3. Subtract:

(i) $\frac{-6}{13}$ from $\frac{4}{13}$ (ii) $\frac{-1}{2}$ from $\frac{-2}{3}$ (iii) $\frac{5}{9}$ from $\frac{-2}{3}$.

4. Find:

(i) $\frac{5}{63}-\left(\frac{-6}{21}\right)$ (ii) $\frac{-6}{13}-\left(\frac{-7}{15}\right)$ (iii) $3\frac{1}{8}-\left(-1\frac{5}{6}\right)$.

5. The sum of two rational numbers is $\frac{2}{5}$. If one of them is $\frac{-4}{7}$, find the other.

6. What rational number should be added to $\frac{-5}{12}$ to get $\frac{-7}{8}$?

7. What rational number should be subtracted from $\frac{-2}{3}$ to get $\frac{-5}{6}$?

8. Find the product:

(i) $\frac{2}{3}\times\frac{-7}{8}$ (ii) $\frac{-6}{7}\times\frac{5}{7}$ (iii) $\frac{-2}{9}\times(-5)$

(iv) $\frac{-5}{11}\times\left(\frac{11}{-5}\right)$ (v) $\frac{8}{35}\times\frac{21}{-32}$ (vi) $\frac{-105}{128}\times\left(-1\frac{29}{35}\right)$.

9. Find the value of :

(i) $(-6)\div\frac{2}{5}$ (ii) $\frac{-1}{10}\div\frac{-8}{5}$ (iii) $\frac{-65}{14}\div\frac{13}{-7}$

(iv) $(-6)\div 3\frac{3}{5}$ (v) $\frac{-48}{49}\div\frac{72}{-35}$ (vi) $3\frac{1}{7}\div\left(\frac{-33}{34}\right)$

10. The product of two rational numbers is $\frac{18}{35}$. If one of them is $\frac{-2}{5}$, find the other.

11. Find the value of :

(i) $\left(\frac{13}{21}\div\frac{39}{42}\right)\times\left(\frac{-3}{5}\right)$ (ii) $\left(-5\frac{5}{21}\right)\div\left(\frac{7}{11}\times\frac{5}{12}\right)$

12. Find the reciprocal of the following :

(i) $\frac{3}{13}\div\frac{-4}{65}$ (ii) $\left(-5\times\frac{12}{15}\right)-\left(-3\times\frac{2}{9}\right)$.

(v) If p and q are positive integers, then $\frac{p}{q}$ is a .... rational number and $\frac{p}{-q}$ is a .... rational number.

2. State whether the following statements are true (T) or false (F):

(i) Zero is the smallest rational number. F

(ii) Every integer is a rational number. T

(iii) Every rational number is an integer. F

(iv) Every fraction is a rational number. T

(v) Every rational number is a fraction. F

(vi) The reciprocal of -1 is -1.

(vii) The difference of two rational numbers is always a rational number.

(viii) The quotient of two integers is always a rational number.

(ix) The value of a rational number remains the same if both its numerator and denominator are multiplied (or divided) by the same (non-zero) integer.

MULTIPLE CHOICE QUESTIONS

Choose the correct answer from the given four options (3 to 14):

3. The rational number $\frac{110}{-132}$ when reduced to standard form is

(a) $\frac{10}{-12}$ (b) $\frac{5}{-6}$ (c) $\frac{-5}{6}$ (d) $\frac{110}{-132}$.

4. Which of the following is not equal to the others?

(a) $\frac{21}{-56}$ (b) $\frac{-15}{40}$ (c) $\frac{-6}{16}$ (d) $\frac{18}{48}$

5. The multiplicative inverse of $\frac{-4}{9}$ is

(a) $\frac{4}{9}$ (b) $\frac{-9}{4}$ (c) $\frac{9}{4}$ (d) none of these.

6. The reciprocal of the rational number $-2\frac{3}{7}$ is

(a) $-\frac{17}{7}$ (b) $\frac{7}{17}$ (c) $-\frac{7}{17}$ (d) none of these.

7. The product of rational number $\frac{-2}{5}$ and its multiplicative inverse is

(a) 1 (b) 0 (c) $\frac{4}{25}$ (d) $\frac{2}{5}$.

8. The product of rational number $\frac{-2}{3}$ and its additive inverse is

(a) 1 (b) $\frac{2}{3}$ (c) $\frac{4}{9}$ (d) $\frac{-4}{9}$.

9. The sum of rational number $\frac{-1}{3}$ and its reciprocal is

(a) 0 (b) 1 (c) $\frac{-10}{3}$ (d) $\frac{-3}{10}$.

10. $\frac{-3}{5}-\left(\frac{-2}{15}\right)$ is equal to

(a) $\frac{-11}{5}$ (b) $\frac{-1}{15}$ (c) $\frac{-7}{15}$ (d) $\frac{7}{15}$.

(iii) The given numbers are multiples of 5 lying between −10 and 25 (both inclusive).

∴ Given set = $\{x \mid x = 5n, n \in \mathbf{I} \text{ and } -2 \le n \le 5\}$.

Exercise 5.1

1. State which of the following collections are sets :
   (i) All states of India
   (ii) Four cities of India having more than one lac population
   (iii) All tall students of your school
   (iv) Four colours of a rainbow
   (v) All beautiful flowers
   (vi) All clever people of Lucknow
   (vii) Last three days of a week
   (viii) All months of a year having atleast 30 days.
2. If **A** = {vowels of English alphabet}, then which of the following statements are true. In case a statement is incorrect, mention why.
   (i) $c \in A$ (ii) $\{a\} \in A$ (iii) $a, i, u \in A$
   (iv) $\{a, u\} \notin A$ (v) $\{a, i, u\} \in A$ (vi) $a, b \in A$.
3. Describe the following sets :
   (i) $\{a, b, c, d, e, f\}$ (ii) {2, 3, 5, 7, 11, 13, 17, 19}
   (iii) {Friday, Saturday, Sunday} (iv) {April, August, October}.
4. Write the following sets in tabular form and also in set builder form :
   (i) The set of even whole numbers which lie between 10 and 50
   (ii) {months of year having more than 30 days}
   (iii) The set of single digit whole numbers which are perfect square
   (iv) The set of factors of 36.
5. Write the following sets in roster form and also in description form :
   (i) $\{x \mid x = 4n, n \in \mathbf{W} \text{ and } n < 5\}$ (ii) $\{x : x = n^2, n \in \mathbf{N} \text{ and } n < 8\}$
   (iii) $\{y : y = 2x - 1, x \in \mathbf{W} \text{ and } x < 5\}$ (iv) $\{x : x$ is a letter in word ULTIMATUM$\}$.
6. Write the following sets in roster form :
   (i) $\{x \mid x \in \mathbf{N}, 5 \le x < 10\}$ (ii) $\{x \mid x = 6p, p \in \mathbf{I} \text{ and } -2 \le p \le 2\}$
   (iii) $\{x \mid x = n^2 - 1, n \in \mathbf{N} \text{ and } n < 5\}$ (iv) $\{x \mid x - 1 = 0\}$
   (v) $\{x \mid x$ is a consonant in word NOTATION$\}$
   (vi) $\{x \mid x$ is a digit in the numeral 11056771$\}$.
7. Write the following sets in set builder form :
   (i) {1, 3, 5, 7, ..., 29} (ii) {2, 3, 5, 7, 11, 13, 17, 19, 23, 29}
   (iii) {1, 4, 9, 16, 25, ...} (iv) $\left\{\frac{1}{5}, \frac{1}{6}, \frac{1}{7}, \ldots, \frac{1}{20}\right\}$
   (v) {−16, −8, 0, 8, 16, 24, 32, 40} (vi) {January, June, July}.
8. If V is the set of vowels in the word COMPETITION, write the given set in
   (i) description form (ii) set builder form (iii) roster form.

