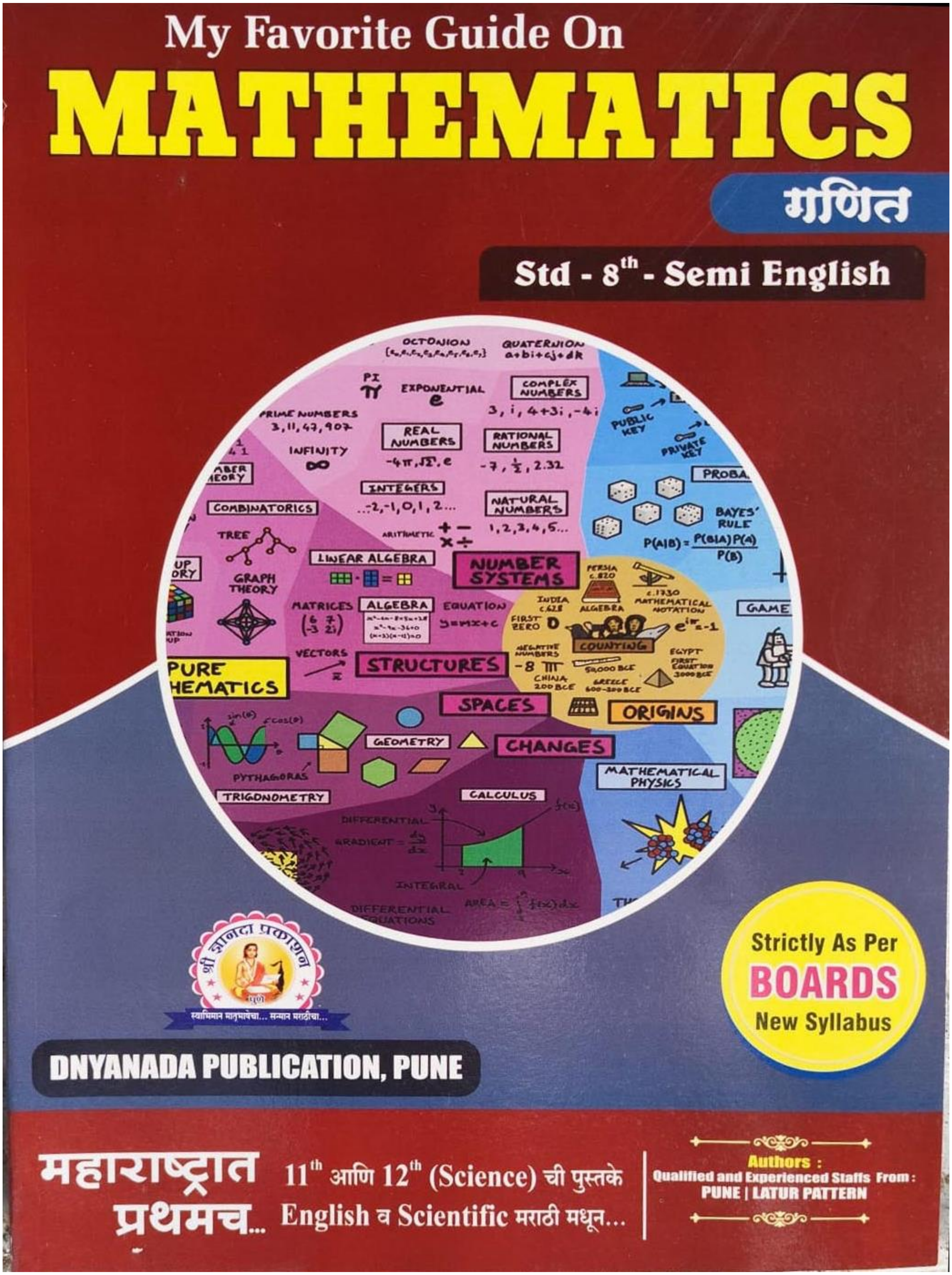
My Favorite Guide On
MATHEMATICS
गणित
Std - 8th - Semi English
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DNYANADA PUBLICATION, PUNE
महाराष्ट्रात प्रथमच... 11th आणि 12th (Science) ची पुस्तके English व Scientific मराठी मधून...
Authors :
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TOPIC - 01
RATIONAL AND IRRATIONAL NUMBERS

Rational and Irrational Numbers
(परिमेय व अपरिमेय संख्या)

1.1 Introduction:

We are familiar with natural numbers, Whole numbers, Integers and Rational numbers.

Natural numbers – 1,2,3,4,……..
Whole numbers – 0,1,2,3,4,……….
Integers – ……,-4,-3,-2,-1,0,1,2,3,…..
Rational numbers – $\frac{-25}{3}, \frac{10}{-7}, -4, 0, 3, 8, \frac{32}{3}, \frac{67}{5}$, etc.

Rational numbers: The numbers of the form $\frac{m}{n}$ are called rational numbers.
Here, m and n are integers but n is not zero. We have also seen that there are infinite rational numbers between any two rational numbers.

आपण Natural number (नैसर्गिक संख्या) समूह, Whole number (पुर्ण संख्या) समूह, Integers (पूर्णांक संख्या) समूह आणि Rational number (परिमेय संख्या) समूह यांची ओळख करुन घेतली.

1) Natural numbers (नैसर्गिक संख्या समूह)-$1, 2, 3, 4, \ldots$

2) Whole numbers (पूर्ण संख्या समूह)-0,1,2,3,4,. . .

3) Integers (पूर्णांक संख्या समूह) -
$\ldots, -4, -3, -2, -1, 0, 1, 2, 3, \ldots$

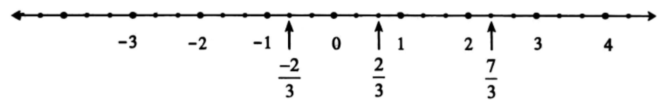
4) Rational numbers (परिमेय संख्या समूह)-
$\frac{-25}{3}, \frac{10}{-7}, -4, 0, 3, 8, \frac{32}{3}, \frac{67}{5}$ इत्यादी

परिमेय संख्या समूह:
$\frac{m}{n}$ या रूपातील संख्यांना परिमेय संख्या म्हणतात. येथे m व n हे पूर्णांक असतात परंतु n हा शून्य नसतो.
दोन परिमेय संख्यांच्या दरम्यान infinite (असंख्य) परिमेय संख्या असतात, हे आपण पाहिले आहे.

1.2 To show rational numbers on a number line

Let us see how to show $\frac{7}{3}, 2, \frac{-2}{3}$ on a number line.

Let us draw a number line.



We can show the number 2 on a number line.

$\frac{7}{3} = 7 \times \frac{1}{3}$, therefore each unit on the right side of zero is to be divided in three equal parts. The seventh point from zero shows $\frac{7}{3}$; or $\frac{7}{3} = 2 + \frac{1}{3}$, hence the point at $\frac{1}{3}$ rd distance of unit after 2 shows $\frac{7}{3}$.
To show $\frac{-2}{3}$ on the number line, first we show $\frac{2}{3}$ on it. The number to the left of 0 at the same distance will show the number $\frac{-2}{3}$.

संख्यारेषेवर परिमेय संख्या दाखवणे (To Show rational numbers on a number line)
$\frac{7}{3}, 2, \frac{-2}{3}$ या संख्या संख्यारेषेवर कशा दाखवायच्या हे पाहू.
प्रथम एक number lins (संख्यारेषा) draw (काढू).
1) 2ही परिमेय संख्या पूर्णांकही आहे. ती संख्यारेषेवर दाखवू.
2) $\frac{7}{3} = 7 \times \frac{1}{3}$, म्हणून शून्याच्या उजवीकडील each unit (प्रत्येक एककाचे) तीन equal (समान) divided (भाग) करु. शून्यापासूनचा सातवा बिंदू $\frac{7}{3}$ ही संख्या दाखवेल; किंवा $\frac{7}{3} = 2 + \frac{1}{3}$ म्हणून 2 या संख्येचा पुढील $\frac{1}{3}$ एकक distance (अंतरावरील) बिंदू $\frac{7}{3}$ ही संख्या दाखवेल.
संख्यारेषेवर $-\frac{2}{3}$ ही संख्या दाखवण्यासाठी, आधी $\frac{2}{3}$ही संख्या दाखवून 0 च्या डाव्या बाजूला same (तेवढ्याच) अंतरावर $-\frac{2}{3}$ ही संख्या दाखवता येईल.

Practice set - 1.1

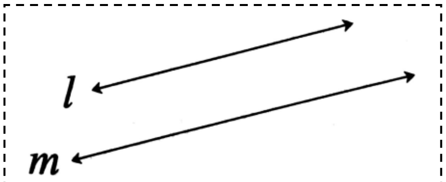
1) Show the following numbers on a number line. Draw a separate number line for each example:

i) $\frac{3}{2}, \frac{5}{2}, -\frac{3}{2}$.

Parallel lines and Transversal (समांतर रेषा व छेदिका)

2.1 Introduction:

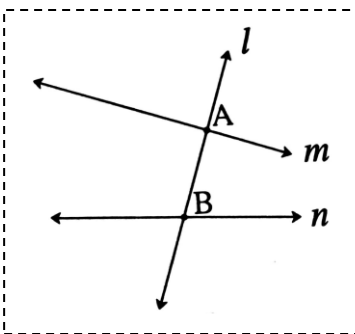
The lines in the same plane which do not intersect each other are called parallel lines.
'Line l and line m are parallel lines,' is written as 'line l || line m .



Same plane (एकच प्रतल) मध्ये असणाऱ्या आणि एकमेकांना न intersect (छेदणे) करणाऱ्या रेषांना parallel line (समांतर रेषा) म्हणतात.
रेषा l व रेषा m या समांतर रेषा आहेत, हे रेषा l || रेषा m असे लिहितात.

