No. 47

QUADRATIC EQUATIONS

- **Word Problem on Marks Scored**

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

Sol : Sum of Shefali's marks in Mathematics and English is 30

Let Shefali's marks in Mathematics be x

$\therefore$ Marks in English = (30 – x)

New marks obtained in Mathematics = $\boxed{(x + 2)}$

New marks obtained in English = 30 – x – 3

= $\boxed{(27 – x)}$

According to the given condition,

(x + 2)(27 – x) = 210

$\therefore$ x (27 – x) + 2 (27 – x) = 210

$\therefore$ 27x – x^2 + 54 – 2x = 210

$\therefore$ – x^2 + 27x – 2x + 54 – 21

$\therefore$ – x^2 + 25x – 156 = 0

$\therefore$ 1x^2 – 25x + 156 = 0

Calculation

2	156
2	78
3	39
13	13

156 = 0

(x – 13)

(x - 13) = 0

What

Do we k

marks in Mathematics

x – 12 = 0

156

– 13 – 12

Find two factors of 156 in such a way that by

Multiplying throughout by – 1

sign is '+'

sign only

both factors.

156 × 1 = 156

= 12

x + Englis

No

or x = 12

$\therefore$ English = 30 - x

30 - 13

17

= 18

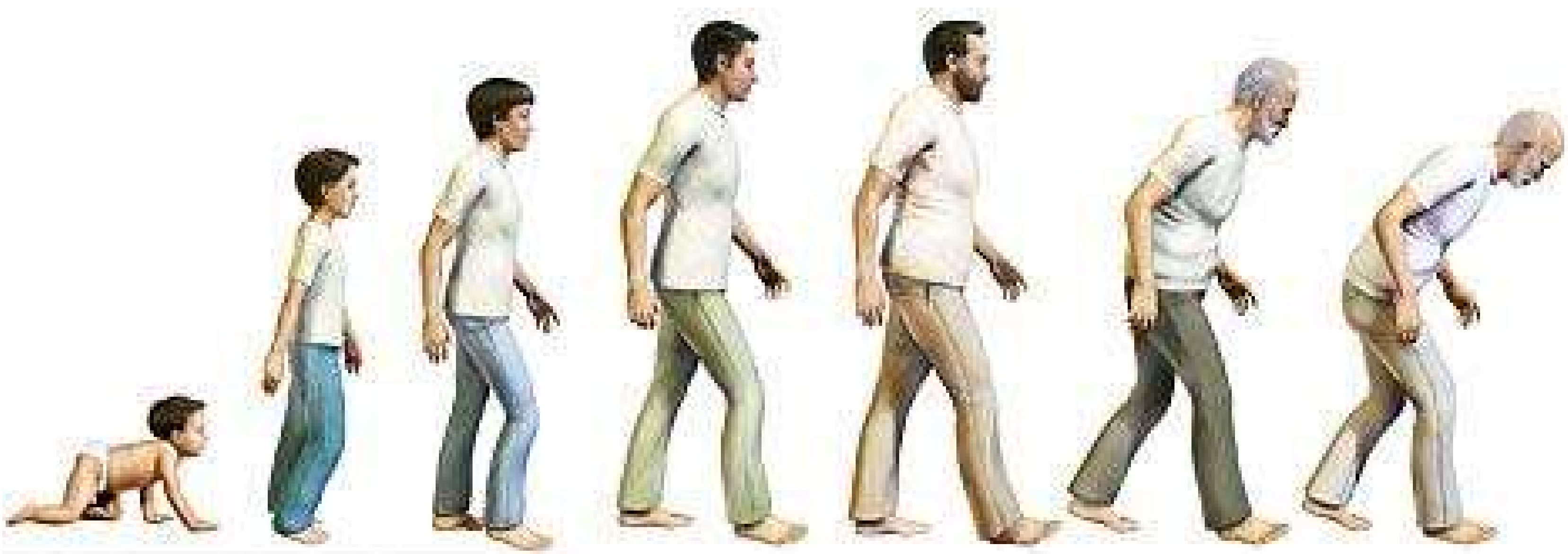
Shefali's marks in Mathematics & English are 13, 17 or 12, 18

No. 48

QUADRATIC EQUATIONS

- **Sum based on Age**

Word Problems Based On AGES



[redacted]

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

Sol :