(*viii*) $\{x \mid x \in \mathbf{N}, x$ is a prime factor of 180$\}$
(*ix*) $\{x : x$ is a vowel in the word WHY$\}$
(*x*) $\{x : x = 5n, n \in \mathbf{W}$ and $x < 60\}$.

2. Which of the following describe the same sets :
(*i*) {vowels of English alphabet} and $\{e, a, u, i, o\}$
(*ii*) $\{a, b, d\}$ and $\{d, a, b, b\}$
(*iii*) {letters of PUPPET} and {E, T, P, U}
(*iv*) {1, 2, 3} and {2, 3, 4}
(*v*) {1, 2, 3, 4, 5} and $\{x \mid x \in \mathbf{N}, x \leq 5\}$.

3. Find pairs/groups of equal sets from the following sets :
A = {0, 1, 2, 3}
B = $\{x : x^2 < 10, x \in \mathbf{W}\}$
C = {letters of word FOLLOW}
D = {days of a week}
E = $\{x \mid x \in \mathbf{W}, x < 4\}$
F = {letters of word FLOW}
G = {Monday, Tuesday, ..., Sunday}
H = {letters of word WOLF}.

4. Find pairs/groups of equivalent sets from the following sets :
A = {colours of a rainbow}
B = {letters of word GOOD}
C = $\{x : x$ is a digit in the numeral 371011489$\}$
D = {letters of word TOM}
E = $\{x : x \in \mathbf{I}, x^2 < 10\}$
F = {months of a year}
G = {days of a week}
H = $\{x \mid x = 3n, n \in \mathbf{W}$ and $n < 12\}$
I = {all even numbers between 1 and 53}
J = {all letters of English alphabet}.

5. In the following, find whether $A \subset B$ or $B \subset A$ or none of these :
(*i*) A = {1, 2, 3}, B = {2, 3, 3, 3, 1, 3}
(*ii*) A = {2, 4, 6, ...}, B = {all natural numbers}
(*iii*) $A = \{x \mid x \in \mathbf{I}, x^2 < 20\}$, B = {0, 1, 2, 3, 4}
(*iv*) A = {letters of KING}, B = {letters of QUEEN}.

6. State whether each of the following statement is true or false for the sets A and B where
A = {letters of CLOUD} and B = {letters of KOLKATA}
(*i*) $A \subset B$ (*ii*) $B \subset A$ (*iii*) $A \leftrightarrow B$.

7. Write all the subsets of the following sets : (*i*) ϕ (*ii*) {3, 5} (*iii*) {2, 4, 6}.

8. If $A = \{x : x = 2n, n < 5\}$, then find A when : (*i*) $\xi = \mathbf{N}$ (*ii*) $\xi = \mathbf{W}$ (*iii*) $\xi = \mathbf{I}$.

Objective Type Questions

MENTAL MATHS

1. Fill in the blanks:
(*i*) If x is not a member of the set A, then symbolically we write it as ... .
(*ii*) Each element of a set is listed once and only ..., repetitions are removed.
(*iii*) A set that contains a limited number of different elements is called a ... set.
(*iv*) Two finite sets are called equivalent if and only if they have ... number of elements.

2. State whether the following statements are true (T) or false (F) :
(*i*) A collection of books is a set.

$\frac{x}{19} \Rightarrow x = 28 \times 20 \Rightarrow x = 560.$

Hence, the cost price of the item = ₹560.

Exercise 7.3

1. Rohan bought a calculator for ₹760 and sold it for ₹874. Find his profit and profit percentage.
2. Kirti bought a saree for ₹2500 and sold it for ₹2300. Find her loss and loss percent.
3. Tell what is profit or loss in the following transactions. Also find profit percent or loss percent in each case:
   (*i*) Gardening shears bought for ₹250 and sold for ₹325.
   (*ii*) A shirt bought for ₹250 and sold at ₹150.
4. Rajinder bought one almirah for ₹4800 and the other for ₹3640. He sold the first almirah at a gain of $13\frac{1}{3}$% and the other at a loss of 15%. How much did he gain or lose in the whole deal?
5. In a furniture shop, 24 tables were bought at the rate of ₹450 per table. The shopkeeper sold 16 of them at the rate of ₹ 600 per table and the remaining at the rate of ₹ 400 per table. Find his gain or loss percent.
6. By selling a fan for ₹810, a dealer makes a profit of ₹60. What is the cost price of the fan? What is his profit percent?

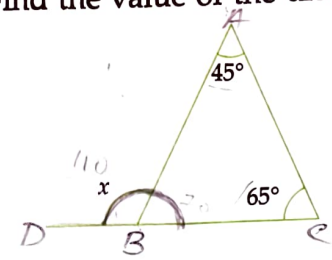
7. By selling a steel almirah for ₹3906, a manufacturer suffers a loss of ₹294. Find the cost price of the almirah and his loss percentage.
8. The cost price of a flower vase is ₹120. It the shopkeeper sells it at a loss of 10%, find the price at which it was sold.
9. I buy a T.V. for ₹10000 and sell it at a profit of 20%. How much money do I get for it?
10. A shopkeeper sells an article at ₹300, thus earning a profit of 20%. Find the cost price of the article.
11. A shopkeeper sells an article at ₹320, thus suffering a loss of 20%. Find the cost price of the article.
12. By selling a chair for ₹522, a shopkeeper makes a profit of 16%. What is its cost price?
13. A trader sold some damaged garments for ₹7360 at a loss of 8%. Find the cost price of the garments.
14. By selling a table for ₹3168, Rashid loses 12%. Find its cost price. What percent would he gain or lose by selling the table for ₹3870?
15. By selling an article for ₹4550, Tony incurs a loss of 9%. What percent would he gain or lose by selling it for ₹4825?
16. Arif bought a second hand car for ₹ 80000 and spent 12.5% of the cost of the car on its repairs. At what price should he sell the car to make a profit of 15%?