2.2 Transversal

In the adjoining figure, line l intersects line m and line n in two distinct points. line l is a transversal of line m and line n.

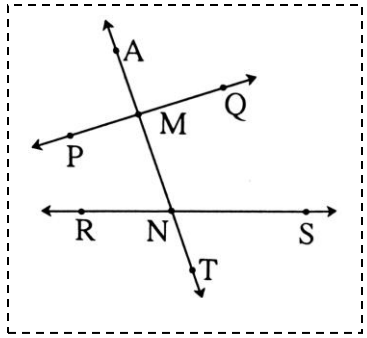


If a line intersects given two lines in two distinct points then that line is called a transversal of those two lines.

Transversal (छेदिका) -
वरील आकृतीत रेषा m व रेषा n यांना रेषा l ही अनुक्रमे बिंदू A व बिंदू B या दोन distinct point (भिन्न बिंदू) मध्ये intersects (छेदणे)करते. रेषा m व रेषा n यांची रेषा l ही transversal (छेदिका) आहे.

जर एखादी line (रेषा) दिलेल्या दोन रेषांना two distinct point (दोन भिन्न बिंदू) मध्ये छेदत असेल, तर त्या रेषेला त्या दोन रेषांची transversal (छेदिका) म्हणतात.

2.3 Angles made by a transversal



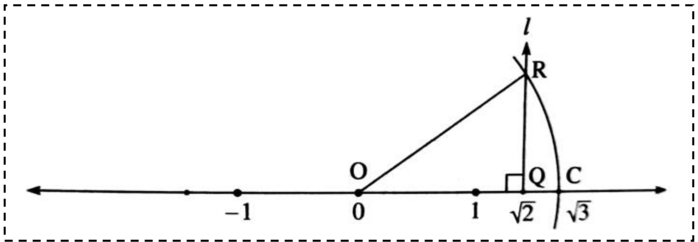
In the adjoining figure, due to the transversal, there are two distinct points of intersection namely M and N. At each of these points, four angles are formed. Hence there are 8 angles in all. Each of these angles has one arm on the transversal and the other is on one of the given lines. These angles are grouped in different pairs of angles. Let's study the pairs given in figure.

Angles made by a transversal (छेदिकेमुळे होणारे कोन):
सोबतच्या आकृतीत छेदिकेमुळे two distinct point (दोन भिन्न बिंदू) छेदनबिंदू M जवळ चार आणि छेदन बिंदू N जवळ चार असे एकूण 8 कोन झालेले दिसतात. आठ ही कोनांपैकी प्रत्येक angles (कोन) ची एक arm (भुजा) छेदिकेवर आहे व दुसरी भुजा दोनपैकी एका line (रेषा) वर आहे याचा उपयोग करून कोनांच्या जोड्या ठरवल्या आहेत. त्या जोड्यांचा study (अभ्यास) करूया.

Practice Set - 1.4

1) The number $\sqrt{2}$ is shown on a number line. Steps are given to show $\sqrt{3}$ on the number line using $\sqrt{2}$. Fill in the boxes properly and complete the activity.

Activity:
i) The point Q on the number line shows the number$\sqrt{2}$.
ii) A line (l) perpendicular to the number lineis drawn through the point Q.
Point R is at the unit distance from Q on the line l.
iii) By drawing seg OR, a right angled Δ ORQ is obtained.



iv) $l(OQ) = \sqrt{2}, l(QR) = 1$
By 'Pythagoras' theorem,

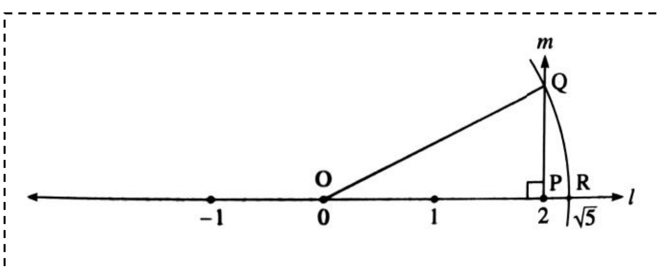
$$[l(OR)]^2 = [l(OQ)]^2 + [l(OR)]^2$$
$$= \boxed{\sqrt{2}}^2 + \boxed{1}^2$$
$$= \boxed{2} + \boxed{1} = \boxed{3}$$
$$\therefore \ l(OR) = \boxed{\sqrt{3}}$$

Draw an arc with centre O and radius OR.
Let it intersect the number line at the point C. The point C shows the number$\sqrt{3}$.

विद्यार्थी मित्रांनो $\sqrt{3}$ संख्यारेषेवर दाखवण्यासाठी आकृतीमध्ये बिंदू Q च्या ठिकाणी $\sqrt{2}$ आहे हे दिसते, तर बिंदू Q पासून 1 unit चा एक लंब काढला त्या रेषेला l असे नाव दिले व त्या 1 unit अंतरावर बिंदू R असे नाव दिले, बिंदू O व R जोडले. येथे $l(OQ) = \sqrt{2}$ व $l(QR) = 1$ आहे तर पायथागोरसच्या प्रमेयावरून कर्ण OR ची लांबी काढली व ती $\sqrt{3}$ आली. OR एवढे अंतर घेऊन R या बिंदूपासून एक चाफ संख्येरेषेवर मारला तर संख्यारेषेवर आपल्याला $\sqrt{3}$ चे स्थान मिळेल.

2) Show the number $\sqrt{5}$ on the number line.

Ans: Draw a number line l.
Take OP = 2 units.
Draw a line m ⊥ line l through the point P.



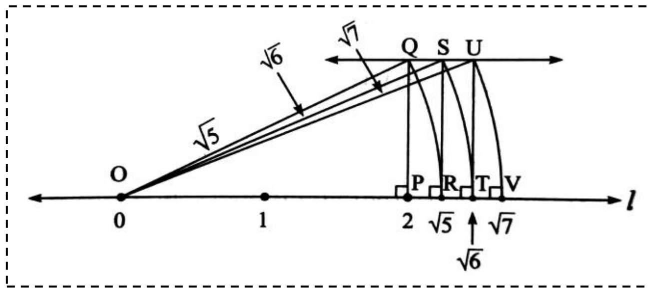
Take a point Q on line m such that PQ = 1 unit.
In right angled ΔOPQ, by Pythagoras'theorem,

$$[l(OQ)]^2 = [l(OP)]^2 + [l(PQ)]^2$$
$$= (2)^2 - (1)^2 = 4 + 1 = 5$$

$\therefore \ l(OQ) = \sqrt{5}$.
With centre O and OQ as radius, draw an arc intersecting line l in the point R.
$OR = \sqrt{5}$ on the number line l.
The point R represents the number$\sqrt{5}$.

3) Show the number $\sqrt{7}$ on the number line.

Ans: Draw a number line l.
Show the number $\sqrt{5}$ on this number line. Let the point R represent the number $\sqrt{5}$.

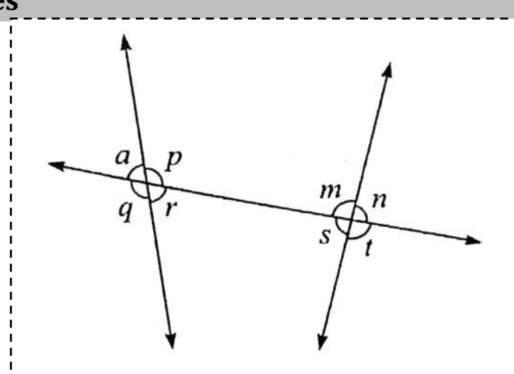


Draw seg RS⊥ line l. Take RS = 1 unit. With centre O and radius OS draw an arc intersecting line l at the point T. Point T will represent the number $\sqrt{6}$. Draw seg TU⊥line l. Take TU = 1 unit. With centre O and radius OU draw an arc intersecting line l at the point V. This point V will represent the number $\sqrt{7}$.

अशाप्रकारे आपण Irrational numbers संख्यारेषेवर दाखवू शकतो. ही दाखवण्याची Process, थोडी किचकट आहे, परंतू Practice केली की, तुम्हाला सर्व समजुन जाईल.

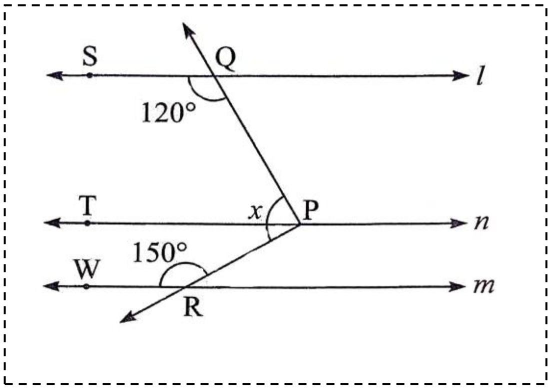
3 - MARKS QUESTIONS

1) Observe the figure and write the following pair of angles



1) Corresponding angles
2) Interior alternate angles
3) Interior angles

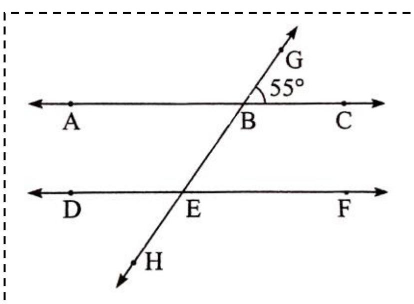
2) In the figure, line p || line q and line r is the transversal. Find the values of ∠ a. ∠ b and ∠ c.



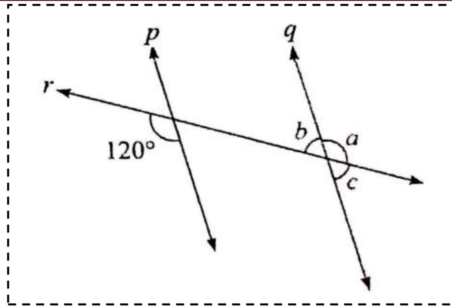
3) Draw a line l. Take a point A outside it. Using set square, draw line p parallel to line l passing through A.
4) Draw a line m. Draw a line l which is parallel to line m at a distance of 5.5 cm from it.
5) Draw a line l. How many lines can be drawn parallel to line l at a distance of 4.2 cm from it?
Using set square, draw the lines.