Let Rehman's present age be 'x' years

∴ Rehman's age 3 years ago = (x – 3) years

Rehman's age 5 years from now = (x+ 5) years

According to the given condition,

$$\frac{1}{x-3} + \frac{1}{x+5} = \frac{1}{3}$$

$$\therefore \frac{x+5+x-3}{(x-3)(x+5)} = \frac{1}{3}$$

$$\therefore \frac{2x+2}{x(x+5)-3(x+5)} = \frac{1}{3}$$

$$\therefore \frac{2x+2}{x^2+5x-3x-15} = \frac{1}{3}$$

$$\therefore \frac{2x+2}{x^2+2x-15} = \frac{1}{3}$$

∴ ... − 15)

∴ ... 15

∴ ... 15 – 6x - 6

∴ 0 = x ... − 21

∴ $\boxed{1}x^2 - 4x - 21 = 0$

... 7x + 3x − 21

(x − 7) + 3(x − 7)

∴ A...

∴ x ≠ −3 , hence x = 7

∴ The present age of Rehman is 7 years

D...

1...

Means $\frac{1}{?}$

No

'-' sign means

Find two factors of 21 in such a way that by subtracting factors we get midd... number.

21

– 7 + 3

Since last sign is '-' Give middle sign to the ... factor & ... sign to smaller factor.

7 – 3 = 4

No. 49

QUADRATIC EQUATIONS

- Word Problem on Age

Two years ago my age was $4\frac{1}{2}$ times the age of my son. Six years ago, my age was twice the square of the age of my son. What is the present age of my son?

Sol. Let the present age of my son be x years

	My Son's Age	My Age
Present Age	x	$\frac{9}{2}(x-2)+2$ $2 \times (x-6)^2+6$
Age 2 yrs ago	$x - 2$	$4\frac{1}{2}(x-2)$ $= \frac{9}{2}(x-2)$
Age 6 yrs ago	$x - 6$	$2 \times (x-6)^2$

Since both are my present age,
So both are equal

My present age =

My present age =

Two years ago my age was $4\frac{1}{2}$ times the age of my son. Six years ago, my age was twice the square of the age of my son. What is the present age of my son ?

Sol. Let the present age of my son be x years

$$\frac{9}{2}(x - 2) + 2 = 2(x-6)^2 + 6$$

$$\therefore \frac{9}{2}(x - 2) - 2(x - 6)^2 + 2 - 6 \ldots$$

$$\therefore \frac{9}{2}(x - 2) - 2(x \ldots$$

Multiplying ...

$$9(x - 2) - \ldots$$

$$\therefore 9x - 18 - 4 \ldots$$

$$\therefore 9x - 18 - 4 \ldots$$

$$\therefore -4x^2 + 57x \ldots 170 = 0$$

$$\therefore 4x^2 - 57x + 170 = 0$$

$$\therefore 4x^2 - 40x - 17x + 170 = 0$$

$$\therefore 4x(x - 10) - 17(x - 10) = 0$$

$$\therefore (x - 10)(4x - 17) = 0$$

$$\therefore x - 10 = 0 \quad \text{or} \quad 4x - 17 = 0$$

$$\therefore x = 10 \quad \text{or} \quad 4x = 17$$

$$x = 10 \quad \text{or} \quad x = \frac{17}{4}$$

17

My son's age six years ago $= x - 6 = \frac{17}{4} - 6$

9

Find two factors of 680 in such a way

'+' sign me... adding...

S... ... h fact...

Let us do the prime factorizatio... 680

2

5

17

	My Son's Age	My Age
Present Age	x	$2\times(x-6)^2 + 2$
Age 2 yrs ago	$x - 2$	$4\frac{1}{2}(x-2) = \frac{9}{2}(x-2)$
Age 6 yrs ago	$\boxed{x - 6}$	$2 \times (x-6)^2$