Exercise 7.4

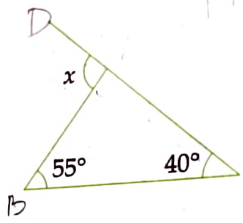
1. Find the simple interest on :
   (*i*) ₹350 for 2 years at 11% per annum
   (*ii*) ₹20000 for $4\frac{1}{2}$ years at $8\frac{1}{2}$% per annum
   (*iii*) ₹648 for 8 months at $16\frac{2}{3}$% per annum.
   Also find the amount in each case.
2. Find the time when :
   (*i*) simple interest on ₹2500 at 4% per annum is ₹200
   (*ii*) simple interest on ₹12000 at $6\frac{1}{2}$% per annum is ₹2730.
3. Find the rate of interest when :
   (*i*) simple interest on ₹1560 in 3 years is ₹585
   (*ii*) simple interest on ₹1625 in $2\frac{1}{2}$ years is ₹325.
4. Find the principal when :
   (*i*) simple interest at 16% per annum for $2\frac{1}{2}$ years is ₹3840
   (*ii*) simple interest at $7\frac{1}{2}$% per annum for 2 years 4 months is ₹2730.
5. Find the rate of interest when :
   (*i*) ₹1200 amounts to ₹1320 in 2 years
   (*ii*) ₹300 amounts to ₹400 in 2 years.
6. Find the time when :
   (*i*) ₹1250 amounts to ₹1950 at 16% per annum
   (*ii*) ₹6540 amounts to ₹8447.50 at $12\frac{1}{2}$ per annum.
7. ₹14000 is invested at 4% per annum simple interest. How long will it take for the amount to reach ₹16240?
8. An amount of money invested trebled in 6 years. Find the rate of interest earned.
9. Find the principal when :
   (*i*) final amount is ₹4500 at 20% per annum for 5 years
   (*ii*) final amount is ₹2420 at 4% per annum for $2\frac{1}{2}$ years.
10. If the simple interest on a certain sum of money for 3 years is three-tenth of the sum, then find the rate of interest per annum.
11. What sum of money will amount to ₹2760 in 3 years at 5% per annum simple interest?
12. A sum of ₹ 6000 amounts to ₹ 6900 in 3 years. What will it amount to if the rate of interest is increased by 2%?

Exercise 11.2

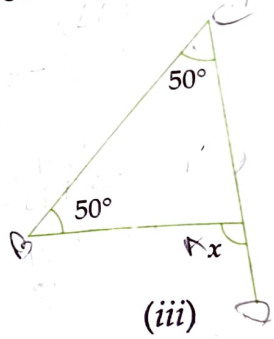
1. Find the value of the unknown exterior angle x in each of the following diagrams:



(*i*)

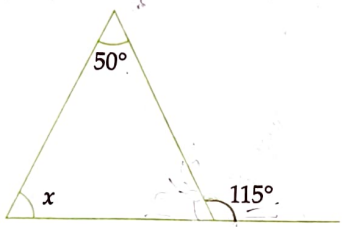


(*ii*)

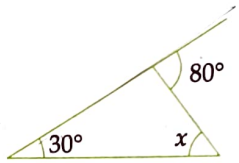


(*iii*)

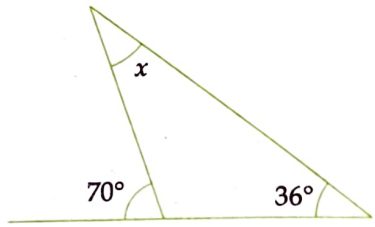
2. Find the value of the unknown interior angle x in each of the following diagrams:



(*i*)

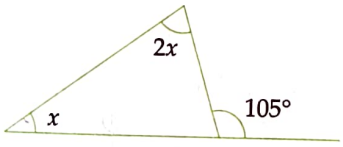


(*ii*)

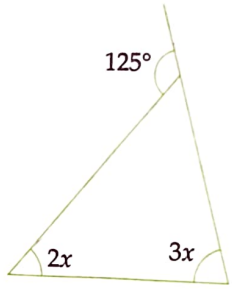


(*iii*)

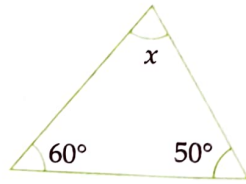
3. Find the value of x in each of the following diagrams:



(*i*)

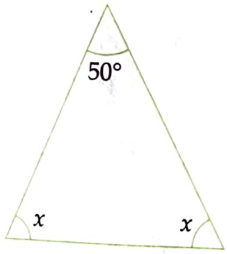


(*ii*)

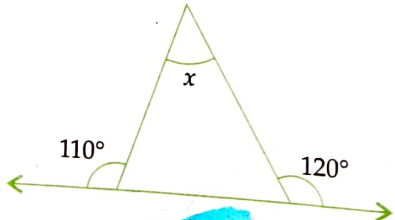


(*iii*)

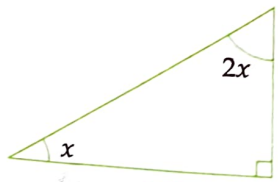
4. Find the value of unknown x in each of the following diagrams:



(*i*)

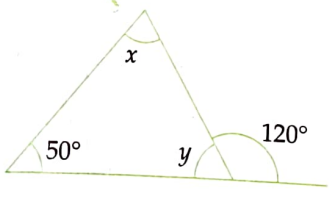


(*ii*)

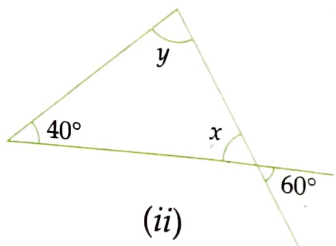


(*iii*)

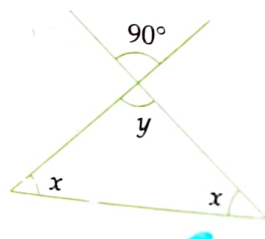
5. Find the values of x and y in each of the following diagrams:



(*i*)

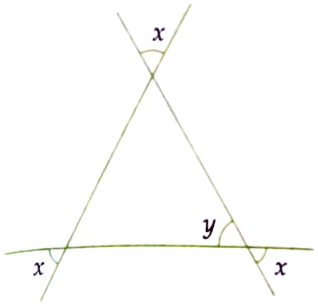


(*ii*)

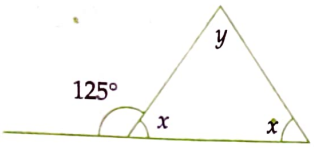


(*iii*)

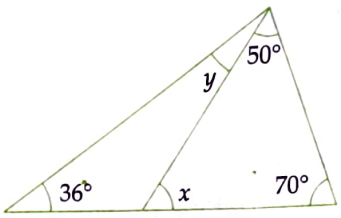
6. Find the values of x and y in each of the following diagrams:



(*i*)

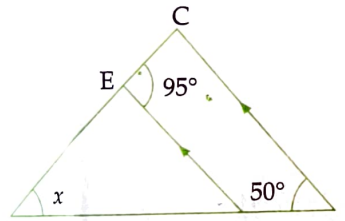


(*ii*)

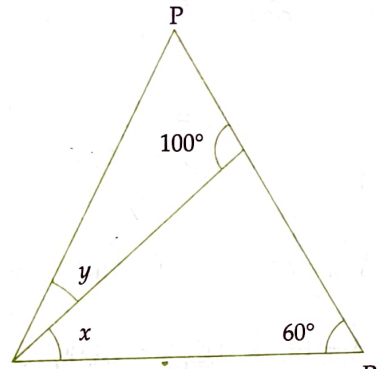


(*iii*)

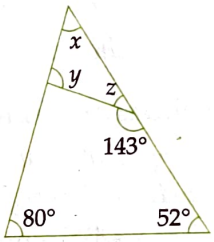
7. (*a*) In the fig. (*i*) given below, DE ∥ BC. Find the value of x.
   (*b*) In the fig. (*ii*) given below, $\angle P = 3y$. Find the values of x and y.
   (*c*) In the fig. (*iii*) given below, find the size of each lettered angle.



