Previous Year Questions 2024

Q1: In flight of 2800 km, an aircraft was slowed down due to bad weather. Its average speed is reduced by 100km/h and by doing so, the time of flight is increased by 30 minutes. Find the original duration of the flight. (CBSE 2024)

Ans:

Let the speed of aircraft be x km/hr.

Time taken to cover 2800 km by speed of x km/hr = 2800/x hrs.

New speed is (x – 100) km/hr

so time taken to cover 2800 km at the speed of

$(x-100)$ km/hr $= \frac{2800}{x-100}$ hrs

ATQ $\frac{2800}{x-100} - \frac{2800}{x} = \frac{1}{2}$

$\Rightarrow 2800\left(\frac{x-x+100}{x(x-100)}\right) = \frac{1}{2}$

$\Rightarrow \frac{100}{x^2-100x} = \frac{1}{2\times 2800}$

$\Rightarrow 560000 = x^2 - 100x$

$\Rightarrow x^2 - 100x - 560000 = 0$

$\Rightarrow x^2 - 800x + 700x - 560000 = 0$

$\Rightarrow x(x - 800) + 700(x - 800) = 0$

$\Rightarrow (x - 800)(x + 700) = 0$

$\Rightarrow x = 800, -700$ (Neglect)

$\Rightarrow x = 800$

Speed = 800 km/hr

Time = 2800/800

= 3 hr 30 min.

Q2: The denominator of a fraction is one more than twice the numerator. If the sum of the fraction and its reciprocal is $2\frac{16}{21}$, find the fraction. (CBSE 2024)

Ans: Let the numerator be x.

Denominator = 2x + 1

Fraction $= \frac{x}{2x+1}$

ATQ, $\frac{x}{2x+1} + \frac{2x+1}{x} = 2\frac{16}{21}$

Let, $y = \frac{x}{2x+1}$

Then, the equation will be.

$y + \frac{1}{y} = \frac{58}{21}$

$\Rightarrow \frac{y^2+1}{y} = \frac{58}{21}$

$\Rightarrow 21y^2 + 21 = 58y$

$\Rightarrow 21y^2 - 58y + 21 = 0$

$\Rightarrow 21y^2 - 49y - 9y + 21 = 0$

$\Rightarrow 7y(3y - 7) - 3(3y - 7) = 0$

$\Rightarrow (3y - 7)(7y - 3) = 0$

$y = \frac{7}{3}, \frac{3}{7}$

∴ Required fraction will be 7/3 and 3/7.

Previous Year Questions 2023

Q3: Find the sum and product of the roots of the quadratic equation $2x^2 - 9x + 4 = 0$. (CBSE 2023)

Ans: Let α and β be the roots of given quadratic equation $2x^2 - 9x + 4 = 0$.

Sum of roots = α + β = -b/a = (-9)/2 = 9/2

and Product of roots, αβ = c/a = 4/2 = 2

Q4: Find the value of p, for which one root of the quadratic equation $px^2 - 14x + 8 = 0$ is 6 times the other. (CBSE 2023)

Ans: Let the first root be α, then the second root will be 6a

Sum of roots = -b/a

$\Rightarrow a + 6a = 14/p$

$\Rightarrow 7a = 14/p$

$\Rightarrow a = 2/p$

Product of roots = c/a

$\Rightarrow a \times 6a = 8/p$

$\Rightarrow 6a^2 = 8/p$

$$\Rightarrow 6\left(\frac{2}{p}\right)^2 = \frac{8}{p}$$

$$\Rightarrow 6 \times \frac{4}{p^2} = \frac{8}{p}$$

$\Rightarrow p = 6 \times 4/8$

$\Rightarrow p = 3$

Hence, the value of p is 3.

Q5: The least positive value of k for which the quadratic equation $2x^2 + kx + 4 = 0$ has rational roots, is (2023)

(a) ±2√2

(b) 4√2

(c) ±2

(d) √2

Ans: (c)

Sol: Put k = 2,

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

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

$\Rightarrow 2x(x + 2) - 2(x + 2) = 0$

$\Rightarrow x = 1, -2$

Put k = -2,

$\Rightarrow 2x^2 - 2x - 4 = 0$

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

$\Rightarrow 2x(x - 2) + 2(x - 2) = 0$

$\Rightarrow x = -1, 2$

Hence, to get the rational values of x, that is, to get rational roots, k must be ±2.

