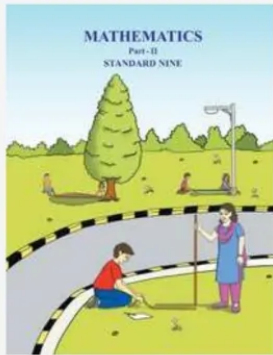


Maharashtra Board Solutions Class 9-Maths

(Part 2): Chapter 3.1- Triangles

BOOK SOLUTIONS
CLASS 9
MATHS (PART 2)

CHAPTER 3.1
Triangles



Maharashtra Board Solutions→

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Maharashtra Board Solutions Class 9-Maths

(Part 2): Chapter 3.1- Triangles

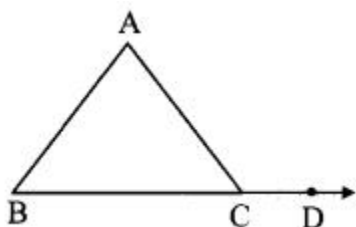
Class 9: Maths Chapter 3.1 solutions. Complete Class 9 Maths Chapter 3.1 Notes.

Maharashtra Board Solutions Class 9-Maths (Part 2): Chapter 3.1- Triangles

Maharashtra Board 9th Maths Chapter 3.1, Class 9 Maths Chapter 3.1 solutions

Question 1.

In the adjoining figure, $\angle ACD$ is an exterior angle of $\triangle ABC$. $\angle B = 40^\circ$, $\angle A = 70^\circ$.
Find the measure of $\angle ACD$.



Solution:

$$\angle A = 70^\circ, \angle B = 40^\circ \text{ [Given]}$$

$\angle ACD$ is an exterior angle of $\triangle ABC$. [Given]

$$\therefore \angle ACD = \angle A + \angle B$$

$$= 70^\circ + 40^\circ$$

$$\therefore \angle ACD = 110^\circ$$

Question 2.

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In ΔPQR , $\angle P = 70^\circ$, $\angle Q = 65^\circ$, then find $\angle R$.

Solution:

$$\angle P = 70^\circ, \angle Q = 65^\circ \text{ [Given]}$$

In ΔPQR ,

$$\angle P + \angle Q + \angle R = 180^\circ \text{ [Sum of the measures of the angles of a triangle is } 180^\circ]$$

$$\therefore 70^\circ + 65^\circ + \angle R = 180^\circ$$

$$\therefore \angle R = 180^\circ - 70^\circ - 65^\circ$$

$$\therefore \angle R = 45^\circ$$

Question 3.

The measures of angles of a triangle are x° , $(x - 20)^\circ$, $(x - 40)^\circ$. Find the measure of each angle.

Solution:

The measures of the angles of a triangle are x° , $(x - 20)^\circ$, $(x - 40)^\circ$. [Given]

$$\therefore x^\circ + (x - 20)^\circ + (x - 40)^\circ = 180^\circ \text{ [Sum of the measures of the angles of a triangle is } 180^\circ]$$

$$\therefore 3x - 60 = 180$$

$$\therefore 3x = 180 + 60$$

$$\therefore 3x = 240$$

$$\therefore x = 240$$

$$\therefore x = \frac{240}{3} = 80$$

$$\therefore x = 80^\circ$$

$\therefore$ The measures of the remaining angles are

$$x - 20^\circ = 80^\circ - 20^\circ = 60^\circ,$$

$$x - 40^\circ = 80^\circ - 40^\circ = 40^\circ$$

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$\therefore$ The measures of the angles of the triangle are 80° , 60° and 40° .

Question 4.

The measure of one of the angles of a triangle is twice the measure of its smallest angle and the measure of the other is thrice the measure of the smallest angle. Find the measures of the three angles.

Solution:

Let the measure of the smallest angle be x° .

One of the angles is twice the measure of the smallest angle.

$\therefore$ Measure of that angle = $2x^\circ$

Another angle is thrice the measure of the smallest angle.

$\therefore$ Measure of that angle = $3x^\circ$

$\therefore$ The measures of the remaining two angles are $2x^\circ$ and $3x^\circ$.

Now, $x^\circ + 2x^\circ + 3x^\circ = 180^\circ$ [Sum of the measures of the angles of a triangle is 180°]

$$\therefore 6x = 180$$

$$\therefore x = 180$$

$$\therefore x = \frac{180}{6} = 30$$

$$\therefore x^\circ = 30^\circ$$

The measures of the remaining angles are $2x^\circ = 2 \times 30^\circ = 60^\circ$

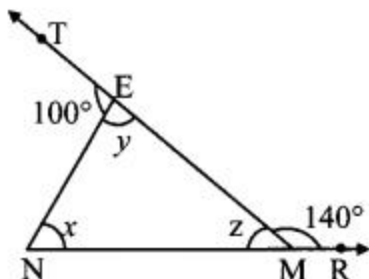
$$3x^\circ = 3 \times 30^\circ = 90^\circ$$

The measures of the three angles of the triangle are 30° , 60° and 90° .