(*i*)



(*ii*)



(*iii*)

8. One of the angles of a triangle measures 80° and the other two angles are equal. Find the measure of each of the equal angles.
9. If one angle of a triangle is 60° and the other two angles are in the ratio 2 : 3, find these angles.
10. If the angles of a triangle are in the ratio 1 : 2 : 3, find the angles. Classify the triangle in two different ways.
11. Can a triangle have three angles whose measures are
    (*i*) 65°, 74°, 39°? (*ii*) $\frac{1}{3}$ right angle, 1 right angle, 60°?

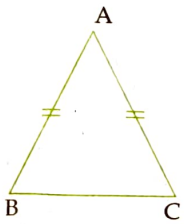
    [Hint. Find the sum of angles.]

Angle property of special triangles

Isosceles triangle

A triangle in which lengths of two sides are equal is called an ***isosceles triangle.***

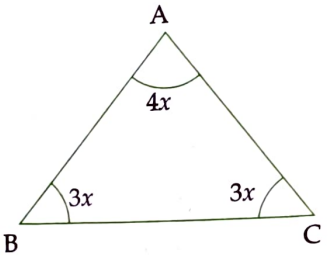
In the adjoining figure, AB = AC, so ΔABC is an isosceles triangle. The angles which are opposite equal sides are called *base angles* and ∠A is called *vertical angle.*



Make a replica of ∠B and place it over ∠C. We observe that replica of ∠B exactly covers ∠C. It follows that ∠B = ∠C *i.e.* the base angles are equal. It is an important result to remember.

Example 5. *The ratio between the vertical angle and a base angle of an isosceles triangle is 4 : 3. Find all the angles of the triangle.*

Solution. We know that the base angles of an isosceles triangle are equal.



Since the ratio between the vertical angle and a base angle of an isosceles triangle is 4 : 3, let the vertical angle be $4x$, then each base angle is $3x$.

$\therefore \quad 4x + 3x + 3x = 180°$ (sum of angles in a triangle)

$\Rightarrow \quad 10x = 180°$

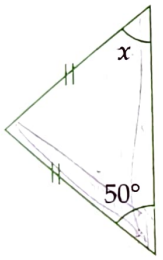
$\Rightarrow \quad x = 18°$

$\Rightarrow \quad 4x = 72°$ and $3x = 54°$.

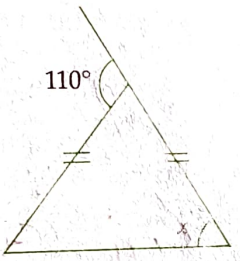
Hence, the angles of the triangle are 72°, 54°, 54°.

Exercise 11.3

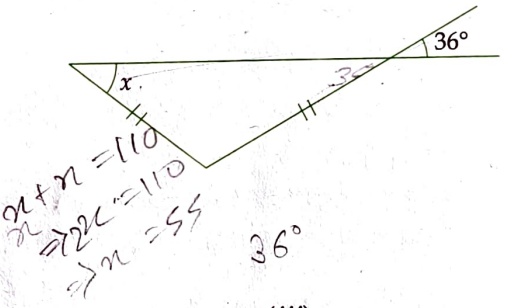
1. Find the value of x in each of the following figures:



(*i*)

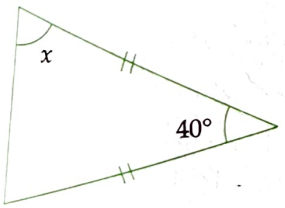


(*ii*)

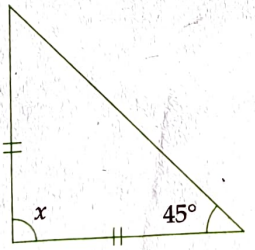


(*iii*)

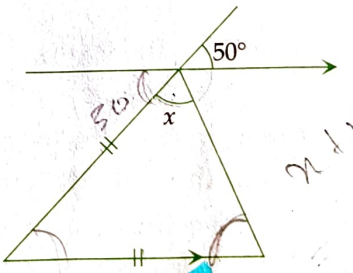
2. Find the value of x in each of the following figures:



(*i*)

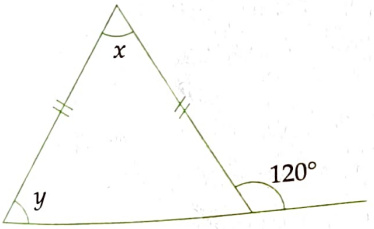


(*ii*)

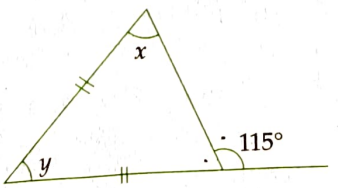


(*iii*)

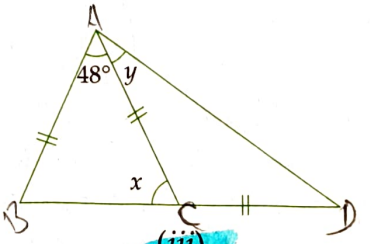
3. Find the values of x and y in each of the following figures:



(*i*)



(*ii*)



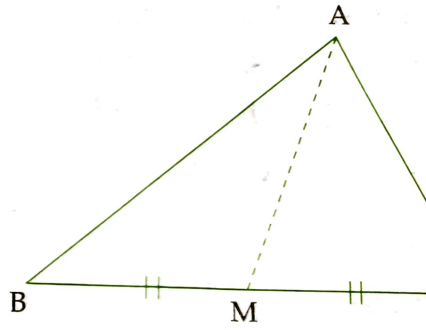
(*iii*)

given lengths *i.e.* (6 cm + 8 cm) *i.e.* 14 cm. length of third side must be less than the sum

Hence, the length of the third side of the triangle must greater than 2 cm and than 14 cm.

Example 3. *In the given figure, AM is a median of a triangle ABC. Show that* $AB + BC + CA > 2\ AM$.

Solution. We know that the sum of the lengths of two sides of a triangle > the length of third side.



In ΔABM, $AB + BM > AM$ ...(*i*)

In ΔACM, $MC + CA > AM$ ...(*ii*)

From (*i*) and (*ii*), we get

$$AB + BM + MC + CA > 2\ AM$$

$$\Rightarrow \quad AB + (BM + MC) + CA > 2\ AM$$

$$\Rightarrow \quad AB + BC + CA > 2\ AM. \qquad (\because BM + MC = BC)$$

Exercise 11.4

1. Is it possible to have a triangle with the following sides?

(*i*) 2 cm, 3 cm, 5 cm

(*ii*) 2.5 cm, 4.5 cm, 8 cm

(*iii*) 10.2 cm, 5.8 cm, 4.5 cm

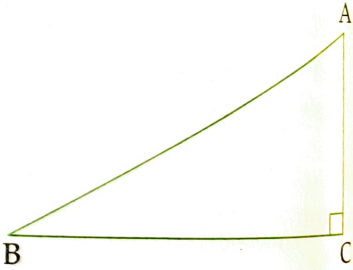
(*iv*) 3.4 cm, 4.7 cm, 6.2 cm.