No. 50

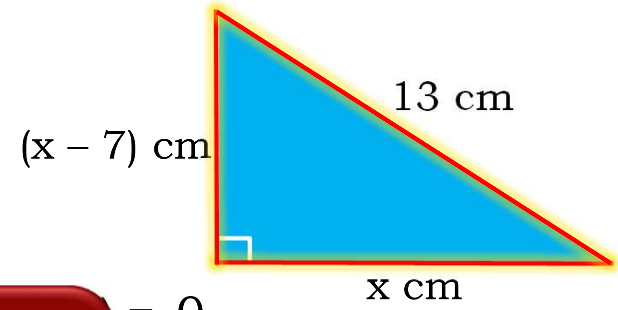
QUADRATIC EQUATIONS

- **Geometric Figures sum based on right angled triangle**

Word Problems Based On Geometric Figures

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

Sol. Let base of right triangle be x cm



$\therefore$ Altitude of right triangle $= (x - 7)$ cm

Hypotenuse

In a right triangle,

By Pythagoras Theorem,

$(\text{Base})^2 + (\text{Altitude})^2 = (\text{Hypo}$

$x^2 + (x - 7)^2 = (13)^2$

$x^2 + x^2 - 14x + 49 =$

$2x^2 - 14x + 49 - 169$

$\therefore 2x^2 - 14x - 120 = 0$

Dividing throughout

$\therefore 1x^2 - 7x - 60 = 0$

$\therefore \underline{x^2 - 12x} + \underline{5x - 60} = 0$

$\therefore x\,\underline{(x - 12)} + 5\,\underline{(x - 12)} = 0$

Calculation

2 | 60

$$60 \to -12,\ +5$$

Find tw…
60 in su…

…now the … which … all three …s of …d triangle

…is sum which …etric figure is …nsidered ?

…negative

‘-’ sig… su…

Since last sign is ‘-’ Give middle sign to the bigger factor & opposite sign to smaller factor.

… 7 = 5

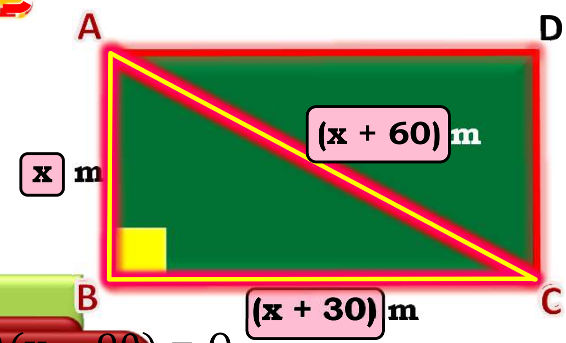
…des of right triangle is … cm.

No. 51

QUADRATIC EQUATIONS

- Sum based on Rectangular Field

Q. The diagonal of a rectangle 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.



Sol : Let the shorter side of the rectangle field be $\boxed{x}$ metres

$\therefore$ Longer side of the rectangular field = (x + 30) metres

$\therefore$ Diagonal of a rectangular field = (x + 60) metres

In ΔABC, $\angle B = 90^0$

$\therefore$ ΔABC is a right angled triangle

$\therefore$ By Pythagoras Theorem ,

$AC^2 = AB^2 + BC^2$

$\therefore$ $(x + 60)^2 = x^2 +$

$\therefore$ $\cancel{x^2} + 120x + 3600$ $(\cancel{x^2} + 30)$

$\therefore$ $0 = x^2 + 60x - 120x + 9$

$\therefore$ $0 = x^2 - 60x - 2700$

$\therefore$ $1x^2 - 60x - 2700 = 0$

$\therefore$ $x^2 - 90x + 30x - 2700 = 0$

2700

270

Find two factors of 2700 in such a way that by subtracting factors we get middle number.

smaller factor.

ative

er comes

= 6

$(x - 90) + 30(x - 90) = 0$

$+ 30) = 0$

or $x + 30 = 0$

or $x = -30$

t be negative

$30 = 120$

$\therefore$ The length of longer side is 120 m and length of shorter side is 90 m.

No. 52

QUADRATIC EQUATIONS

- **Sum based on Two Squares**

Q. Sum of the areas of two squares is 468 m². If the difference of their perimeters is 24m, find the sides of two squares.

Sol :

Let the side of smaller square be x m

Difference between their perimeters is 24

$\therefore$ The side of bigger square = (x + 6)m

Area of square = $(\text{Side})^2$

As per the given condition

$x^2 + (x + 6)^2$ ...

$\therefore$ $x^2 + x^2 + 12x$ ...

$\therefore$ $2x^2 + 12$ ...

$\therefore$ $2x^2 + 12$ ...

Dividing thro...

$\therefore$ $1x^2 + 6x - 21$...

$\therefore$ $x^2 + 18x - 1$...