Question 5.

In the adjoining figure, measures of some angles are given. Using the measures, find the values of x , y , z .

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**Solution:**

i. $\angle NET = 100^\circ$ and $\angle EMR = 140^\circ$

$$\angle EMN + \angle EMR = 180^\circ$$

$$\therefore z + 140^\circ = 180^\circ$$

$$\therefore z = 180^\circ - 140^\circ$$

$$\therefore z = 40^\circ$$

ii. Also, $\angle NET + \angle NEM = 180^\circ$ [Angles in a linear pair]

$$\therefore 100^\circ + y = 180^\circ$$

$$\therefore y = 180^\circ - 100^\circ$$

$$\therefore y = 80^\circ$$

iii. In $\triangle ENM$,

$$\therefore \angle ENM + \angle NEM + \angle EMN = 180^\circ \text{ [Sum of the measures of the angles of a triangle is } 180^\circ]$$

$$\therefore x + 80^\circ + 40^\circ = 180^\circ$$

$$\therefore x = 180^\circ - 80^\circ - 40^\circ$$

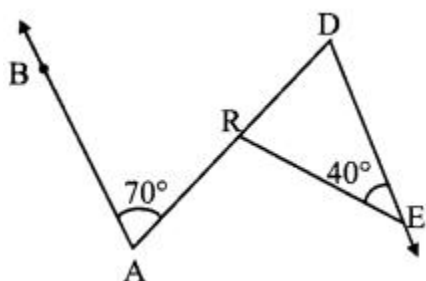
$$\therefore x = 60^\circ$$

$$\therefore x = 60^\circ, y = 80^\circ, z = 40^\circ$$

Question 6.

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In the adjoining figure, line AB || line DE. Find the measures of $\angle DRE$ and $\angle ARE$ using given measures of some angles.



Solution:

i. $\angle BAD = 70^\circ$, $\angle DER = 40^\circ$ [Given]

line AB || line DE and seg AD is their transversal.

$\therefore \angle EDA = \angle BAD$ [Alternate Angles]

$\therefore \angle EDA = 70^\circ$ (i)

In $\triangle DRE$,

$\angle EDR + \angle DER + \angle DRE = 180^\circ$ [Sum of the measures of the angles of a triangle is 180°]

$\therefore 70^\circ + 40^\circ + \angle DRE = 180^\circ$ [From (i) and D – R – A]

$\therefore \angle DRE = 180^\circ - 70^\circ - 40^\circ$

$\therefore \angle DRE = 70^\circ$

ii. $\angle DRE + \angle ARE = 180^\circ$ [Angles in a linear pair]

$\therefore 70^\circ + \angle ARE = 180^\circ$

$\therefore \angle ARE = 180^\circ - 70^\circ$

$\therefore \angle ARE = 110^\circ$

$\therefore \angle DRE = 70^\circ$, $\angle ARE = 110^\circ$

Question 7.

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In $\triangle ABC$, bisectors of $\angle A$ and $\angle B$ intersect at point O. If $\angle C = 70^\circ$, find the measure of $\angle AOB$.

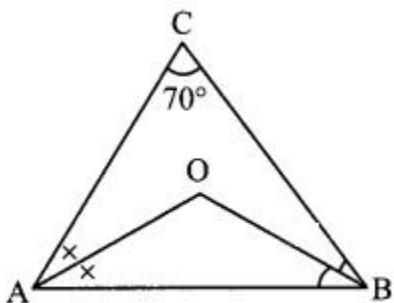
Solution:

$$\angle OAB = \angle OAC = \frac{1}{2} \angle BAC \dots (i) \text{ [Seg AO bisects } \angle BAC]$$

$$\angle OBA = \angle OBC = \frac{1}{2} \angle ABC \dots (ii) \text{ [Seg BO bisects } \angle ABC]$$

In $\triangle ABC$,

$$\angle BAC + \angle ABC + \angle ACB = 180^\circ \text{ [Sum of the measures of the angles of a triangle is } 180^\circ]$$



$$\therefore \angle BAC + \angle ABC + 70^\circ = 180^\circ$$

$$\therefore \angle BAC + \angle ABC = 180^\circ - 70^\circ$$

$$\therefore \angle BAC + \angle ABC = 110^\circ$$

$$\therefore \frac{1}{2}(\angle BAC) + \frac{1}{2}(\angle ABC) = \frac{1}{2} \times 110^\circ \text{ [Multiplying both sides by } \frac{1}{2}]$$

$$\therefore \angle OAB + \angle OBA = 55^\circ \dots (iii) \text{ [From (i) and (ii)]}$$

In $\triangle AOB$,

$$\angle OAB + \angle OBA + \angle AOB = 180^\circ \text{ [Sum of the measures of the angles of a triangle is } 180^\circ]$$

$$\therefore 55^\circ + \angle AOB = 180^\circ \text{ [From (iii)]}$$

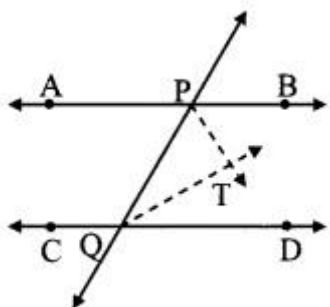
$$\therefore \angle AOB = 180^\circ - 55^\circ$$

$$\therefore \angle AOB = 125^\circ$$

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Question 8.