2. If the lengths of two sides of a triangle are 7 cm and 10 cm, then what can be the length of the third side?

3. We know that in a triangle, the sum of lengths of any two sides is greater than the length of the third side. Is the sum of any angles of a triangle also greater than the third angle? If no, draw a rough sketch to show such a case.

Pythagoras property of a right angled triangle

In a right angled triangle, the sides have special names. The side opposite to the right angle is called **hypotenuse** and the other two sides are called the **legs** of the right angled triangle. Hypotenuse is the longest side. In the adjoining triangle ABC, $\angle C = 90°$. So, AB is its hypotenuse and BC and CA are the two legs.



Pythagoras property

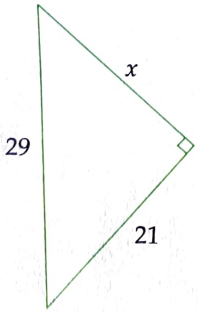
In a right angled triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.

or

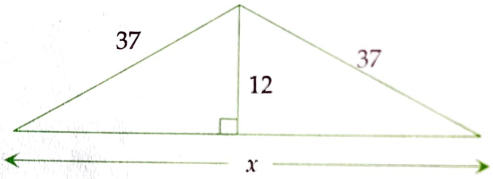
In a right angled triangle, the area of the square on the hypotenuse is equal to the sum of the areas of the squares on the other two sides.

Exercise 11.5

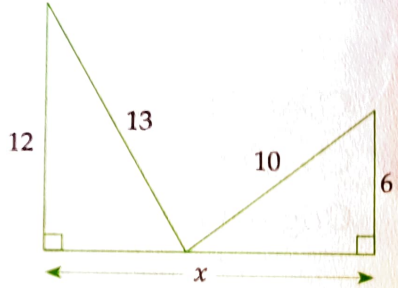
1. PQR is a triangle, right angled at P. If PQ = 10 cm and PR = 24 cm, find QR.
2. ABC is a triangle, right angled at C. If AB = 25 cm and AC = 7 cm, find BC.
3. Find the value of x in each of the following figures. All measurements are in centimetres.



(*i*)



(*ii*)

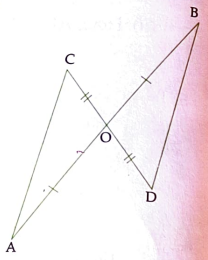


(*iii*)

4. Which of the following can be the sides of a right angled triangle?
   (*i*) 4 cm, 5 cm, 7 cm
   (*ii*) 1.5 cm, 2 cm, 2.5 cm
   (*iii*) 7 cm, 5.6 cm, 4.2 cm
   In case of right angled triangles, identify the right angles.
5. A 15 m long ladder reaches a window 12 m high from the ground on placing it against a wall. How far is the foot of the ladder from the wall?
6. Find the area and the perimeter of the rectangle whose length is 15 cm and the length of one diagonal is 17 cm.
7. If the diagonals of a rhombus measure 10 cm and 24 cm, find its perimeter.
8. The side of a rhombus is 5 cm. If the length of one diagonal of the rhombus is 8 cm, then find the length of the other diagonal.

(ii) From part (i), $\Delta ADB \cong \Delta ADC$ (SAS rule of congruency)
(Note that A ↔ A, D ↔ D and B ↔ C)
(iii) $\angle B = \angle C$ (corresponding parts of congruent triangles)

Example 8. *In the adjoining figure, $\overline{AB}$ and $\overline{CD}$ bisect each other at O.*



(i) State the three pairs of equal parts in two triangles AOC and BOD.
(ii) Which of the following statements is true?
(a) $\Delta AOC \cong \Delta DOB$
(b) $\Delta AOC \cong \Delta BOD$.

Solution. (i) In ΔAOC and ΔBOD, three pairs of equal parts are:

OA = OB	(given)
OC = OD	(given)
$\angle AOC = \angle BOD$	(vertically opposite angles)

(ii) From part (i), by SAS rule of congruency, the given triangles are congruent.

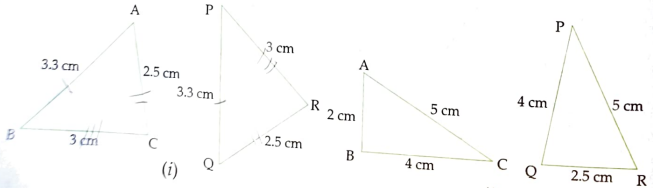
If we superpose trace-copy of ΔAOC on ΔBOD (by rotating), then the two triangles cover each other exactly. In this process, we note that A falls on B, C falls on D and O falls on O *i.e.* A ↔ B, C ↔ D and O ↔ O.

∴ $\Delta AOC \cong \Delta BOD$.

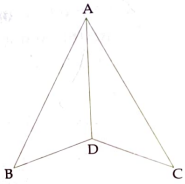
Hence, the statement (b) is true.

Exercise 12.1

1. If ΔABC and ΔDEF are congruent under the correspondence ABC ↔ FED, write all the corresponding congruent parts of the triangles.
2. If $\Delta DEF \cong \Delta BCA$, then write the part(s) of ΔBCA that correspond to
(i) $\angle E$ (ii) $\overline{EF}$ (iii) $\angle F$ (iv) $\overline{DF}$
3. In the figures given below, the lengths of the sides of the triangles are indicated. By using SSS congruency rule, state which pairs of triangles are congruent. In case of congruent triangles, write the result in symbolic form:

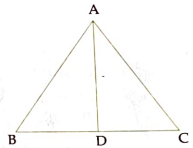


4. In the adjoining figure, AB = 5 cm, AC = 5 cm, BD = 2.5 cm and CD = 2.5 cm.



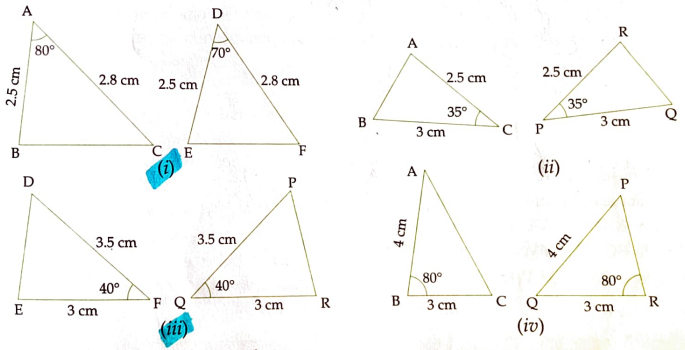
(i) State the three pairs of equal parts in ΔADB and ΔADC.
(ii) Is $\Delta ADB \cong \Delta ADC$? Give reasons.
(iii) Is $\angle B = \angle C$? Why?

5. In the adjoining figure, AB = AC and D is the mid-point of $\overline{BC}$.

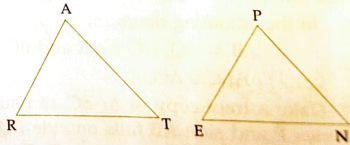


(i) State the three pairs of equal parts in ΔADB and ΔADC.
(ii) Is $\Delta ADB \cong \Delta ADC$? Give reasons.
(iii) Is $\angle B = \angle C$? Why?