Q6: Find the discriminant of the quadratic equation $4x^2 - 5 = 0$ and hence comment on the nature of roots of the equation. (CBSE 2023)

Ans: Given quadratic equation is $4x^2 - 5 = 0$

Discriminant, $D = b^2 - 4ac = 0^2 - 4(4)(-5) = 80 > 0$

Hence, the roots of the given quadratic equation are real and distinct.

Q7: Find the value of 'p' for which the quadratic equation px(x - 2) + 6 = 0 has two equal real roots. (2023)

Ans: The given quadratic equation is $px(x - 2) + 6 = 0$

$\Rightarrow px^2 - 2xp + 6 = 0$

On comparing with $ax^2 + bx + c = 0$, we get

$a = p$, $b = -2p$ and $c = 6$

Since, the quadratic equations has two equal real roots.

$\therefore$ Discriminant D = 0

$\Rightarrow b^2 - 4ac = 0$

$\Rightarrow (-2p)^2 - 4 \times p \times 6 = 0$

$\Rightarrow 4p^2 - 24p = 0$

$\Rightarrow p^2 - 6p = 0$

$\Rightarrow p(p - 6) = 0$

$\Rightarrow p = 0$ or $p = 6$

But $p \neq 0$ as it does not satisfy equation

Hence, the value of p is 6.

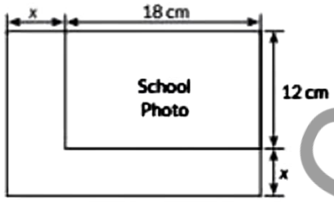
Q8: Case Study : While designing the school year book, a teacher asked the student that the length and width of a particular photo is increased by n units each to double the area of the photo. The original photo is 18 cm long and 12 cm wide.

Based on the above information. answer the following Questions:

(i) Write an algebraic equation depicting the above information.

(ii) Write the corresponding quadratic equation in standard form.

(iii) What should be the new dimensions of the enlarged photo?



OR

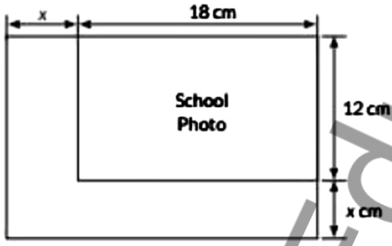
Can any rational value of x make the new area equal to 220 cm^2 ? (2023)

Ans: Area = 18 x 12 cm = 216 cm^2

Length (l) is increased by x cm

So, new length =(18 + x) cm

New width = (12 + x) cm



(i) Area of photo after increasing the length and width

= (18 + x)(12 + x) = 2 x 18 x 12

i.e., (18 + x) (12 + x) = 432 is the required algebraic equation.

(ii) From part (i) we get, (18 + x) (12 + x) = 432

$\Rightarrow$ 216 + 18x + 12x + x^2 = 432

$\Rightarrow$ x^2 + 30x - 216 = 0

(iii) x^2 + 30x - 216 = 0

$\Rightarrow$ x^2+ 36x - 6x - 216 = 0

$\Rightarrow$ x(x+ 36) - 6 (x+ 36) = 0 $\Rightarrow$ x = 6, -36

-36 is not possible.

So, new length = (18 + 6) cm = 24 cm

New width = (12 + 6) cm = 18cm

So. new dimension = 24cm x 18 cm

OR

According to question (18 + x) (12 + x) = 220

$\Rightarrow$ 216 + 30x + x^2 = 220

$\Rightarrow$ $x^2 + 30x + 216 - 220 = 0$

$\Rightarrow$ $x^2 + 30x - 4 = 0$

For rational value of x. discriminant (D) must be perfect square.

So, $D = b^2 - 4ac$

$= (30)^2 - 4(1)(-4) = 900 + 16 = 916$

$\therefore$ 916 is not a perfect square.

So, no rational value of x is possible.