4 - MARK QUESTIONS

1) In the figure, line AC is parallel to line DF and line GH is the transversal if $\angle GBC = 55^\circ$ then find the measures of the remaining angles.



2) In the figure, line l || line n || line m. Through P, line n is drawn parallel to lines l and m. If $\angle SQP = 120^\circ, \angle WRP = 150^\circ$ and $\angle QPR = x^\circ$ then find x.



ANSWERS

1- MARK QUESTIONS

1) A 2) C 3) B 4) A 5) D

2 - MARKS QUESTIONS

1) i) ∠ h ii) ∠ e iii) ∠ a iv) ∠ g
2) 2) 15 3) 50 4) $\angle SYZ = 70^\circ, \angle ZYQ = 110^\circ$

3 - MARKS QUESTIONS

1) **Corresponding angles:**
∠ a and ∠ m, ∠ q and ∠ s, ∠ p and ∠ n, ∠ r and ∠ t.
Interior alternative angles: ∠ p and ∠ s, ∠ r and ∠ m.
Interior angles:
∠ p and ∠ m, ∠ r and ∠ s.
2) $m\angle a = 120^\circ, m\angle b = 60^\circ, m\angle c = 60^\circ$
5) Two lines can be drawn

4 - MARKS QUESTIONS

1) $\angle GBA = 125^\circ, \angle ABE = 55^\circ$,
$\angle EBC = 125^\circ, \angle BEF = 55^\circ$,
$\angle DEB = 125^\circ, \angle DEH = 55^\circ$,
$\angle HEF = 125^\circ$
2) x = 90°.

Example for Practice - HOME WORK

1 - MARK QUESTIONS

Q.1 Choose the correct alternative answer for each of the following questions:

1) What is the value of x, if $4^x = 64$?

A) 6 B) 3 C) 2 D)1

2) What is the simplification of $(-1)^4 \times (-1)^{-4}$?

A) 0 B) -1 C) 1 D) $(-1)^{-16}$

3) The simplified form of $(-1)^3 \times (-1)^6$ is ... ...

A) 0 B) -1 C) 1 D) $(-1)^{18}$

4) $\left[\left(\frac{3}{7}\right)^{-3}\right]^4 = ?$

A) $\left(\frac{3}{7}\right)^{-7}$ B) $\left(\frac{3}{7}\right)^{1}$ C) $\left(\frac{7}{3}\right)^{-12}$ D) $\left(\frac{7}{3}\right)^{12}$

5) $\sqrt[3]{\frac{729}{1728}} = ?$

A) $\frac{243}{576}$ B) $\frac{81}{192}$ C) $\frac{27}{64}$ D) $\frac{3}{4}$

Q.2) Express the following numbers in index form:

1) Seventh root of 7
2) Square root of cube of 4
3) Sixth root of 11.

Q.3) Write in the form 'nth root of a' (or write the meaning of):

1) $(27)^{\frac{1}{3}}$ 2) $(49)^{\frac{1}{7}}$ 3) $(10)^{\frac{1}{10}}$.

2 - MARKS QUESTIONS

Q.1) Find the cube root of the following numbers:

1) 512 2) -1728 3) 42875 4) -13824.

3 - MARKS QUESTIONS

Q.1) Express two meaning of the following numbers:

[First is solved for you.]

1) $(27)^{\frac{4}{7}}$: 4th power of 7th root of 27. 7th root of 4th power of 27.

2) $(216)^{\frac{3}{4}}$ 3) $(64)^{\frac{2}{3}}$.

Q. 2) Simplify:

1) $\sqrt[3]{\frac{4096}{5832}}$ 2) $\sqrt[3]{\frac{9261}{13824}}$

Q. 3) Simplify:

1) $\left[\left(\frac{3}{2}\right)^{-2} - \left(\frac{1}{3}\right)^2\right] \times \left(\frac{5}{3}\right)^{-2}$ 2) $\sqrt[3]{13.824}$.

ANSWERS

1 - MARK QUESTIONS

Q. 1) 1) B 2) C 3) B 4) D 5) D

Q. 2) 1) $7^{\frac{1}{7}}$ 2) $(4^{\frac{1}{2}})^3$ 4) $11^{\frac{1}{6}}$

Q. 3) 1) Cube root of 27 2) 7th root of 49
3) 10th root of 10

2 - MARKS QUESTIONS

Q. 1) 1) 8 2) -12 3) 35 4) -24

3 - MARKS QUESTIONS

Q. 1) 2) Cube of 4th root 216; 4th root of cube of 216

3) Square of cube root of 64; Cube root of square of 64

Q. 2) 1) $\frac{8}{9}$ 2) $\frac{7}{8}$

Q. 3) 1) $\frac{3}{25}$ 2) 2.4.

BEST WISHES ...
DNYANADA PUBLICATIONS ...

TOPIC – 05
EXPANSION FORMULAE

Expansion Formulae (विस्तार सुत्रे)

5.1 Introduction:

We have studied the following expansion formulae in previous standard.

i) $(a+b)^2 = a^2 + 2ab + b^2$,
ii) $(a-b)^2 = a^2 - 2ab + b^2$,
iii) $(a+b)(a-b) = a^2 - b^2$

Use the above formulae to fill proper terms in the following boxes.

i) $(x+2y)^2 = x^2 + \boxed{4xy} + 4y^2$
ii) $(2x-5y)^2 = \boxed{4x} - 20xy + \boxed{25y^2}$
iii) $(101)^2 = (100+1)^2 = \boxed{(100)^2} + \boxed{(2\times100\times1)} + 1^2 = \boxed{10201}$
iv) $(98)^2 = (100-2)^2 = 10000 - \boxed{400} + \boxed{4} = \boxed{9604}$
v) $(5m+3n)(5m-3n) = \boxed{(5m)^2} - \boxed{(3n)^2} = \boxed{25m^2} - \boxed{9m^2}$

5.2 - I) Expansion of $(x+a)(x+b)$

$(x+a)$ and $(x+b)$ are binomials with one term in common. Let us multiply them.

$(x+a)(x+b) = x(x+b) + a(x+b) = x^2 + bx + ax + ab$
$= x^2 + (a+b)x + ab$
$\therefore \boxed{(x+a)(x+b) = x^2 + (a+b)x + ab}$

$(x+a)$ आणि $(x+b)$ चा विस्तार

$(x+a)$ आणि $(x+b)$ या एक पद समान असलेल्या द्विपदी आहेत. या द्विपदींचा गुणाकार करून आपल्याला
$(x+a)(x+b) = x^2 + (a+b)x + ab$ मिळते.

Expand:

Ex. 1) $(x+2)(x+3) = x^2 + (2+3)x + (2\times3) = x^2 + 5x + 6$

Ex. 2) $(y+4)(y-3) = y^2 + (4-3)y + (4)\times(-3) = y^2 + y - 12$

Ex. 3) $(2a+3b)(2a-3b) = (2a)^2 + [(3b) + (-3b)]2a + [3b\times(-3b)]$
$= 4a^2 + 0\times2a - 9b^2 = 4a^2 - 9b^2$

Ex. 4) $\left(m+\frac{3}{2}\right)\left(m+\frac{1}{2}\right) = m^2\left(\frac{3}{2}+\frac{1}{2}\right)m + \frac{3}{2}\times\frac{1}{2} = m^2 + 2m + \frac{3}{4}$

Ex. 5) $(x-3)(x-7) = x^2 + (-3-7)x + (-3)(-7) = x^2 - 10x + 21$

Practice Set - 5.1

Q. Expand:

1) $(a+2)(a-1)$
2) $(m-4)(m+6)$
3) $(p+8)(p-3)$
4) $(13+x)(13-x)$
5) $(3x+4y)(3x+5y)$
6) $(9x-5t)(9x+3t)$
7) $\left(m+\frac{2}{3}\right)\left(m-\frac{7}{3}\right)$
8) $\left(x+\frac{1}{x}\right)\left(x-\frac{1}{x}\right)$
9) $\left(\frac{1}{y}+4\right)\left(\frac{1}{y}-9\right)$

Solution:

1) $(a+2)(a-1)$
$= a^2 + (2-1)a + (2)\times(-1)$
$= a^2 + a - 2$
Ans: $a^2 + a - 2$

2) $(m-4)(m+6)$
$= m^2 + (-4+6)m + (-4)\times(6)$
$= m^2 + 2m - 24$
Ans: $m^2 + 2m - 24$.

3) $(p+8)(p-3)$
$= p^2 + (8-3)p + (8)\times(-3)$
$= p^2 + 5p - 24$
Ans: $p^2 + 5p - 24$.

4) $(13+x)(13-x)$
$= (13)^2 + (x-x)13 + (x)\times(-x)$
$= 169 + (0)\times13 - x^2$
$= 169 - x^2$

TOPIC - 06
FACTORISATION OF ALGEBRAIC EXPRESSION

Factorization of Algebraic Expression
(बैजिक राशींचे अवयव)

6.1. Introduction:

In the previous standard we have learnt to factorise the expressions of the formax + ay and $a^2 - b^2$

For example,
1) $4xy + 8xy^2 = 4xy(1 + 2y)$
2) $p^2 - 9q^2 = (p)^2 - (3q)^2 = (p + 3q)(p - 3q)$

6.2 Factors of a quadratic trinomial

An expression of the form $ax^2 + bx + c$ is called a quadratic trinomial.
We know that $(x + a)(x + b) = x^2 + (a + b)x + ab$
$\therefore$ the factors of $x^2 + (a + b)x + ab$ are $(x + a)$ and $(x + b)$.
To find the factors of $x^2 + 5x + 6$, by comparing it with $x^2 + (a + b)x + ab$ we get, $a + b = 5$ and $ab = 6$.
So, let us find the factors of 6 whose sum is 5.
Then writing the trinomial in the form
$x^2 + (a + b)x + ab$ find its factors.

$$x^2 + 5x + 6 = x^2 + (3 + 2)x + 3 \times 2$$
…… $x^2 + (a + b)x + ab$

$= x^2 + 3x + 2x + 2 \times 3$ ……. multiply $(3 + 2)$ by x, make two groups of the four terms obtained.