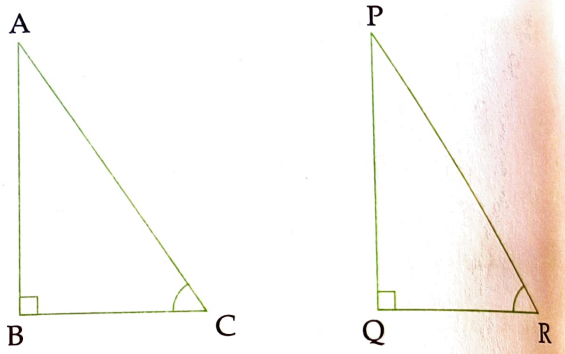
6. In the figures given below, the measures of some parts of the triangles are indicated. By using SAS rule of congruency, state which pairs of triangles are congruent. In case of congruent triangles, write the result in symbolic form.



7. By applying SAS congruence rule, you want to establish that $\Delta PQR \cong \Delta FED$. It is given that PQ = FE and RP = DF. What additional information is needed to establish the congruence?
8. You want to show that $\Delta ART \cong \Delta PEN$
(a) If you have to use SSS criterion, then you need to show
(i) AR = (ii) RT = (iii) AT =
(b) If it is given that $\angle T = \angle N$ and you are to use SAS criterion, you need to have
(i) RT = and (ii) PN =



3. If ΔABC and ΔPQR are to be congruent, name one additional pair of corresponding parts. What criterion did you use?



4. Given below are measurements of some parts of two triangles. Examine whether the two triangles are congruent or not, by ASA congruence rule. In case of congruence, write it in symbolic form.

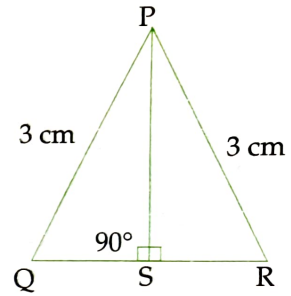
ΔDEF	ΔPQR
(*i*) $\angle D = 60°$, $\angle F = 80°$, DF = 5 cm	$\angle Q = 60°$, $\angle R = 80°$, QR = 5 cm
(*ii*) $\angle D = 60°$, $\angle F = 80°$, DF = 6 cm	$\angle Q = 60°$, $\angle R = 80°$, QP = 6 cm
(*iii*) $\angle E = 80°$, $\angle F = 30°$, EF = 5 cm	$\angle P = 80°$, PQ = 5 cm, $\angle R = 30°$

5. In the adjoining figure, measures of some parts are indicated.

(*i*) State three pairs of equal parts in triangles ABC and ABD.

(*ii*) Is $\Delta ABC \cong \Delta BAD$? Give reasons.

9. In the adjoining figure, measurements of some parts are given.

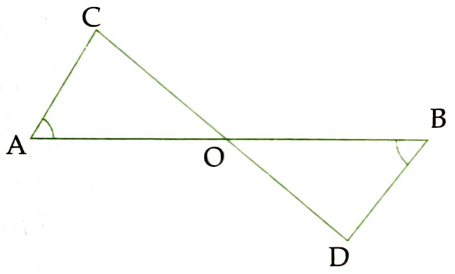


(*i*) State the three pairs of equal parts in ΔPQS and ΔPRS.

(*ii*) Is $\Delta PQS \cong \Delta PRS$? Give reasons.

(*iii*) Is S mid-point of $\overline{QR}$? Why?

10. In the adjoining figure, O is mid-point of $\overline{AB}$ and $\angle A = \angle B$. Show that $\Delta AOC \cong \Delta BOD$.



[**Hint.** $\angle AOC = \angle BOD$ (vertically opposite angles)
Also AO = OB. Use ASA congruence rule.]

Objective Type Questions

MENTAL MATHS

1. Fill in the blanks:

(*i*) Two line segments are congruent if ....

(*ii*) Among two congruent angles, one has a measure of 63°; the measure of the other

2. Draw a line l. Draw a perpendicular to l at any point on l. On this perpendicular choose a point A, 3.5 cm away from line l. Through A, draw a line m parallel to l.

3. Construct a triangle ABC, given that

   (*i*) AB = 5 cm, BC = 6 cm and AC = 7 cm

   (*ii*) AB = 4.5 cm, BC = 5 cm and AC = 6 cm.

4. Construct a triangle PQR given that PQ = 5.4 cm, QR = PR = 4.7 cm. Name the triangle.

5. Construct a triangle LMN such that length of each side is 5.3 cm. Name the triangle.

6. Construct a triangle ABC such that AB = 2.5 cm, BC = 6 cm and AC = 6.5 cm. Measure $\angle ABC$ and name the triangle.

7. Construct a triangle PQR, given that PQ = 3 cm, QR = 5.5 cm and $\angle PQR = 60°$.

8. Construct ΔDEF such that DE = 5 cm, DF = 3 cm and $m\angle EDF = 90°$.

9. Construct an isosceles triangle in which the length of each of its equal sides is 6.5 cm and the angle between them is 110°. Measure base angles.

10. Construct triangle XYZ if it is given that XY = 6 cm, $\angle X = 30°$ and $\angle Y = 100°$.

11. Construct a triangle PQR given that PQ = 4.9 cm, $\angle P = 45°$ and $\angle Q = 60°$. Measure $\angle R$.

12. Construct a right angled triangle whose hypotenuse is 6 cm long and one of the legs is 4 cm long.

H.W → 4, 5, 7, 11

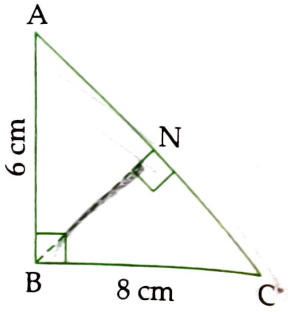
4. The perimeter of a rectangular field is 151 m. If its breadth is 32 m, find its length and area.
5. The area of a rectangular plot is 340 m^2 and its breadth is 17 m. Find the cost of surrounding the plot with a fence at ₹5.70 per metre.
6. The area of a square park is the same as that of a rectangular park. If the side of the square park is 60 m and the length of the rectangular park is 90 m, find the breadth of the rectangular park.
7. A wire is in the shape of a rectangle. Its length is 40 cm and breadth is 22 cm. If the same wire is rebent in the shape of a square, what will be the measure of each side? Also find which shape encloses more area and by how much?
8. A door of breadth 1m and height 2 m is fitted in a wall. The length of the wall is 4.5 m and the height is 3.6 m. Find the cost of white washing the wall, if the rate of white washing the wall is ₹20 per m^2.
9. A rectangular park is 45 m long and 30 m wide. A path 2.5 m wide is constructed outside the park. Find the area of the path.
10. A carpet of size 5 m × 2 m has 25 cm wide red border. The inner part of the carpet is blue in colour. Find the area of blue portion. What is the ratio of the areas of red portion to blue portion?
11. A *verandah* of width 2.25 m is constructed all along outside a room which is 5.5 m long and 4 m wide. Find:
    (*i*) the area of the *verandah*.
    (*ii*) the cost of cementing the floor of the *verandah* at the rate of ₹200 per m^2.
12. Two cross roads, each of width 5 m, run at right angles through the centre of a rectangular park of length 70 m and breadth 45 m and parallel to its sides. Find the area of the roads. Also find the cost of constructing the roads at the rate of ₹105 per m^2.
13. A rectangular room is 10 m long and 7.5 m wide. Find the cost of covering the floor with carpet 1.25 m wide at ₹250 per metre.
14. Find the cost of flooring a room 6.5 m by 5 m with square tiles of side 25 cm at the rate of ₹9.40 per tile.
15. The floor of a room is in the shape of a square of side 4.8 m. The floor is to be covered with square tiles of perimeter 1.2 m. Find the cost of covering the floor if each tile costs ₹27.
16. A rectangular plot of land is 50 m wide. The cost of fencing the plot at the rate of ₹18 per metre is ₹4680. Find
    (*i*) the length of the plot.
    (*ii*) the cost of leveling the plot at the rate of ₹7.6 per m^2.
17. The area of a rectangular plot is 460 m^2. If the length is 15% more than its breadth, find the perimeter of the plot.