Q9: The roots of the equation $x^2 + 3x - 10 = 0$ are:

(a) 2, −5

(b) −2, 5

(c) 2, 5

(d) −2, −5 (CBSE 2023)

Ans: (a)

To find the roots of the quadratic equation $x^2 + 3x - 10 = 0$, we can use the quadratic formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

For the equation $x^2 + 3x - 10 = 0$:

a = 1

b = 3

c = −1

Substitute these values into the formula:

$$x = \frac{-3 \pm \sqrt{(3)^2 - 4 \cdot 1 \cdot (-10)}}{2 \cdot 1}$$

$$x = \frac{-3 \pm \sqrt{9 + 40}}{2}$$

$$x = \frac{-3 \pm \sqrt{49}}{2}$$

$$x = \frac{-3 \pm 7}{2}$$

Now, calculate the two roots:

(i) For x = 3 + 7 / 2 = 4/2 = 2

(ii) For x = -3 - 7/2 = -10/2 = -5

The roots of the equation are 2 and -5.

So, the correct answer is: (a) 2,−5

Previous Year Questions 2022

Q10: If the sum of the roots of the quadratic equation $ky^2 - 11y + (k - 23) = 0$ is 13/21 more than the product of the roots, then find the value of k. (2022)

Ans: Given, quadratic equation is $ky^2 - 11y + (k - 23) = 0$

Let the roots of the above quadratic equation be α and β.

Now, Sum of roots, $\alpha + \beta = -(-11)/k = 11/k$ ...(i)

and Product of roots, $\alpha\beta = k-23/k$ ...(ii)

According to the question,

$\alpha + \beta = \alpha\beta + 13/21$

$\therefore \frac{11}{k} = \frac{k-23}{k} + \frac{13}{21}$ ...[From equations (i) and (ii)]

$\Rightarrow \frac{11}{k} - \frac{(k-23)}{k} = \frac{13}{21}$

$\Rightarrow \frac{11-k+23}{k} = \frac{13}{21}$

$\Rightarrow 21(34 - k) = 13k$

$\Rightarrow 714 - 21k = 13k$

$\Rightarrow 714 = 13k + 21k$

$\Rightarrow 34k = 714$

$\Rightarrow k = 714/34$

$\Rightarrow k = 21$

Q11: Solve the following quadratic equation for x: $x^2 - 2ax - (4b^2 - a^2) = 0$

Ans: $x^2 - 2ax - (4b^2 - a^2) = 0$

$\Rightarrow x^2 + (2b - a)x - (2b + a)x - (4b^2 - a^2) = 0$

$\Rightarrow x(x + 2b - a) - (2b + a)(x + 2b - a) = 0$

$\Rightarrow (x + 2b - a)(x - 2b - a) = 0$

$\Rightarrow (x + 2b - a) = 0, (x - 2b - a) = 0$

$\therefore x = a - 2b, a + 2b$

Q12: In the picture given below, one can see a rectangular in-ground swimming pool installed by a family In their backyard. There is a concrete sidewalk around the pool of width x m. The outside edges of the sidewalk measure 7 m and 12 m. The area of the pool is 36 sq. m.

Based on the information given above, form a quadratic equation in terms of x Find the width of the sidewalk around the pool. (2022)

Ans: Given, width of the sidewalk = x m.

Area of the pool = 36 sq.m

∴ Inner length of the pool

= (12 - 2x)m

Inner width of the pool = (7 - 2x)m

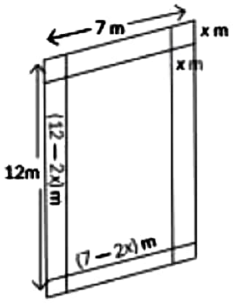
∴ Area of the pool. A = l x b

$\Rightarrow$ 36 = (12 - 2x) x (7 - 2x)

$\Rightarrow$ 36 = 84 - 24x - 14x + $4x^2$

$\Rightarrow$ $4x^2$ - 38x + 48 = 0

$\Rightarrow$ $2x^2$ - 19x + 24 = 0, is the required quadratic equation.



Area of the pool given by quadratic equation is $2x^2$ - 19x + 24 = 0

$\Rightarrow$ $2x^2$ - 16x - 3x + 24 = 0

$\Rightarrow$ 2x(x - 8) - 3(x - 8) = 0

$\Rightarrow$ (x - 8)(2x - 3) = 0

$\Rightarrow$ x = 8 (not possible) or x = 3/2 = 1.5

Width of the sidewalk =1.5m

Q13: The sum of two numbers is 34. If 3 Is subtracted from one number and 2 is added to another. the product of these two numbers becomes 260. Find the numbers. (2022)

Ans: Let one number be x and another number be y.