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

Factors of a quadratic trinomial (वर्ग त्रिपदीचे अवयव) -
$ax^2 + bx + c$ या स्वरूपाच्या बैजिक राशीला quadratic trinomial (वर्ग त्रिपदी) म्हणतात.
आपल्याला हे माहीत आहे की

$$(x + a)(x + b) = x^2 + (a + b)x + ab$$

$\therefore x^2 + (a + b)x + ab$ चे $(x + a)$ व $x + b$ हे अवयव आहेत.
$x^2 + 5x + 6$ या वर्ग त्रिपदीचे factor (अवयव) काढण्यासाठी तिची comparing (तुलना) $x^2 + (a + b)x + ab$ या त्रिपदीशीकरून, $a + b = 5$ आणि $ab = 6$ म्हणून 6 चे असे अवयव पाडू की त्यांची sum (बेरीज) 5 येईल आणि $x^2 + (a + b)x + ab$ या रूपात लिहून तिचे factors (अवयव) पाडू.
$x^2 + 5x + 6 = x^2 + (3 + 2)x + 3 \times 2$ ....$(x^2 + (a + b)x + ab$
$= x^2 + 3x + 2x + 2 \times 3$ … … … $(3 + 2)$ ला x ने multiply करु. मिळालेल्या चार terms (पद) चे दोन गट पाडू व अवयव मिळवू.

$$= x(x + 3) + 2(x + 3) \qquad = (x + 3)(x + 2)$$

Study the following examples to know how a given trinomial is factorized.

Ex. 1) Factorise: $2x^2 - 9x + 9$

Solution: First we find the product of the coefficient of the square term and the constant term. Here the product is $2 \times 9 = 18$.
Now, find factors of 18 whose sum is -9, that is equal to the coefficient of the middle term.

$$18 = (-6) \times (-3)\,;(-6) + (-3) = -9$$

Write the term $-9x$ as $- 6x - 3x$

$$2x^2 - 9x + 9$$
$$= \underline{2x^2 - 6x} - \underline{3x + 9}$$
$$= 2x\underline{(x - 3)} - 3\underline{(x - 3)}$$
$$= (x - 3)(2x - 3)$$
$$\therefore\ 2x^2 - 9x + 9 = (x - 3)(2x - 3)$$

Ex. 2) Factorice: $2x^2 + 5x - 18$.

Solution:$2x^2 + 5x - 18$
$$= \underline{2x^2 + 9x} - \underline{4x - 18}$$
$$= x(2x + 9) - 2(2x + 9)$$
$$= (2x + 9)(x - 2)$$

Ex. 3) Factorise: $x^2 - 10x + 21$.

Solution:$x^2 - 10x + 21$
$$= \underline{x^2 - 7x} - \underline{3x + 21}$$
$$= x(x - 7) - 3(x - 7)$$
$$= (x - 7)(x - 3)$$

Examples for Practice – HOME WORK

1 - MARK QUESTIONS

Q. Choose the correct alternative answer for each of the following questions:

1) $\left(\mathbf{18x^4 = 21x^3}\right) \div \mathbf{3x^2} = ?$

A) $6x^2$ B) $7x$ C) $6x^2 + 7x$ D) $6x + 7$

2) $\left(\mathbf{-36x^4}\right) \div \mathbf{4x} = ?$

A) $9x^3$ B) $-9x^3$ C) $9x^5$ D) $-9x^5$

3) $\left(\mathbf{14x^3 - 21x^2 - 35x}\right) \div (\mathbf{-7x}) = ?$

A) $5 + 3x - 2x^2$ B) $2x^2 - 3x - 5$
C) $-2x^2 - 3x + 5$ D) $-2x^2 + 3x - 5$

4) $\left(\mathbf{64y^2 - 4}\right) \div (\mathbf{4y - 1}) = ?$

A) $16y - 4$ B) $16y + 4$
C) $16y + 1$ D) $16y - 1$

5) $\left(\mathbf{5x^3 - 17x^2 + 14x}\right) \div (\mathbf{x - 2}) = ?$

A) $5x^2 - 17x + 7$ B) $5x^2 + 17x - 7$
C) $5x^2 + 7x$ D) $5x^2 - 7x$

2 - MARKS QUESTIONS

Q. Divide. Write the quotient and the remainder:

1) $(x^2 + 3x + 9) \div (x - 3)$
2) $(6x^2 + 5x - 3) \div (2x - 1)$
3) $(3x^2 + x - 5) \div (x + 2)$
4) $(15x^2 - 8x - 10) \div (5x - 1)$

3 - MARKS QUESTIONS

Q. Divide. Write the quotient and the remainder:

1) $(m^4 - 16m^2 + 6m - 20) \div (m - 4)$
2) $(6x^3 - 17x^2 + 6x - 7) \div (2x - 3)$
3) $(x^4 + 3x^3 + 8x^2 + 12x - 7) \div (x^2 + 3)$

4 - MARKS QUESTIONS

Q. Divide. Write the quotient and the remainder:

1) $(y^4 + y^3 - y^2 + y - 1) \div (y^3 + 1)$
2) $(24p^4 - 25p^3 + 6p^2 - 56p + 24) \div (8p - 3)$
3) $(x^4 + 2x^3 - 3x^2 + 4x - 5) \div (x^2 + 2)$

ANSWERS

1 MARK QUESTIONS

1) C 2) B 3) A 4) B 5) D

2 MARKS QUESTIONS

1) $Q = x + 6; R = 27$
2) $Q = 3x + 4; R = 1$
3) $Q = 3x - 5; R = 5$
4) $Q = 3x - 1; R = -11$

3 MARKS QUESTIONS

1) $Q = m^3 + 4m^2 + 6; R = 4$
2) $Q = 3x^2 - 4x - 3; R = -16$
3) $Q = x^2 + 3x - 5; R = -3x + 8$

4 MARKS QUESTIONS

1) $Q = y + 1; R = -y^2 - 2$
2) $Q = 3p^3 - 2p^2 - 7; R = 3$
3) $Q = x^2 + 2x - 5; R = 5.$

BEST WISHES ...
DNYANADA PUBLICATIONS ...

Quadrilateral: Constructions and Types
(चौकोन रचना व चौकोनाचे प्रकार)

Construction of a quadrilateral:

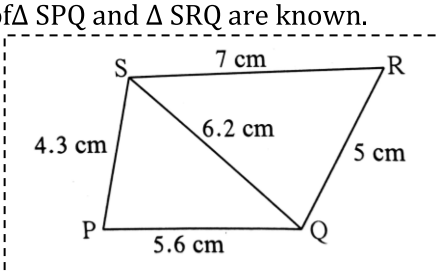
We can construct a quadrilateral if we know the measures of some specific 5 elements out of 10. Constructions of triangles are the basis of constructions of quadrilaterals. This will be clear from the following examples.

Construction of a quadrilateral (चौकोन रचना) -
Quadrilateral (चौकोनाच्या) दहा घटकांपैकी specific (विशिष्ट) पाच elements (घटकांची) मापे माहीत असतील तर त्या construction of quadrilaterals (चौकोनाची रचना) करता येते.
या रचनांचा आधार त्रिकोण रचना हाच असतो, हे पुढील उदाहरणांतून समजून घ्या.

I) To construct a quadrilateral if the lengths of four sides and a diagonal is given.

Ex. Construct □ PQRS such that,
$l(PQ) = 5.6$ cm , $l(QR) = 5$ cm, $l(PS) = 4.3$ cm, $l(RS) = 7$ cm, $l(QS) = 6.2$ cm

Solution: Let us draw a rough figure and show the given information in it. From the figure we see that the sides of Δ SPQ and Δ SRQ are known.



So if we construct ΔSPQ and ΔSRQ of given measures, we get □ PQRS. Construct the given quadrilateral on your own.

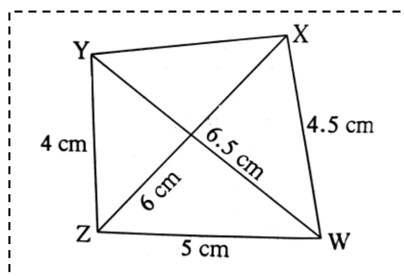
I) चौकोनाच्या चार sides (बाजू) आणि एक diagonal (कर्ण) दिला असता construct a quadrilateral (चौकोनाची रचना) करणे.

उदा.□ PQRS असा काढा की, l(PQ) 5.6सेमी, l(QR) = 5 सेमी, l(PS) = 4.3सेमी, l(RS) = 7 सेमी, l(QS) = 6.2 सेमी,
Solution (उकल): प्रथम rough (कच्ची) figure (आकृती) काढू. आकृतीत चौकोनाच्या दिलेल्या घटकांची information (माहिती) दाखवू. आकृतीवरून सहज दिसते, की △SPQ च्या आणि △SRQ च्या सर्व sides (बाजूंची) लांबी आपल्याला माहीत आहे. त्यानुसार △SPQ आणि △SPQ काढले की दिलेली measures (मापे) असणारा □PQRS मिळेल. ह्या quadrilateral (चौकोनाची) construct (रचना) your own (तुम्ही स्वत:) करा.

II) To construct a quadrilateral if three sides and two diagonals are given.

