vinay by himself can complete the job in 5 days less than Praveen. How long will it take Vinay to complete the job.



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5. Show that the sum of roots of a quadratic equation  $ax^2 + bx + c = 0 (a \neq 0)$  is  $\frac{-b}{a}$ .



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6. Show that the product of the roots of a quadratic equation  $ax^2 + bx + c = 0 (a \neq 0)$  is  $\frac{c}{a}$ .



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7. If the sum of the fraction and its reciprocal is  $2\frac{16}{21}$ , find the fraction.



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