AREA OF A PARALLELOGRAM

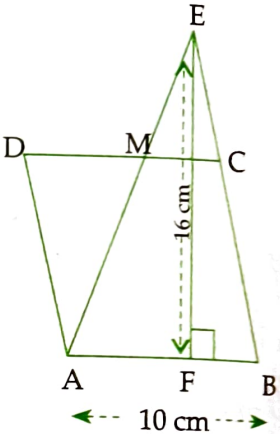
Base and height of a parallelogram

A parallelogram has two pairs of opposite sides which are equal and parallel. Any side can be taken as **base** of the parallelogram. The perpendicular dropped on that side from one of the opposite vertex is known as (**corresponding**) **height**.

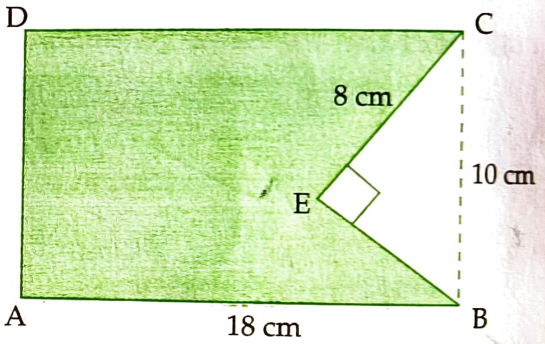
8. In the adjoining figure, ΔABC is right angled at B. Its legs are 8 cm and 6 cm. Find the length of perpendicular BN on the side AC.



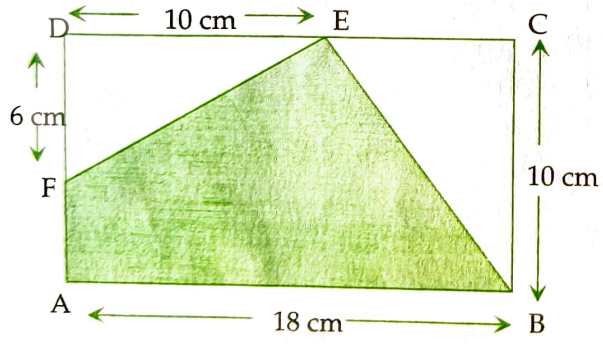
9. In the adjoining figure, area of ΔABE is equal to the area of parallelogram ABCD. If altitude EF is 16 cm long, find the length of the altitude of the parallelogram to the base AB of length 10 cm. What is the area of ΔAMD, where M is mid-point of side DC?



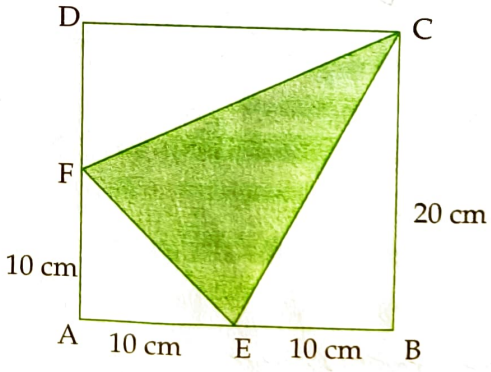
10. In the adjoining figure, ABCD is a rectangle of size 18 cm by 10 cm. In ΔBEC, $\angle E = 90°$ and EC = 8 cm. Find the area of the shaded region.



11. In the following figures, find the area of the shaded regions:

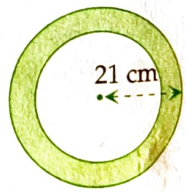


(i)

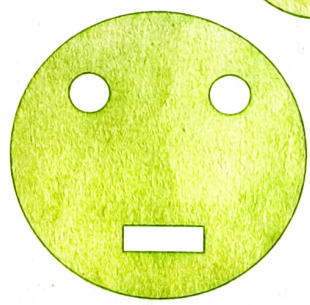


(ii)

5. A gardener wants to fence a circular garden of diameter 21 m. Find the length of the rope he needs to purchase, if he makes 2 rounds of fence. Also find the cost of the rope, if it costs ₹4 per metre.
6. If the circumference of a circle exceeds its diameter by 30 cm, find the radius of the circle.
7. Find the length of the diameter of a circle whose circumference is 44 cm.
8. The circumference of a circle is 31.4 cm. Find the radius and the area of the circle. (Take $\pi = 3.14$)
9. Find the radius and the circumference of a circle whose area is 144π cm^2.
10. How many times will the wheel of a car rotate in a journey of 88 km, given that the diameter of the wheel is 56 cm?
11. From a square cardboard of side 21 cm, a circle of maximum area is cut out. Find the area of the cardboard left.
[**Hint.** Diameter of circle of maximum area = 21 cm.]
12. A piece of wire is bent in the shape of an equilateral triangle of side 4.4 cm. If this wire is rebent to form of a circle, find the radius and the area of the circle.
13. A wire is in the form of a square of side 27.5 cm. It is straightened and bent into the shape of a circle. Find the area of the circle.
14. A wire is in the form of a rectangle 18.7 cm long and 14.3 cm wide. If this wire is reshaped and bent in the form of circle, find the radius and the area of the circle so formed.
15. The diameter of a circular park is 84 m. On its outside, there a 3.5 m wide road. Find the cost of constructing the road at ₹ 240 per m^2.
16. A circular pond is surrounded by a 2 m wide circular path. If the outer circumference of the circular path is 44 m, find the inner circumference of the circular path. Also find the area of the path.
17. In the adjoining figure, the area enclosed between the concentric circles is 770 cm^2. If the radius of the outer circle is 21 cm, calculate the radius of the inner circle.

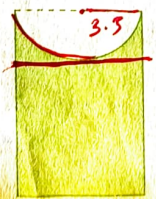


18. From a circular card sheet of radius 14 cm, two circles of radius 3.5 cm and a rectangle of length 3 cm and breadth 1 cm are removed (as shown in the adjoining figure). Find the area of the remaining sheet.

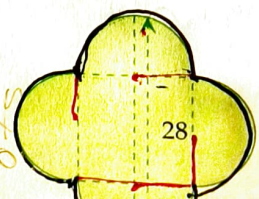


19. Calculate the length of the boundary and the area of the shaded region in the following diagrams. All measurements are in centimetres.