Ex. Construct□ WXYZ such that, $l(YZ) = 4$cm, $l(ZX) = 6$ cm, $(WX) = 4.5$ cm, $l(ZW) =$ cm, $l(YW) = 6.5$cm

Solution: Let us draw a rough figure and show the given measures in it.
From the figure we see that all sides of ΔWXZ and ΔWZY are known. So let us draw ΔWXZ and ΔWZY using given measures. We will get □ WXYZ after drawing segment XY.
Construct this quadrilateral on your own.



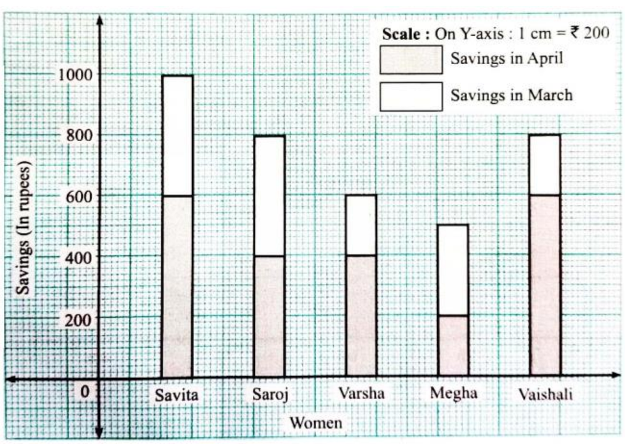
II) चौकोनाच्या तीन sides (बाजू) आणि दोन diagonals (कर्ण) दिले असता चौकोन रचना करणे.

उदा. □WXYZ असा काढा की, l(YZ) = 4 सेमी, l(ZX) = 6 सेमी, l(WX) = 4.5 सेमी, l(ZW) = 5 सेमी, l(YW) = 6.5 सेमी.
उकल: rough (कच्ची) figure (आकृती) काढू. दिलेली माहिती आकृतीत दाखवू. आकृतीवरून दिसते, की △WXZ च्या आणि △WZY च्या सर्व sides (बाजूंची) लांबी आपल्याला मिळाली आहे. त्यांनुसार △WXZ आणि△WZY काढू. नंतर रेख XY काढला की

Practice Set - 11.2

1) Observe the following graph and answer the questions:
i) State the type of the graph.
ii) How much is the savings of Vaishali in the month of April?
ii) How much is the total of savings of Saroj in the months March and April?
iv) How much more is the total savings of Savita than the total savings of Megha?
v) Whose savings in the month of April is the least?

खालील आकृतीचे Observation (निरीक्षण) करून प्रश्नांची उत्तरे लिहा.
1) ही आकृती कोणत्या प्रकारच्या स्तंभालेखाची आहे?
2) वैशालीची एप्रिल महिन्यातील **savings** (बचत) किती आहे?
3) सरोजची मार्च व एप्रिल महिन्यांतील एकूण बचत किती?
4) सविताची एकूण बचत मेघाच्या एकूण बचतीपेक्षा किती जास्त आहे?
5) कोणाची एप्रिल महिन्यातील बचत सर्वांत कमी आहे?



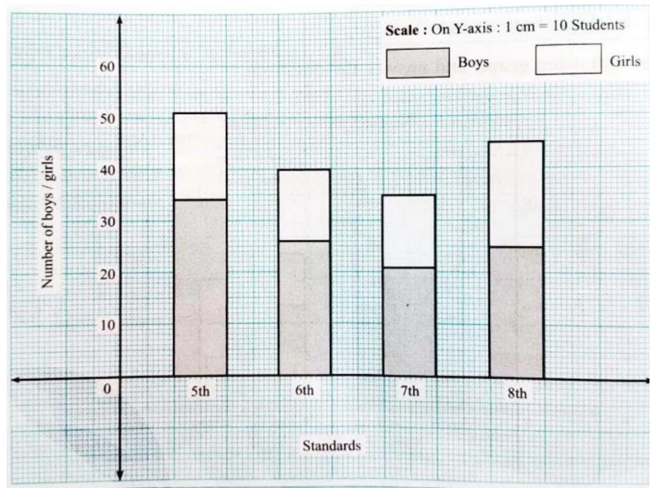
Ans:
i) The given graph is a subdivided bar graph.
ii) The savings of Vaishali in the month of April is ₹ 600.
iii) The total of savings of Saroj in the months of March and April is ₹ 800.
iv) The total savings by Savita is ₹ 1000 and that by Megha is ₹ 500. ₹$(1000 - 500) =$ ₹ 500.
The total savings by Savita is ₹ 500 more than that of Megha
v) The savings of Megha is the least in the month of April.

2) The number of boys and girls, in Std. 5 to Std. 8 in a Z.P. school is given in the table. Draw a subdivided bar graph to show the data.
(Scale: On Y axis, 1 cm = 10 students)

Standard	**5th**	**6th**	**7th**	**8th**
Boys	**34**	**26**	**21**	**25**
Girls	**17**	**14**	**14**	**20**

Solution:

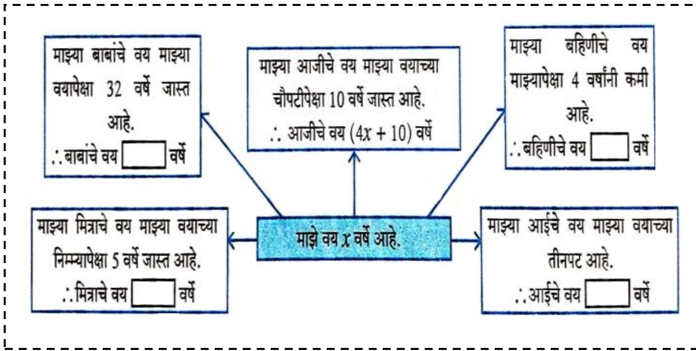
Standard	**5th**	**6th**	**7th**	**8th**
Boys	34	26	21	25
Girls	17	14	14	20
Total	51	40	35	45



3) In the following table number of saplings planed in the years 2016 and 2017 in four towns is given.Shown the data with the help of subdivided bar graph.

Town / Year	**Karjat**	**Wadgaon**	**Shivapur**	**Khandala**
2016	**150**	**250**	**200**	**100**
2017	**200**	**300**	**250**	**150**

Solution:



Word Problems (शाब्दिक उदाहरणे) -

Word problem (शाब्दिक उदाहरणातील) दिलेल्या माहितीसाठी variable (चल) वापरून ती माहिती algebraic expression (बैजिक राशींत) कशी लिहितात ते पाहू.

From the above information find my age if my friend's age is 12 years.

My age = x years

$\therefore$ friend's age $= \frac{x}{2} + 5$

$\frac{x}{2} + 5 = 12$ .... (Given)

$\therefore x + 10 = 24$ .... (Multiplying each term by 2)

$\therefore x = 24 - 10$

$\therefore x = 14,$

$\therefore$ My age is 14 years.

Find the ages of other persons from the above information.

आधी दिलेल्या माहितीनुसार माझ्या मित्राचे वय जर 12 वर्षे असेल तर माझे age (वय) किती?

माझे वय = x वर्षे $\therefore$ मित्राचे वय $= \frac{x}{2} + 5$

$\frac{x}{2} + 5 = 12$ .... (दिले आहे)

$\therefore x + 10 = 24$ ..... (प्रत्येक पदाला २ ने गुणून)

$\therefore x = 24 - 10$

$\therefore x = 14$

$\therefore$ माझे वय 14 वर्षे आहे. यावरून वरील माहितीतील ages of other persons (इतर व्यक्तींची वये) काढा.

Solved Examples

Ex.1) Joseph's weight is two times the weight of his younger brother. Find Joseph's weight if sum of their weights is 63 kg

Solution: Let the weight of Joseph's younger brother be x kg

$\therefore$ Joseph's weight is two times the weight of his younger brother = 2x

$\therefore$ from the given information $x + 2x = 63$

$\therefore 3x = 63$ $\therefore x = 21$

$\therefore$ Joseph's weight $= 2x = 2 \times 21 = 42$ kg

विद्यार्थी मित्रांनो, या example मध्ये आपण जोसेफच्या वजनाला x किग्रॅ मानले तर त्याच्या भावाचे वजन त्याच्या दुप्पट आहे त्याप्रमाणे ते 2x झाले तर उदाहरणात दिलेल्या माहितीवरून समीकरण तयार करून त्यांना सोडवून जोसफचे वजन काढले.

Ex.2) Numerator of a fraction is 5 more than its denominator. If 4 is added to numerator and denominator, the fraction obtained is $\frac{6}{5}$. Find the fraction.

Solution: Let the denominator of the fraction be x.

$\therefore$ Numerator of the fraction is 5 more than denominator means x + 5.

$\therefore$ The fraction is $\frac{x+5}{x}$.

If 4 is added to both numerator and denominator, fraction obtained is $\frac{6}{5}$

$$\therefore \frac{x + 5 + 4}{x + 4} = \frac{6}{5}$$

$$\therefore \frac{x + 9}{x + 4} = \frac{6}{5}$$

$$\therefore 5(x + 9) = 6(x + 4)$$

$$\therefore 5x + 45 = 6x + 24$$

$$\therefore 45 - 24 = 6x - 5x$$

$$\therefore 21 = x$$

$\therefore$ denominator of fraction = 21,

and numerator = 21 + 5 = 26

$$\therefore \text{fraction is} = \frac{26}{21}$$

Ex. 3) Ratna has ₹ 200 more than three times the amount Rafik has. If ₹ 300 from the amount with Ratna are given to Rafik, amount with Ratna will be $\frac{7}{4}$ times the amount with Rafik. Find the initial amount with Rafik.

the amount of ₹1 after 1 year $= 1 \times M = 1 \times \frac{100+R}{100} = 1 \times \left(1 + \frac{R}{100}\right)$

the amount of ₹P after 1 year $= P \times \frac{100+R}{100} = P \times \left(1 + \frac{R}{100}\right)$

∴ if the principle P, interest rate R p.c.p.a. and duration is N years then the amount after N years, $\mathbf{A = P \times \left(\frac{100+R}{100}\right)^N = P \times \left(1 + \frac{R}{100}\right)^N}$

Compound interest (चक्रवाढव्याज):

Fixed deposit or a loan (ठेव किंवा कर्ज) यावर बँक compound interest (चक्रवाढव्याज) आकारते, ते का व कसे हे आपण शिकूया.