Since, x + y = 34 $\Rightarrow$ y = 34 - x (i)

Now. according to the question. (x - 3) (y + 2) = 260 (ii)

Putting the value or y from (i) in (ii), we get

$\Rightarrow$ (x - 3)(34 - x + 2) = 260

$\Rightarrow$ (x - 3)(36 - x) = 260

$\Rightarrow$ 36x -x^2 - 108 + 3x = 260

$\Rightarrow$ x^2 - 39x +368 = 0

$\Rightarrow$ $4x^2$- 23x - 16x + 368 = 0

$\Rightarrow$ x(x - 23) - 16(x - 23) = 0

$\Rightarrow$ x(x - 23) - 16(x - 23) = 0

$\Rightarrow$ (x - 23)(x - 16) =0

$\Rightarrow$ x = 23 or 16

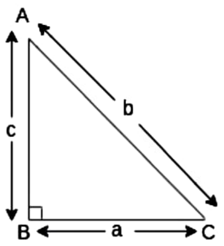
Hence; when x = 23 from (i), y = 3+ - 23 = 11

When x = 16. then y = 34 - 16 = 18

Hence the required numbers are 23 and 11 or 16 and 18.

Q14: The hypotenuse (in cm) of a right angled triangle is 6 cm more than twice the length of the shortest side. If the length of third side is 6 cm less than thrice the length of shortest side, then find the dimensions of the triangle. (2022)

Ans:



Let ΔABC be the right angle triangle, right angled at B, as shown in the figure.

Also, let AB = c cm, BC = a cm and AC = b cm

Then, according to the given information, we have

b = 6 + 2a .....(i) (Let a be the shortest side)

and c = 3a – 6 ...(ii)

We know that, $b^2 = c^2 + a^2$

$\Rightarrow (6 + 2a)^2 = (3a – 6)^2 + a^2$ ...[Using (i) and (ii)]

$\Rightarrow 36 + 4a^2 + 24a = 9a^2 + 36 – 36a + a^2$

$\Rightarrow 60a = 6a^2$

$\Rightarrow$ 6a = 60 ...[∵ a cannot be zero]

$\Rightarrow$ a = 10 cm

Now, from equation (i),

b = 6 + 2 × 10 = 26

and from equation (ii),

c = 3 × 10 – 6 = 24

Thus, the dimensions of the triangle are 10 cm, 24 cm and 26 cm.

Q15: Solve the quadratic equation: $x^2 – 2ax + (a^2 – b^2) = 0$ for x. (2022)

Ans: We have, $x^2 – 2ax + (a^2 – b^2) = 0$

$\Rightarrow x^2 – ((a + b) + (a – b))x + (a^2 – b^2) = 0$

$\Rightarrow x^2 – (a + b)x – (a – b)x + (a + b)(a – b) = 0$ ......[∵ $a^2 – b^2 = (a + b)(a – b)$]

$\Rightarrow$ x(x – (a + b)) – (a – b)(x – (a + b)) = 0

$\Rightarrow$ (x – (a + b))(x – (a – b) = 0

Q16: Find the value of m for which the quadratic equation $(m - 1)x^2 + 2(m - 1)x + 1 = 0$ has two real and equal roots. (2022)

Ans: We have

$(m - 1)x^2 + 2(m - 1)x + 1 = 0$ ----(i)

On comparing the given equation with $ax^2 + bx + c = 0$,

we have $a = (m - 1)$, $b = 2(m - 1)$, $c = 1$

Discriminant, $D = 0$

$\Rightarrow b^2 - 4ac = 0 \Rightarrow 4m^2 + 4 - 8m - 4m + 4 = 0$

$\Rightarrow 4m^2 - 12m + 8 = 0$

$\Rightarrow m^2 - 3m + 2 = 0 \Rightarrow m^2 - 2m - m + 2 = 0$

$\Rightarrow m(m - 2) - 1(m - 2) = 0$

$\Rightarrow (m - 1)(m - 2) = 0 \Rightarrow m = 1, 2$

Q17: The quadratic equation $(1 + a^2)x^2 + 2abx + (b^2 - c^2) = 0$ has only one root. What is the value of $c^2(1 + a^2)$? (2022)