$\therefore$ x (x + 18) - 12(x + 18)

– 12)=

Sid

or x

or

...are can never be negative

Side

Hence, x = 12

...er of Square = 4 × Side

6 = 18

...of Big square = 4 (Side)

...f two squares are ...m.

...ing throughout by 4

...de – x = 6

$\therefore$ side = x + 6

Calculation

2	216
2	108
2	54
	27

216

+18 − 12

Let us ... two ... One ... and o... as sid...

Pe... squ... sm...

...wo factors of ...y ...g

Since last sign is '-' Give middle sign to the bigger factor & opposite sign to smaller factor.

18 – 12 = 6

No. 53

QUADRATIC EQUATIONS

- **Word problem on Square Swimming Pool**

Around a square pool there is a footpath of width 2m. If the area of the footpath is $\frac{5}{4}$ times that of the pool. Find the area of the pool.

Sol. Let the length of the side of the p

Area of square = (side)^2

$\therefore$ (Area of the pool) $= x^2$

Length of side of outer squ

$\therefore$ Area of the outer square =

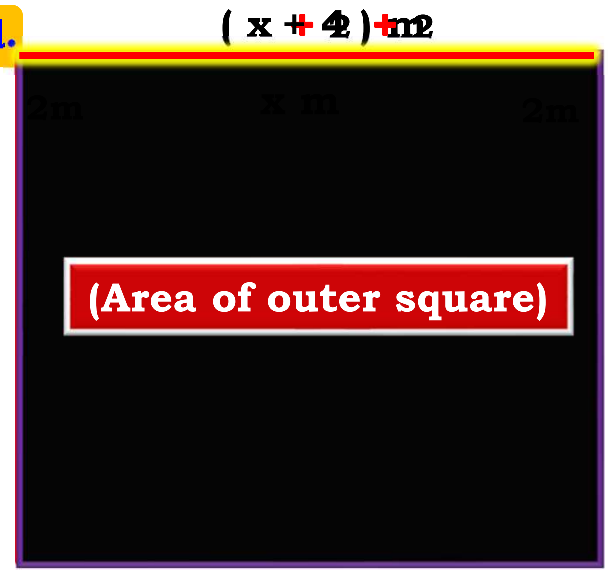
$\therefore$ (Area of footpath) $= \frac{5}{4}$ (Area of pool)

$\therefore$ (Area of footpath) $= \frac{5}{4} x^2$

(Area of the pool) + (Area of footpath) = (Area of outer square)

That means we

For Finding Area of Outer square we will have to find the length of side of outer square



Around a square pool there is a footpath of width 2m. if the area of the footpath is $\frac{5}{4}$ times that of the pool. Find the area of the pool.

Sol. Let the length of the side of the pool be x m.

Area of square = (side)²

$\therefore$ (Area of the pool) = x^2

Length of side of outer square = (x + 4) m

$\therefore$ Area of the outer square = $(x + 4)^2$

$\therefore$ (Area of footpath) = $\frac{5}{4}$ (Area of pool)

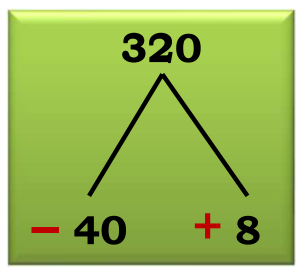
$\therefore$ (Area of footpath) = $\frac{5}{4}x^2$

(Area of the pool) + (Area of footpath) = (Area of outer square)

$\therefore \quad x^2 + \frac{5}{4}x^2 = (x + 4)^2$

$\therefore \quad \cancel{x^2} + \frac{5}{4}x^2 = \cancel{x^2} + 8x + 16$

$\therefore \quad \frac{5}{4}x^2 - 8x - 16 = 0$



Multiplying through

$\therefore \quad \boxed{5}x^2 - \boxed{32}x - 64 = 0$

$\therefore \quad 5x^2 - 40x + 8 \ldots 64 = 0$

$\therefore \quad 5 \ldots (x - 8) \ldots$

$\therefore \quad x = 8$

$\therefore \quad x^2 = 8^2$

$\therefore \quad x^2 = 64$

$\therefore$ **Area of pool is 64 sq.m.**

64 × 5 = 320 …s …btracting

Find two … of 320 in … way th… subtra… factors we get middle number.

Since last sign is '-' Give middle sign to the bigger factor & opposite sign to smaller factor.