शिक्षिका: सज्जनरावांनी एका बँकेतून द.सा.द.शे. 10 दराने 1 वर्षाने परतफेडीच्या अटीवर 10,000 रुपये कर्ज घेतले, तर वर्षअखेर त्यांना व्याजासह किती रक्कम द्यावी लागेल?

विद्यार्थी: येथे P = 10,000 रु. ; R = 10; N = 1 वर्ष.

$I = \frac{PNR}{100} = \frac{10000 \times 10 \times 1}{100} = 1000$रुपये.

∴ सज्जनरावांना वर्षअखेर व्याजासह $10,000 + 1000 = 11,000$ रुपये द्यावे लागतील.

विद्यार्थी: पण एखादा borrower (कर्जदार) वर्षअखेर व्याजाची रक्कम देखील भरू शकला नाही तर?

शिक्षिका: बँक प्रत्येक वर्षाच्या शेवटी interest (व्याज) आकारणी करते व दरवर्षी कर्जदाराने ती व्याजाची रक्कम बँकेत भरावी अशी Expectation (अपेक्षा) करते. कर्जदाराने पहिल्या वर्षानंतर व्याज दिले नाही, तर बँक दुसऱ्या वर्षासाठी principal (मुद्दल) व पहिल्या वर्षाचे व्याज मिळून होणारी रक्कम कर्ज आहे असे मानते. म्हणून मुद्दल आणि पहिल्या वर्षाचे व्याज मिळून जी रास होते, तीच रक्कम दुसऱ्या वर्षी मुद्दल मानून पुढे व्याज आकारले जाते. म्हणजे दुसऱ्या वर्षी व्याज आकारणी करताना मुद्दलाची रक्कम पहिल्या वर्षीच्या राशीएवढी असते. या पद्धतीने केलेल्या व्याज आकारणीस Compound interest (चक्रवाढव्याज) असे म्हणतात.

विद्यार्थी: सज्जनरावांनी duration of loan (कर्जफेडीची मुदत) आणखी एक वर्ष वाढवली तर?

शिक्षिका: तर दुसऱ्या वर्षासाठी 11,000 रुपये मुद्दल मानून त्यावर व्याज आणि amount (रास) काढावी लागेल.

विद्यार्थी: यासाठी आधीच्या इयत्तेत शिकलेले $\frac{Amount}{Principal} = \frac{110}{100}$ हे ratio (गुणोत्तर) वापरले तर चालेल ना?

शिक्षिका: नक्कीच! प्रत्येक वर्षासाठी $\frac{Amount}{Principal}$ हे गुणोत्तर constant (स्थिर) आहे. चक्रवाढव्याजाची आकारणी करताना प्रत्येक वर्षी मागील वर्षाची रास ही पुढच्या वर्षाचे मुद्दल असते. म्हणून व्याजाऐवजी थेट रास काढणे सोईचे ठरते. पहिल्या वर्षानंतर रास A_1, दुसऱ्या वर्षानंतर रास A_2, तिसऱ्या वर्षानंतर रास A_3 असे लिहू.

प्रथम मुद्दल P होते.

$\therefore \frac{A_1}{P} = \frac{110}{100} \quad \therefore A_1 = P \times \frac{110}{100}$

दुसऱ्या वर्षाची रास काढण्यासाठी

$\therefore \frac{A_2}{A_1} = \frac{110}{100} \quad \therefore A_2 = A_1 \times \frac{110}{100} = p \times \frac{110}{100} \times \frac{110}{100}$

विद्यार्थी: मग तिसऱ्या वर्षाची रास A_3 काढताना

$\therefore \frac{A_3}{A_2} = \frac{110}{100} \quad \therefore A_3 = A_2 \times \frac{110}{100} = p \times \frac{110}{100} \times \frac{110}{100} \times \frac{110}{100}$

शिक्षिका: शाब्बास! हे चक्रवाढव्याजाने रास काढण्याचे सूत्रच आहे. येथे, $\frac{110}{100}$ ही एक रुपयाची वर्षअखेर होणारी रास आहे हे लक्षात घ्या. जेवढ्या वर्षांची रास काढावयाची तेवढ्या वेळा मुद्दलाला या गुणोत्तराने गुणावे.

विद्यार्थी: म्हणजे पहिल्या वर्षाअखेर रास $\frac{\text{वर्ष}}{\text{मुद्दल}}$ हे गुणोत्तर M आहे आणि P हे मुद्दल आहे असे मानले तर वर्ष अखेर रास P ×M, दुसऱ्या वर्षाअखेर $P \times M^3$, तिसऱ्या वर्षाअखेर $P \times M^3$ होते. या रितीने कितीही वर्षांची रास काढता येते.

शिक्षिका: बरोबर! द. सा. द. शे. R हा व्याजाचा दर असेल, तर

∴ 1 रुपयाची 1 वर्षांने होणारी रास $= 1 \times M = 1 \times \frac{100 \times R}{100} = P \times (1 + \frac{R}{100})$

∴ P रुपयांची 1 वर्षाची रास $= P \times \frac{100 \times R}{100} = P \times (1 + \frac{R}{100})$

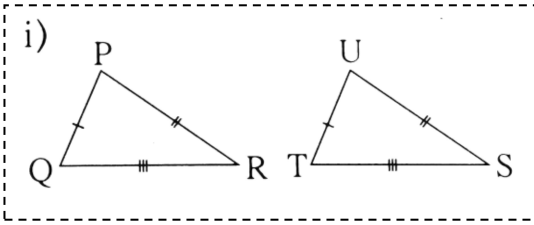
∴ मुद्दल P, व्याजाचा दसादशे दर R, मुदत N वर्षे असेल, तर N वर्षांनंतर रास, $A = P \times (\frac{100+R}{100})^N = P(1 + \frac{R}{100})^N$

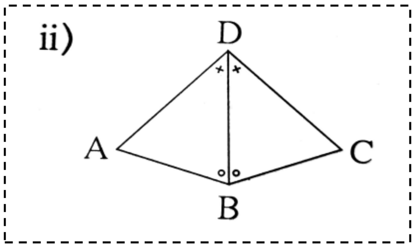
Solved Examples

Ex. 1) In the given figures parts of triangles bearing identical marks are congruent. State the test and the one to one correspondence of vertices by which the triangles in each pair are congruent.

पुढील आकृत्यांतील त्रिकोणांच्या प्रत्येक जोडीत सारख्या खुणांनी घटक एकरुप आहेत. प्रत्येक जोडीतील त्रिकोण कोणत्या

कसोट्यानुसार आणि शिरोबिंदूंच्या कोणत्या एकास एक संगतीनुसार एकरुप होतात, हे लिहा.





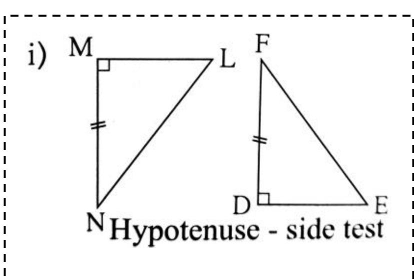
Solution:

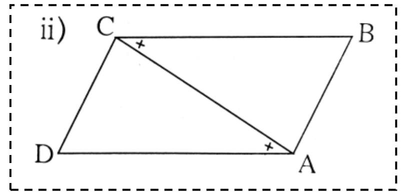
i) By SSS test, in the correspondence PQR ↔ UTS

ii) By ASA test, in the correspondence DBA ↔ DBC

Ex.2) In each pair of triangles in the following figures, parts indicated by identical marks are congruent. A test of congruence of triangles is given below each figure. State the additional information which is necessary to show that the triangles are congruent by the given test. With this additional information, state the one to one correspondence in which the triangles will be congruent.

पुढील आकृत्यांतील त्रिकोणांच्या प्रत्येक जोडीतील समान खुणांनी दाखवलेले घटक एकरुप आहेत. प्रत्येक आकृतीखाली त्रिकोणांच्या एकरुपतेची कसोटी लिहिली आहे. त्या कसोटीने त्रिकोण एकरुप होण्यासाठी आणखी कोणती माहिती देणे आवश्यक आहे आणि ती माहिती दिल्यावर त्रिकोण शिरोबिंदूंच्या कोणत्या एकास संगतीने एकरुप होतील, हे लिहा.





Solution:

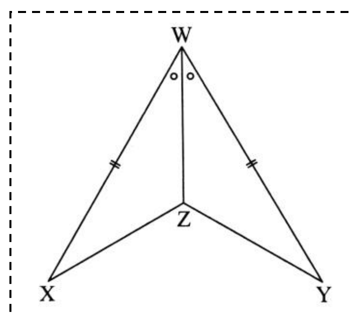
i) The given triangles are right angled. One of the sides of a triangle is congruent with a side of the other triangle. So the additional information necessary is hypotenuseLN ≅ hypotenuse EF. With this information the triangles will be congruent in the correspondence LMN ↔ EDF.

ii) The side CA of the two triangles is common. So the additional necessary information is∠DCA ≅ ∠BAC. With this information, the triangles will be congruent in the correspondence DCA ↔ BAC.

Practice Set - 13.1

Q. In each pair of triangles in the following figures, parts bearing identical marks are congruent. State the test and correspondence of vertices by which triangles in each pair are congruent:

i)



Q) Diameter of the circular garden is 42 m. There is a 3.5 m wide road around the garden. Find the area of the road.