Ans: $(1 + a^2)x^2 + 2abx + (b^2 - c^2) = 0$

Comparing on $Ax^2 + Bx + C = 0$

$A = 1 + a^2$, $B = 2ab$ & $C = (b^2 - c^2)$

Now, $B^2 - 4AC = 0$

$\Rightarrow (2ab)^2 - 4 \times (1 + a^2) \times (b^2 - c^2) = 0$

$\Rightarrow 4a^2b^2 - 4(b^2 - c^2 + a^2b^2 - a^2c^2) = 0$

$\Rightarrow 4a^2b^2 - 4b^2 + 4c^2 - 4a^2b^2 + 4a^2c^2 = 0$

$\Rightarrow -b^2 + c^2 + a^2c^2 = 0$

$\Rightarrow c^2 + a^2c^2 = b^2$

$\therefore$ **$c^2(1 + a^2) = b^2$**

Previous Year Questions 2021

Q18: Write the quadratic equation in x whose roots are 2 and-5. (2021)

Ans: Roots of quadratic equation are given as 2 and - 5.

Sum of roots = 2 + (-5) = -3

Product of roots = 2 (-5) = -10

Quadratic equation can he written as

x^2 - (sum of roots)x + Product of roots = 0

$\Rightarrow x^2 + 3x - 10 = 0$

Previous Year Questions 2020

Q19: Sum of the areas of two squares is 544 m^2. If the difference of their perimeters is 32 m, find the sides of the two squares. (2020)

Ans: Let the sides of the two squares be x m and y m, where ; x > y.

Then, their areas are x^2 and y^2 and their perimeters are 4x and 4y respectively.

By the given condition, $x^2 + y^2 = 544$ --------(i)

and $4x - 4y = 32$

$\Rightarrow x - y = 8$

$\Rightarrow x = y + 8$ ------------ (ii)

Substituting the value of x from (ii) in (i) we get

$\Rightarrow (y + 8)^2 + y^2 = 544$

$\Rightarrow y^2 + 64 + 16y + y^2 = 544$

$\Rightarrow 2y^2 + 16y - 480 = 0$

$\Rightarrow y^2 + 8y - 240 = 0$

$\Rightarrow y^2 + 20y - 12y - 240 = 0$

$\Rightarrow y(y + 20) - 12(y + 20) = 0$

$\Rightarrow (y - 12)(y + 20) = 0$

$\Rightarrow y = 12$ ($\because y \neq 20$ as length cannot be negative)

From (ii), x = 12 + 8 = 20 Thus, the sides of the two squares are 20 m and 12 m.

Q20: A motorboat whose speed is 18 km/h in still water takes 1 hour more to go 24 km upstream than to return downstream to the same spot. Find the speed of the stream. (2020)

Ans:

Speed of boat = 18 km/hr
Distance = 24 km

Let x be the speed of the stream.
Let t_1 and t_2 be the time for upstream and downstream.

As we know that,

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} \implies \text{Time} = \frac{\text{Distance}}{\text{Speed}}$$

For upstream:

$$\text{Speed} = (18 - x)\,\text{km/hr} \text{Distance} = 24\,\text{km} \text{Time} = t_1$$

$$t_1 = \frac{24}{18 - x}$$

For downstream:

$$\text{Speed} = (18+x)\ \text{km/hr}\text{Distance} = 24\ \text{km}\text{Time} = t_2$$

$$t_2 = \frac{24}{18+x}$$

Now according to the question:

$$t_1 = t_2 + 1$$

Substitute the values:

$$\frac{24}{18-x} = \frac{24}{18+x} + 1$$

Simplify:

$$\frac{1}{18-x} - \frac{1}{18+x} = \frac{1}{24}$$

Combine the fractions:

$$\frac{(18+x)-(18-x)}{(18-x)(18+x)} = \frac{1}{24}$$

$$\frac{2x}{(18-x)(18+x)} = \frac{1}{24}$$

Cross-multiply:

$$48x = (18-x)(18+x)$$

Expand:

$$48x = 324 + 18x - 18x - x^2$$

$$x^2 + 48x - 324 = 0$$

Rearrange:

$$x^2 + 54x - 6x - 324 = 0$$

$$x(x+54) - 6(x+54) = 0$$

$$(x+54)(x-6) = 0$$

Solve for x:

$$x = -54 \text{ or } x = 6$$

Since speed cannot be negative:

$$x = 6$$

Q21: The value(s) of k for which the quadratic equation $2x^2 + kx + 2 = 0$ has equal roots, is

(a) 4

(b) ± 4

(c) - 4

(d) 0 (2020, 1 Mark)

Ans: (b)

Given Quadratic equation is $2x^2 + kx + 2 = 0$

Since, the equation has equal roots.