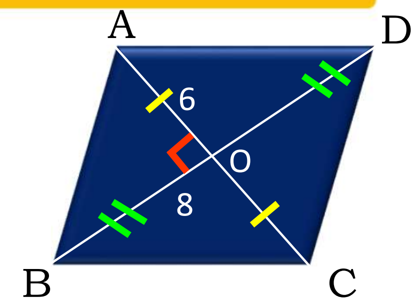
…cause side of

No. 54

QUADRATIC EQUATIONS

- **Word Problem on Rhombus**

One diagonal of a rhombus is greater than other by 4 cm. If the area of the rhombus is 96 cm^2, find the side of the rhombus.



Sol. Let the length of other diagonal of a rhombus be 'x' cm.

$\therefore$ The length of first diagonal is (x + 4) cm.

Area of rhombus = $\frac{1}{2}$ × length of o… …h of other diagonal

As per the given co…

96 = …

$\therefore$ 96 x 2 = x^2 …

$\therefore$ 192 = x^2 + …

$\therefore$ 0 = x^2 …

$\therefore$ $1x^2 + 4x - 192 = 0$

$\therefore$ $x^2 - 12x + 16x - 192 = 0$

$\therefore$ $x(x - 12) + 16(x - 12) = 0$

$\therefore$ $(x - 12)(x + 16) = 0$

$\therefore$ $x - 12 = 0$ or $x + 16 = 0$

$\therefore$ $x = 12$ or $x = -1$…

$\because$ The length of diagonal of the rhombus cannot be negative

Calculation

Find two factors

192 × 1 = 192

192

middle number.

In a comparative statement whatever comes later us taken as x

+ 16 – 12

…oint of

…6 - 12 = 4

Since last sign is '-' Give middle sign to the bigger factor & opposite sign to smaller factor.

× (12) = 6cm

× (16) = 8cm

AOB is a right angled triangle.

In right angled ΔAOB,

By Pythagoras theorem

$[l(AB)]^2 = [l(AO)]^2 + [l(BO)]^2$

$[l(AB)]^2 = (6)^2 + (8)^2$

$[l(AB)]^2 = 36 + 64$

$[l(AB)]^2 = 100$

Taking square root on both the sides we get,

l (AB) = 10 cm

$\therefore$ The side of a rhombus is 10 cm.

No. 55

QUADRATIC EQUATIONS

- **Word Problem based on rectangular park**

Q. Is it possible to design a rectangular park of perimeter 80 m and area 400m² ? If so, find its length and breadth.

Sol. Let the Length of rectangle = $\boxed{x}$ m

and the breadth of rectangle = $\boxed{y}$ m

$\therefore$ According to the given condition,

$$\text{Perimeter} = 80 \text{ m}$$
$$2(\boxed{\text{length}} + \boxed{\text{breadth}}) = 80 \text{ m}$$
$$\therefore \quad 2(x + y) = 80$$
$$\therefore \quad x + y = 40$$
$$\therefore \quad y = 40 - x$$

So, length of given rectangle = $\boxed{x}$ m

and, breadth of given rectangle = $(\boxed{40 - x})$ m

According to the given condition,

Area of rectangle is given as 400 m²

$$(\boxed{\text{length}})(\boxed{\text{breadth}}) = 400$$
$$\text{i.e.} (x)\ (40 - x) = 400$$
$$\therefore \quad 40x - x^2 = 400$$

i.e

i.

So

eq

We k

Area of a rec

br

So let us solve the Quadratic Equation to find the length and breadth

$$= 1600 - 1600$$
$$= 0$$
$$b^2 - 4ac = 0$$

So, the given equation has two equal real roots.

Hence the situation is possible.

Q. Is it possible to design a rectangular park of perimeter 80 m and ... find its length and breadth.

Sol. Sol... uation $x^2 - 40x + 400 = 0$ by factorisation method

... $400 = 0$

... $-20) = 0$

$\therefore \quad (x - 20)\,(x - 20) = 0$

$\therefore \quad x - 20 = 0 \quad$ or $\quad x - 20 = 0$

$\therefore \quad x = 20 \quad$ or $\quad x = 20$

When $x = 20$, $40 - x = 40 - 20 = 20$

$\therefore$ Length of the rectangular park = 20m and breadth of the rectangular park = 20 m

$\therefore$ **The park is a square having 20m side.**

From last two '20' is common along with 3rd term sign

Standard form

1st n...

middle no.