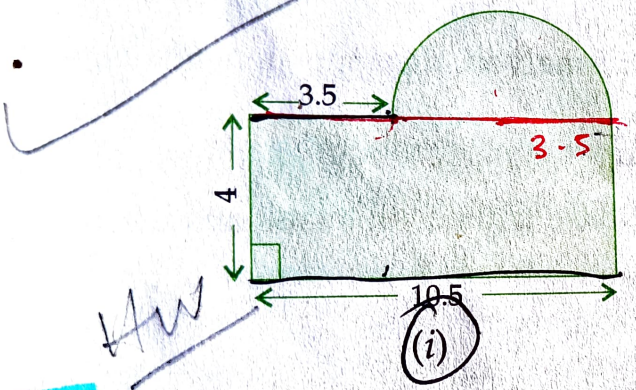
(*i*) Unshaded part is a semicircle



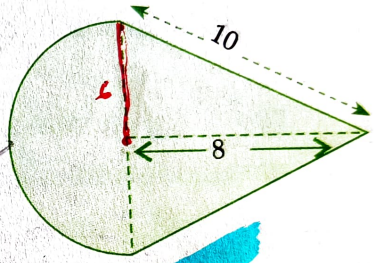
(*ii*) Four semicircles on a square.



20. Find the perimeter and the area of the shaded region in the following figures. All measurements all in centimetres.



(i)



(ii)

21. If a wire is bent in the shape of a square, the area of the square is 81 cm^2. When the same wire is bent into the form of a semicircular arc bounded by its diameter, find the area of the shape so formed. (take $\pi = \frac{22}{7}$).

Objective Type Questions

MENTAL MATHS

1. Fill in the blanks:

..... of a regular polygon = ... × length of a side.

Solution. To calculate the mean pocket money, we construct the following table:

Pocket money (in ₹) x_i	Number of students f_i	$f_i x_i$
5	4	20
8	5	40
10	5	50
15	12	180
20	12	240
25	2	50
Total	$\Sigma f_i = 40$	$\Sigma f_i x_i = 580$

$$\text{Mean} = \frac{\Sigma f_i x_i}{\Sigma f_i} = \frac{580}{40} = \frac{29}{2} = 14.5$$

Hence, mean pocket money per day = ₹14.50

Exercise 17.2

1. Find the mean of the following data:
   (*i*) 40, 30, 30, 0, 26, 60 (*ii*) 3, 5, 7, 9, 11, 13, 15.
2. Find the mean of the first five whole numbers.
3. A batsman scored the following number of runs in six innings:
   36, 35, 50, 46, 60, 55
   Calculate the mean runs scored by him in an inning.
4. The enrolment in a school during six consecutive years was as follows:
   1555, 1670, 1750, 2013, 2540, 2825
   Find the mean enrolment of the school for this period.
5. The marks (out of 100) obtained by a group of students in a science test are:
   85, 76, 90, 85, 39, 48, 56, 95, 81, 75
   Find the:
   (*i*) highest and lowest marks obtained by the students
   (*ii*) range of the marks obtained.
   (*iii*) mean marks obtained by the students.
6. The heights of 10 girls were measured in cm and the results are as follows:
   135, 150, 139, 128, 151, 132, 146, 149, 143, 141
   (*i*) What is the height of the tallest girl?
   (*ii*) What is the height of the shortest girl?
   (*iii*) What is the mean height of the girls?
   (*iv*) How many girls have heights more than the mean height?
7. If the arithmetic mean of 8, 4, 6, x, 2, 7 is 5, then find the value of x.
8. Find the mean of the following data:

Marks obtained	2	3	4	7	10
Number of students	3	2	6	7	2

2. Find the mode of the following data:

(*i*) 3, 1, 5, 6, 3, 4, 5, 3

(*ii*)

Marks obtained	15	17	20	22	25
Number of students	6	17	12	18	13

3. Find the median and the mode of the data:

13, 16, 12, 14, 19, 12, 14, 13, 14

4. The scores in mathematics test (out of 25) of 15 students is as follows:

19, 25, 23, 20, 9, 20, 15, 10, 5, 16, 25, 20, 24, 12, 20

Find the mode and median of this data. Are they same?

5. The weights (in kg) of 15 students of a class are:

38, 42, 35, 37, 45, 50, 32, 43, 43, 40, 36, 38, 43, 38, 47

(*i*) Find the median and mode of this data.

(*ii*) Is there more than one mode?

6. The runs scored in a cricket match by 11 players is as follows:

6, 15, 120, 50, 100, 80, 10, 15, 8, 10, 15

Find the mean, mode and median of this data. Are the three same?

7. Find the mode of the following data:

12, 14, 12, 15, 16, 13, 14, 18, 19, 12, 14, 15, 16, 15, 16, 16, 15, 17, 13, 16, 10, 15, 18, 15, 17, 15, 14, 15, 13, 15, 14.

(*vi*) The event is getting a number less than 7 and all the outcomes 1, 2, 3, 4, 5, 6 are less than 7. So, the number of favourable outcomes to the event getting a number less than 7 = 6.

$\therefore$ P (getting a number less than 7) $= \frac{6}{6} = 1$.

Note that in this experiment, getting a number less than 7 is a ***sure event.***

Example 3. *A bag contains 5 white and 9 red balls. One ball is drawn at random from the bag. Find the probability of getting*

(i) a white ball *(ii) a red ball.*

Solution. Total number of balls in the bag = 5 + 9 = 14.

(*i*) The event is getting a white ball.

The number of outcomes favourable to the event getting a white ball = 5.

$\therefore$ P (getting a white ball) $= \frac{5}{14}$.

(*ii*) The event is getting a red ball.

The number of outcomes favourable to the event getting a red ball = 9.

$\therefore$ P (getting a red ball) $= \frac{9}{14}$.

Exercise 17.4

1. Tell whether the following is certain to happen, impossible to happen, can happen but not certain:
   (*i*) You are older today than yesterday. Certain event
   (*ii*) Two hundred people can sit in a Maruti car. impossible to happen
   (*iii*) A tossed coin will land heads up. can happen but not certain
   (*iv*) A die when tossed shall land up with 8 on top. impossible to happen
   (*v*) India will win the next test series. can happen but not certain
   (*vi*) Tomorrow will be a cloudy day. can happen but not certain
   (*vii*) The next traffic light seen will be green. can happen but not certain
2. A coin is flipped to decide which team starts the game. What is the probability that your team will start the game? P(A) = number of times A can win(1) / total possible outcomes(2)
3. There are 6 marbles in a box with numbers 1 to 6 marked on them.
   (*i*) What is the probability of drawing a marble with number 5?
   (*ii*) What is the probability of drawing a marble with number 2?
4. A die is tossed once. Find the probability of getting
   (*i*) a number less than 3) = 2/6 = 1/3 (*ii*) a prime number) = 3/6 = 1/2
   (*iii*) a number greater than 2.) = 4/6 = 2/3
5. A box contains 3 defective mangoes and 21 good mangoes. One mango is drawn from the box at random. Find the probability of getting
   (*i*) a defective mango) = 3/24 = 1/8 (*ii*) a good mango) = 21/24 = 7/8
6. A card is drawn from a well-shuffled pack of 52 playing cards. Find the probability of getting
   (*i*) a red card (*ii*) a king (*iii*) a card of spades.
   any red card