Solution: Diameter of the circular garden = 42 m

$\therefore$ its radius (r) = $\frac{42}{2}$ = 21 m

Width of the road = 3.5 m

Radius of the outer circle (R) = r + width = 21 + 3.5

= 24.5 m

Area of the road = Area of the outer circle – Area of the inner circle

$$= \pi R^2 - \pi r^2$$
$$= \pi[R^2 - r^2]$$
$$= \frac{22}{7}[24.5^2 - 21^2]$$
$$= \frac{22}{7}[600.25 - 441]$$
$$= \frac{22}{7} \times 159.25$$
$$= 22 \times 22.75$$
$$= 500.5 \text{ sq m}$$

Ans: Area of the road is 500.5 sq m.

4) Find the area of the circle if its circumference is 88 cm.

Solution: Circumference of the circle = 88 cm

Circumference of the circle = $2\pi r$

$$\therefore 88 = 2 \times \frac{22}{7} \times r$$
$$\therefore r = \frac{88 \times 7}{2 \times 22}$$
$$\therefore r = 14 \text{ cm}$$

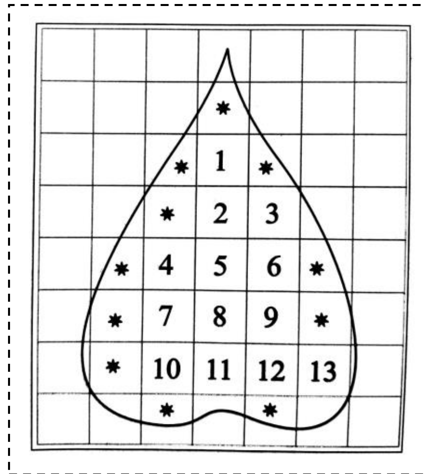
Area of the circle = πr^2

$$= \frac{22}{7} \times 14 \times 14$$
$$= 616 \text{ sq cm}$$

Ans: Area of the circle is 616 sq cm.

15.8 To find the approximate area of irregular figure.

Area of the irregular closed figure can be calculated approximately by using graph paper. Draw an outline of the given piece of object on the graph paper with pencil. Let us learn from the activity how the area of the given figure is calculated by counting the number of squares on the graph paper.



Irregular figures (अनियमित आकाराच्या आकृतीचे) approximate (अंदाजे) क्षेत्रफळ काढणे.

Graph paper (आलेख कागदाच्या) साहाय्याने कोणत्याही closed (बंदिस्त) आकृतीचे क्षेत्रफळ काढता येते. दिलेली आकृती किंवा वस्तूचे एखादे पृष्ठ आलेख कागदावर ठेवून त्याच्या outline (कडेने) पेन्सिल फिरवा. आलेख कागदावरील आकृतीचे area (क्षेत्रफळ) काढण्यासाठी squares (चौरसांची) संख्या कशी counting (मोजायची) व क्षेत्रफळ कसे काढायचे ते खालील कृतीवरून समजून घ्या.

1) The number of complete squares of area 1 sq cm = 13

$\therefore$Area of those squares is= 13 sq cm

2) In the figure the number of parts having area more than $\frac{1}{2}$ sq cm but less than 1 sq cm = 11

$\therefore$ Area of these parts = 11 sq cm

3) From the figure, number of parts having area $\frac{1}{2}$ sq cm = 0

$\therefore$ Area of these parts = 0 sq cm

4) From the figure count the parts having area less than $\frac{1}{2}$ sq cm such parts are not to be considered.

Area of these parts = 0 sq cm.

$\therefore$Total area= 13 + 11 + 0 + 0 = 24 sq cm.

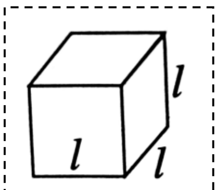
TOPIC – 16
SURFACE AREA AND VOLUME

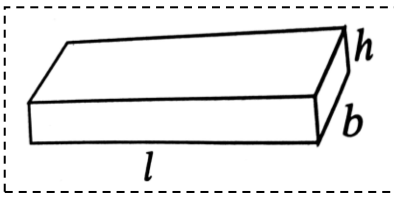
Surface area and volume (पृष्टफळ व घनफळ):

16.1 Introduction:

Total surface area of a cuboid $= 2(l \times b + b \times h + l \times h)$

Total surface area of a cube $= 6l^2$





$$1 \text{ m} = 100 \text{ cm}$$
$$1 \text{ sq m} = 100 \times 100 \text{ sq cm} = 10000 \text{ sq cm} = 10^4 \text{sq cm}$$
$$1 \text{ cm} = 10 \text{ mm}$$
$$1 \text{ sq cm} = 10 \times 10 \text{ sq mm} = 100 \text{ sq mm} = 10^2 \text{ sq mm}$$

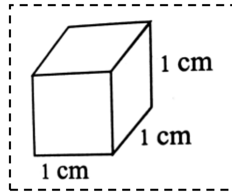
Cuboid, cube, cylinder etc. are three dimensional solid figures. **These solid figures occupy some space. The measure of the space occupied by a solid is called the volume of the solid.**

Cuboid (इष्टिकाचिती), cube (घन) आणि cylinder (वृत्तचिती) हे three dimensional (त्रिमितीय आकार) म्हणजेच solid figures (घनाकृती) असतात. त्या घनाकृती space (अवकाशातील जागा) occupied (व्यापतात). **घनाकृतीने अवकाशातील व्यापलेल्या जागेचे माप म्हणजे त्या volume of th solid (घनाकृतीचे घनफळ) होय.**

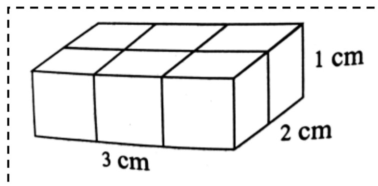
16.2 Standard unit of volume

The cube with side 1 cm is shown in the adjoining figure. The space occupied by this cube is a standard unit of volume. It is written as 1 cubic centimeter. In short it is written as 1 cc or 1cm^3 .

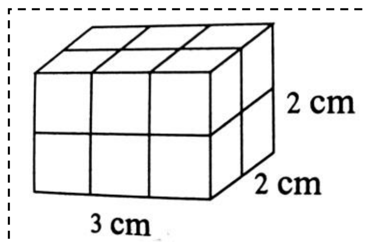
Standard unit of volume (घनफळाचे प्रमाणित एकक) - शेजारील आकृतीत. Cube (घनाची) प्रत्येक side (बाजू)1 सेमी आहे. या घनाने व्यापलेली जागा हे, volume (घनफळ) मापनाचे एक standard unit (प्रमाणित एकक) आहे. ते 1 घनसेंटिमीटर, थोडक्यात 1 घसेमी किंवा 1 सेमी³ असे लिहितात.



Activity I: Get some cubes with side 1 cm. Arrange 6 such cubes as shown in figure. We get a cuboid of length 3 cm, breadth 2 cm and height 1 cm. Note that the volume of the cuboid is $3 \times 2 \times 1 = 6$ cc



Activity II: The length, breadth and height of the adjoining cuboid is 3 cm , 2 cm and 2cm respectively. In this cuboid there are $3 \times 2 \times 2 = 12$ cubes of volume 1 cc each.



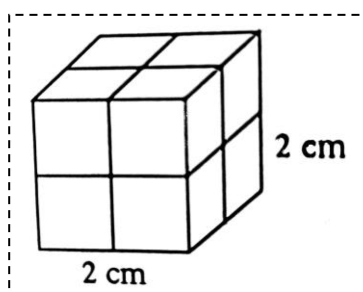
From this we get formula,

Volume of a cuboid = length × breadth × height.

Taking l for length, b for breadth and h for height,

Volume of a cuboid $= l \times b \times h$

Activity III: In the adjoin figure 8 cubes each of volume 1 cc are arranged. By this arrangement we get a cube of side 2 cm Note that volume of this cube $= 2 \times 2 \times 2 = 2^3$



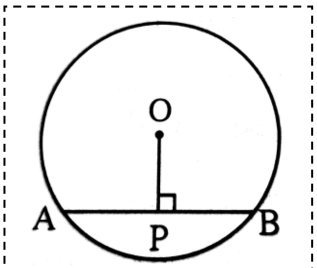
TOPIC – 17
CIRCLE - CHORD AND ARC

Circle – Chord and Arc (वर्तुळ: जीवा व कंस)

17.1 Properties of chord of a circle

Activity I:

Draw chord AB of a circle with centre O.
Draw perpendicular OP to chord AB.
Measure seg AP and seg PB.



Draw five circles with different radii. Draw a chord and perpendicular from the centre to each chord in each circle. Verify with a divider that the two parts of the chords are equal. You will get the following property.

Properties of chord of a circle (वर्तुळाच्या जीवेचे गुणधर्म)

कृती I:

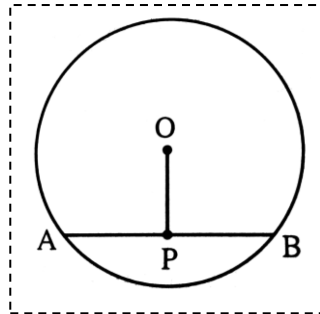
Centre (केंद्र) O असलेल्या वर्तुळाची रेख AB ही chord (जीवा) काढा.
केंद्र O मधून जीवा AB वर रेख OP perpendicular (लंब) काढा.
Segment (रेख) AP व रेख PB ची लांबी मोजा.
याप्रमाणे वेगवेगळ्या radii (त्रिज्येची) पाच वर्तुळे कागदावर काढा. प्रत्येक वर्तुळात एक जीवा काढून त्या जीवेवर केंद्रातून लंब काढा. जीवेचे झालेले दोन भाग समान आहेत का हे divider (कर्कटकाच्या) साहाय्याने verify (तपासून पाहा). तुम्हांला खालील property (गुणधर्म) मिळेल. अनुभव घ्या.