Factorise by spli...

Product of two brackets is zero

$400 = 20 \times 20$

-20

$20 + 20 = 40$

...actorise by splitting middle term

...of 3rd no.

Find two factors of 400 in such a way that by adding factors we get middle no.

Since, last sign is + Give middle sign to both the factors

No. 56

QUADRATIC EQUATIONS

- **Word Problem based on Geometric figure (Rectangle)**

12. A rectangular playground is 420 sq.m. If its length is increased by 7m and breadth is decreased by 5 metres, the area remains the same. Find the length and breadth of the playground ?

Sol. Let the length of a rectangular playground be 'x' m.

We know that

Area of rectangle = length × breadth

$420 = x \times \text{breadth}$

$\therefore \frac{420}{x} = \text{breadth}$

Area of new rectangle = leng

$\therefore 420 = (x + 7) \times ($

$\therefore$ 42

$\therefore$ 42

Multipl

0

5x

588

28 – 21 = 7

Since we are subtracting

Find two factors of 588 in such a way that by subtracting factors we get middle no. 7

Calculation

2	588
2	294
3	147
7	49
7	7
	1

Dividing throughout by 5

$\therefore$ 1x

$\therefore$ x

W

a

Length and Breadth are unknown

+ 28) (x – 21) = 0

= 0 or x – 21 = 0

8 or x = 21

gth of playground cannot

tive

x = 21

$= \frac{420}{x} = \frac{420}{21} = 20$

∴ The length of rectangular playground is 21m and its breadth is 20m.

No. 57

QUADRATIC EQUATIONS

- **Word Problem based on Geometric figure (Polygon)**

Q) **Exterior angle of a regular polygon having n-sides is more than that of the polygon having n^2 sides by 50^0. Find the number of the sides of each polygon.**

Sol.

Number of sides of one of the regular polygon = n

Number of sides of the other regular polygon = n^2

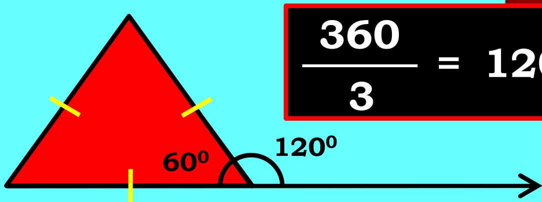
Ex ... 360° ... Number ...

Ex ...

Ex ... ing 'n^2' number of sides = $\frac{360^{\circ}}{n^2}$

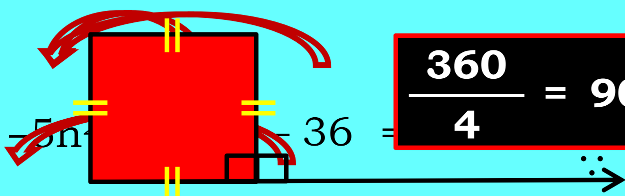
A ...

Equilateral Δ (3 sides)



$\frac{360}{3} = 120^0$

Square (4 sides)



$\frac{360}{4} = 90^0$

Multiplying throughout by –1

...are is 4 sided regular polygon

After ...

30 + 6 = 36

... the ... term sign to both the factors.

$6(n - 6) = 0$

$5) = 0$

r $5n - 6 = 0$

$5n = 6$

or $n = \frac{6}{5}$

...ber of sides cannot ...ction.

80 ... – 6 ... 0

$-5n$ ... $- 36$ =

$\therefore n = \frac{6}{5}$ is not acceptable

$\therefore n = 6$

$\therefore n^2 = (6)^2 = 36$

$\therefore$ Number of sides of required polygons are 6 and 36.

No. 58

QUADRATIC EQUATIONS

- **Word Problem based on Geometric figure (Hexagon)**

Q) **The side of one regular hexagon is larger than that of the other regular hexagon by 1cm. If the product of their areas is 243, then find the sides of both the regular hexagons.**

Sol. Let the side of the smaller regular hexagon be x cm.