$\therefore$ Discriminant = 0

$\Rightarrow k^2 - 4 \times 2 \times 2 = 0$

$\Rightarrow k^2 - 16 = 0$

$\Rightarrow k^2 = 16$

$\Rightarrow k = \pm 4$

Q22: Solve for x: $\frac{1}{x+4} - \frac{1}{x-7} = \frac{11}{30}, x \neq -4, 7.$ (CBSE 2020)

Ans: Given, $\frac{1}{x+4} - \frac{1}{x-7} = \frac{11}{30}$

$$\Rightarrow \frac{x-7-x-4}{(x+4)(x-7)} = \frac{11}{30}$$

$$\Rightarrow \frac{-11}{(x+4)(x-7)} = \frac{11}{30}$$

$$\Rightarrow \frac{-1}{(x+4)(x-7)} = \frac{1}{30}$$

$\Rightarrow (x + 4)(x - 7) = -30$

$\Rightarrow (x + 4)(x - 7) + 30 = 0$

$\Rightarrow x^2 + 4x - 7x - 28 + 30 = 0$

$\Rightarrow x^2 - 3x - 28 + 30 = 0$

$\Rightarrow x^2 - 3x + 2 = 0$

$\Rightarrow x^2 - 2x - x + 2 = 0$

$\Rightarrow x(x - 2) - 1(x - 2) = 0$

$\Rightarrow (x - 2)(x - 1) = 0$

i.e., $x - 1 = 0$ or $x - 2 = 0$

$\Rightarrow x = 1$ or 2

Q23: A train covers a distance of 480 km at a uniform speed. If the speed had been 8 km/h less, it would have taken 3 hours more to cover the same distance. Find the original speed of the train. (CBSE 2020)

Ans: Let the original speed of the train be x km/h. Then, time taken to cover the journey of 480 km = 480 / x hours

Time taken to cover the journey of 480 km with speed of (x – 8) km/h = 480 / x – 8 hours

Now, according to question,

$$\frac{480}{x-8} - \frac{480}{x} = 3$$

$$\Rightarrow 480\left[\frac{x-x+8}{x(x-8)}\right] = 3$$

$\Rightarrow 3x(x - 8) = 3840$

$\Rightarrow 3x(x - 8) = 3840$

$\Rightarrow x(x - 8) = 1280$

$\Rightarrow x^2 - 8x - 1280 = 0$

$\Rightarrow x^2 - 40x + 32x - 1280 = 0$

$\Rightarrow x(x - 40) + 32(x - 40) = 0$

$\Rightarrow (x + 32)(x - 40) = 0$

$\Rightarrow x + 32 = 0$ or $x - 40 = 0$ Q

$\therefore x = -32$ (not possible)

$\therefore x = 40$ Thus, the original speed of the train is 40 km/h.

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Previous Year Questions 2019

Q24: Find the value of k for which x = 2 is a solution of the equation $kx^2 + 2x - 3 = 0$. (CBSE 2019)

Ans: Since x = 2 is a solution of $kx^2 + 2x - 3 = 0$

$k(2)^2 + 2(2) - 3 = 0$

$= 4k + 4 - 3 = 0$

$\Rightarrow k = -1/4$

Q25: Sum of the areas of two squares is 157 m^2. If the sum of their perimeters is 68 m, find the sides of the two squares. (CBSE 2020)

Ans: Let the length of the side of one square be x m and the length of the side of another square be y m.

Given, $x^2 + y^2 = 157$ _(i)

and $4x + 4y = 68$ _(ii)

$x + y = 17$

$y = 17 - x$ _(iii)

On putting the value of y in (i), we get

$x^2 + (17 - x)^2 = 157$

$\Rightarrow x^2 + 289 + x^2 - 34x = 157$

$\Rightarrow 2x^2 - 34x + 132 = 0$

$\Rightarrow x^2 - 17x + 66 = 0$

$\Rightarrow x^2 - 11x - 6x + 66 = 0$

$\Rightarrow x(x - 11) - 6(x - 11) = 0$

$\Rightarrow (x - 11)(x - 6) = 0$

$\Rightarrow x = 6$ or $x = 11$