The perpendicular drawn from the centre of a circle to its chord bisects the chord.

Centre of circle (वर्तुळ केंद्रातून) chord (जीवेवर) टाकलेला perpendicular (लंब) जीवेला bisects (दुभागतो).

Activity - II:

Draw five circles of different radii on a paper. Draw a chord in each circle. Find the midpoint of each chord. Join the centre of the circle and midpoint of the chord as shown in the figure.



Name the chord as AB and midpoint of the chord as P. Check with set – square or protractor that ∠APO or ∠BPO are right angles.
Check whether the same result is observed for the chord of each circle.You will get the following property.

कृती II:

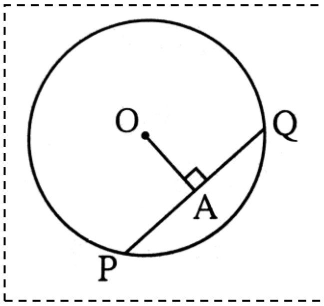
एका कागदावर वेगवेगळ्या त्रिज्यांची 5 वर्तुळे काढा. प्रत्येक वर्तुळात एक chord (जीवा) काढा. त्या जीवेचा midpoint (मध्यबिंदू) मिळवा. वर्तुळकेंद्र O व जीवेचा मध्य जोडा. शेजारील आकृतीत दाखवल्याप्रमाणे प्रत्येक जीवेला AB आणि जीवेच्या मध्यबिंदूला P हे नाव दया. ∠APO व∠BPO right angles (काटकोन) आहेत हे square (गुण्याने) किंवा protractor (कोनमापकाने) तपासून पाहा.
प्रत्येक वर्तुळातील जीवेच्या संदर्भात हाच अनुभव येतो हे पाहा. यावरून तुम्हांला खालील गुणधर्म मिळेल.

The segment joining the centre of a circle and midpoint of its chord is perpendicular to the chord.

वर्तुळाचे centre (केंद्र) व त्या वर्तुळातील chord (जीवेचा) midpoint (मध्यबिंदू) जोडणारा segment (रेषाखंड) हा त्या जीवेला perpendicular (लंब) असतो.

Solved Examples

Ex. 1) In a circle with centre O, seg PQ is a chord oflength 7 cm. seg OA ⊥ chord PQ, then find l(AP).

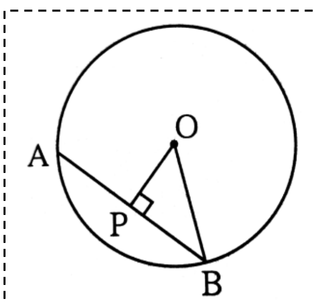


Solution: seg OA $\perp$ chord PQ, $\therefore$ point A is midpoint of chord PQ

$$\therefore \quad l(PA) = \frac{1}{2} l(PQ) = \frac{1}{2} \times 7 = 3.5 \ \text{cm}$$

Ex. 2) Radius of a circle with centre O is 10 cm. Find the length of the chord if the chord is at a distance of 6 cm from the centre.

Solution: Distance of the chord from the centre of the circle is the length of perpendicular drawn from the centre of the circle to the chord. AB is the chord of the circle with centre O.



seg OP $\perp$ chord AB

Radius of the circle = $l(OB) = 10$ cm.
$l(OP) = 6$ cm. Δ OPBis a right angled triangle. According to Pythagoras theorem,

$$[l(OP)]^2 + [l(PB)]^2 = [l(OB)]^2$$
$$\therefore \ 6^2 + [l(PB)]^2 = 10^2$$
$$\therefore \ [l(PB)]^2 = 10^2 - 6^2$$
$$\therefore \ [l(PB)]^2 = (10+6)(10-6) = 16 \times 4 = 64$$
$$\therefore \ l(PB) = 8 \text{ cm.}$$

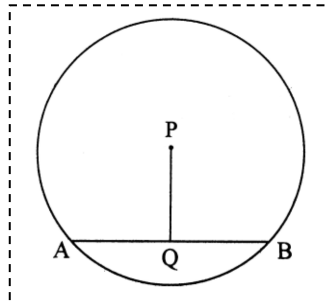
We know that, the perpendicular drawn from centre of the circle to the chord bisects the chord.

$$\therefore l(AB) = 2 \times l(PB) = 2 \times 8 = 16$$

$\therefore$ length of chord AB is 16 cm.

Practice Set 17.1

1) In a circle with centre P, chord AB is drawn of length 13 cm, seg PQ $\perp$ chord AB, then find $l(QB)$.



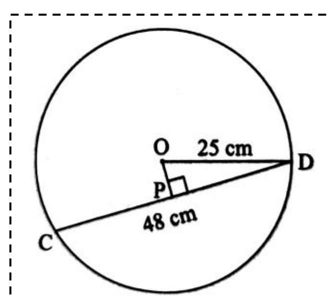
Solution:
$l(AB) = 13$ cm ..... (Given)
seg PQ $\perp$ chord AB
The perpendicular draw from the centre of a circle to its chord bisects the chord.

$$l(QB) = \frac{1}{2} \ l(AB)$$
$$\therefore l(QB) = \frac{1}{2} \times 13$$
$$\therefore l(QB) = 6.5 \text{ cm}$$

Ans: $l(QB) =$ **6.5 cm.**

विद्यार्थी मित्रांनो या example मध्ये आपल्याला QB ची लांबी काढायची आहे. पण रेख PQ $\perp$ जीवा AB आहे म्हणजेच रेख PQ जीवा AB चे दोन समान भागात रुपांतर करते. QB ची लांबी ही जीवा AB च्या निम्मी असेल त्याप्रमाणे QB ची लांबी उदाहरणात दाखवल्याप्रमाणे काढणे.

2) Radius of a circle with centre O is 25 cm. Find the distance of a chord from the centre if length of the chord is 48 cm.



Solution:
$l(OD) = 25$ cm ………
$l(CD) = 48$ cm } (Given)
seg OP $\perp$ chord CD

अशाच प्रकारे ...

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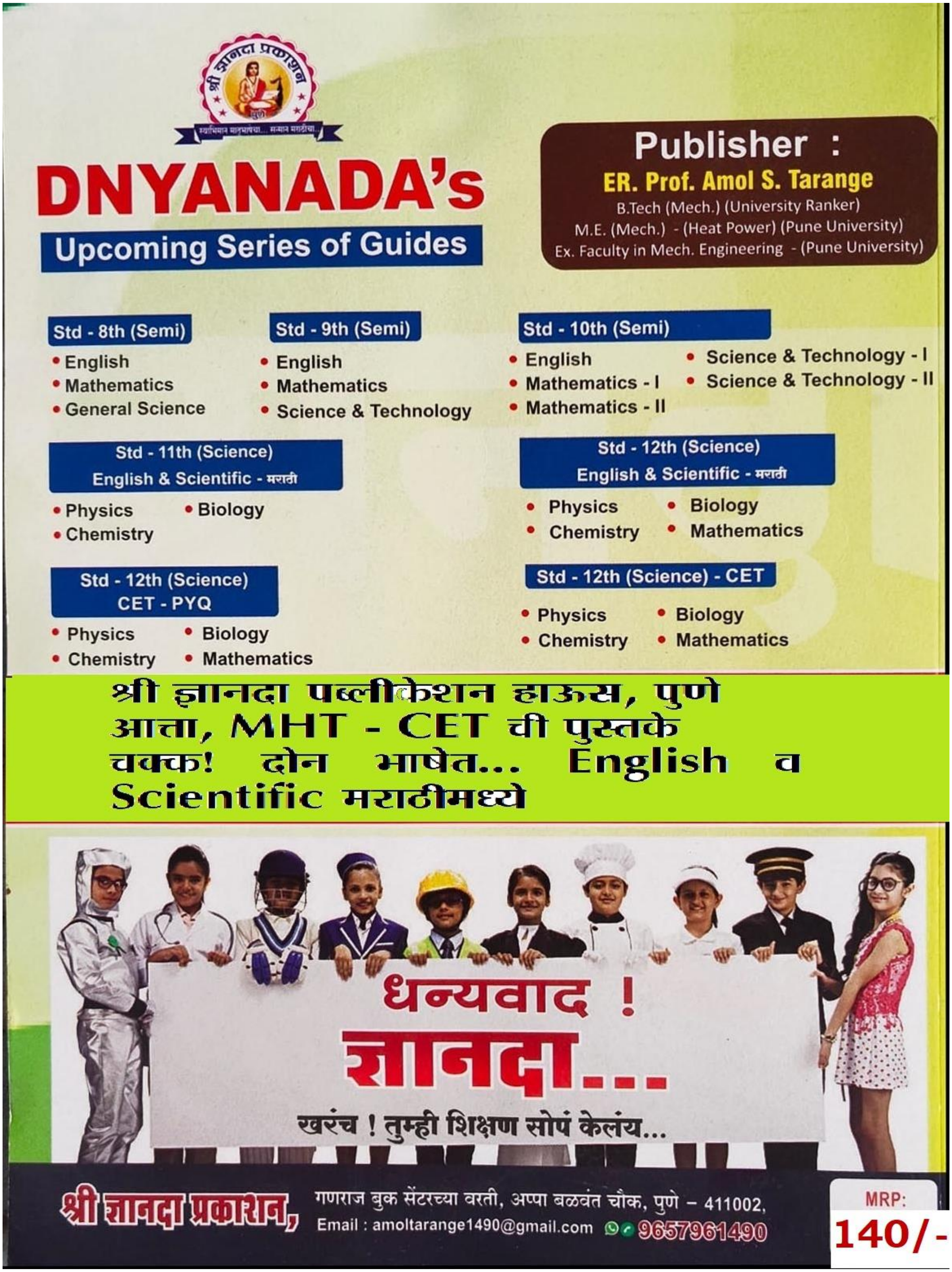
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