$\therefore$ The side of the bigger regular hexagon is (x + 1) cm

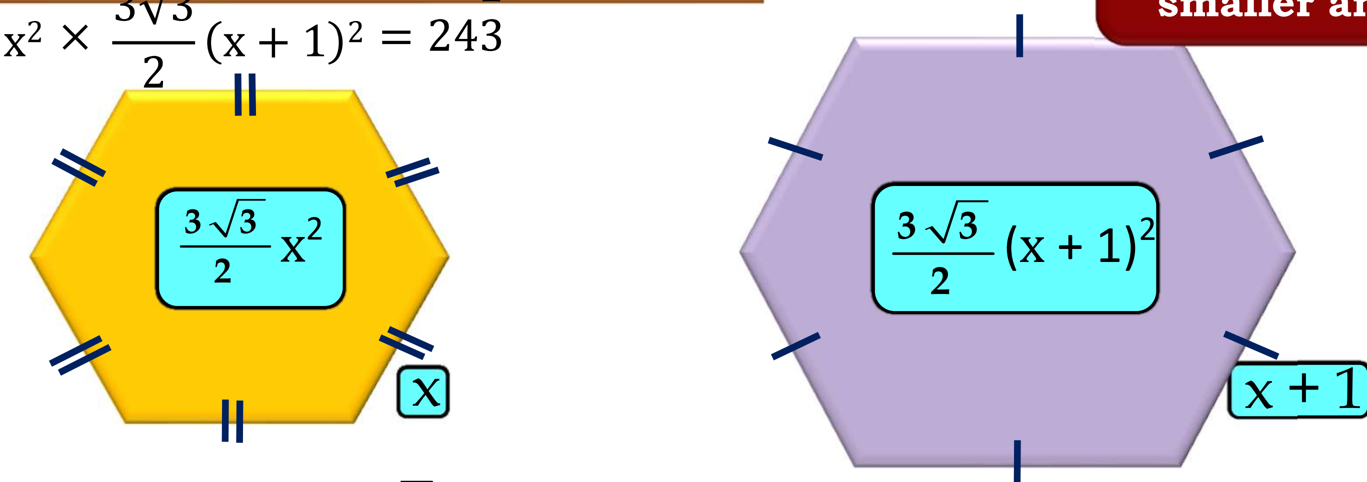
A hexagon is a 6-sided polygon

smaller and one bigger

As per the given condition

Area of regular hexagon = $\frac{3\sqrt{3}}{2} \times (\text{side})^2$

$$\frac{3\sqrt{3}}{2}x^2 \times \frac{3\sqrt{3}}{2}(x+1)^2 = 243$$



$$\frac{3\sqrt{3}}{2}x^2 \times \frac{3\sqrt{3}}{2}(x+1)^2 = 243$$

Q) The sides of one regular hexagon is larger than that of the other regular hexagon by 1cm. If the product of their areas is 243, than find the sides of both the regular hexagons.

Since we are subtracting the factors give middle term sign

Find two factors of 6 in such a way that by subtracting factors we get middle no. 1

aller regular hexagon be x cm.

∴ T gular hexagon is (x + 1) cm.

A

43

$\therefore \frac{}{4} \times x^2(x+1)^2 = 243$

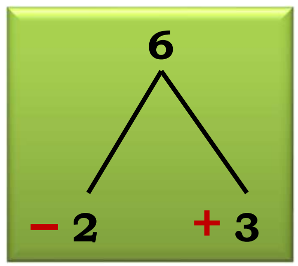
$\therefore [x(x+1)]^2 = \cancel{243}^{\cancel{81}\,9} \times \frac{4}{\cancel{9}_1 \times \cancel{3}_1}$

$\therefore [x(x+1)]^2 = 36$

Taking square root on both the sides, we get,

$x(x+1) = \pm 6$

$x(x+1) = -6$ is not acceptable because product of sides of a hexagon cannot be negative



$\therefore \ x(x+1) = 6$

$\therefore \ x^2 + x = 6$

$\therefore \ \boxed{1}x^2 + \boxed{1}x - 6 = 0$

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

$\therefore \ x(x+3) - 2(x+3) = 0$

$\therefore \ (x+3)(x-2) = 0$

$\therefore \ x + 3 = 0 \ \text{ or } \ x - 2 = 0$

$\therefore \ x = -3 \ \text{ or } \ x = 2$

$\therefore \ x \neq -3$ (as side cannot be negative)

Hence $x = 2$

$\therefore \ x + 1 = 2 + 1 = 3$

∴ **The sides of both the regular hexagon are 2cm and 3cm.**

Thank You