In the adjoining figure, line $AB \parallel$ line CD and line PQ is the transversal. Ray PT and ray QT are bisectors of $\angle BPQ$ and $\angle PQD$ respectively. Prove that $m \angle PTQ = 90^\circ$.



Given: line $AB \parallel$ line CD and line PQ is the transversal.

ray PT and ray QT are the bisectors of $\angle BPQ$ and $\angle PQD$ respectively.

To prove: $m \angle PTQ = 90^\circ$

Solution:

Proof:

$$\angle TPB = \angle TPQ = \frac{1}{2} \angle BPQ \dots (i) \text{ [Ray PT bisects } \angle BPQ]$$

$$\angle TQD = \angle TQP = \frac{1}{2} \angle PQD \dots (ii) \text{ [Ray QT bisects } \angle PQD]$$

line $AB \parallel$ line CD and line PQ is their transversal. [Given]

$$\therefore \angle BPQ + \angle PQD = 180^\circ \text{ [Interior angles]}$$

$$\therefore \frac{1}{2} (\angle BPQ) + \frac{1}{2} (\angle PQD) = \frac{1}{2} \times 180^\circ \text{ [Multiplying both sides by } \frac{1}{2}]$$

$$\angle TPQ + \angle TQP = 90^\circ$$

In $\triangle PTQ$,

$$\angle TPQ + \angle TQP + \angle PTQ = 180^\circ \text{ [Sum of the measures of the angles of a triangle is } 180^\circ]$$

$$\therefore 90^\circ + \angle PTQ = 180^\circ \text{ [From (iii)]}$$

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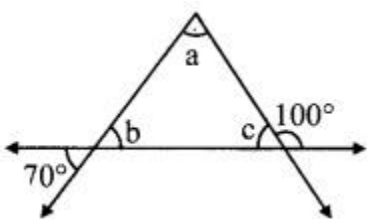
$$\therefore \angle PTQ = 180^\circ - 90^\circ$$

$$= 90^\circ$$

$$\therefore m\angle PTQ = 90^\circ$$

Question 9.

Using the information in the adjoining figure, find the measures of $\angle a$, $\angle b$ and $\angle c$.

**Solution:**

i. $\angle c + 100^\circ = 180^\circ$ [Angles in a linear pair]

$$\therefore \angle c = 180^\circ - 100^\circ$$

$$\therefore \angle c = 80^\circ$$

ii. $\angle b = 70^\circ$ [Vertically opposite angles]

iii. $\angle a + \angle b + \angle c = 180^\circ$ [Sum of the measures of the angles of a triangle is 180°]

$$\angle a + 70^\circ + 80^\circ = 180^\circ$$

$$\therefore \angle a = 180^\circ - 70^\circ - 80^\circ$$

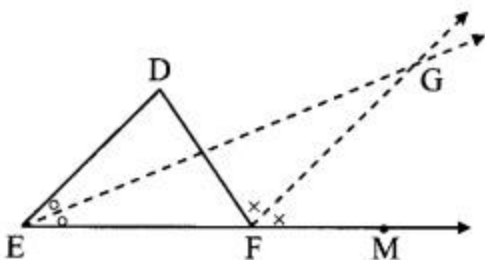
$$\therefore \angle a = 30^\circ$$

$$\therefore \angle a = 30^\circ, \angle b = 70^\circ, \angle c = 80^\circ$$

Question 10.

In the adjoining figure, line $DE \parallel$ line GF , ray EG and ray FG are bisectors of $\angle DEF$ and $\angle DFM$ respectively. Prove that,

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i. $\angle DEG = \frac{1}{2} \angle EDF$

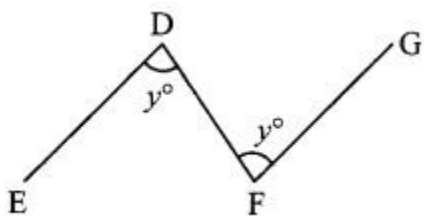
ii. $EF = FG$

Solution:

i. $\angle DEG = \angle FEG = x^\circ$ (i) [Ray EG bisects $\angle DEF$]

$\angle GFD = \angle GFM = y^\circ$ (ii) [Ray FG bisects $\angle DFM$]

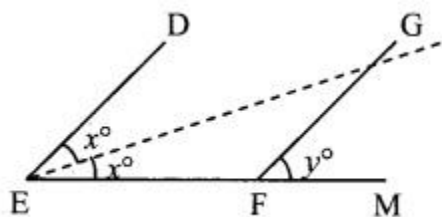
line DE || line GF and DF is their transversal. [Given]



$\therefore \angle EDF = \angle GFD$ [Alternate angles]

$\therefore \angle EDF = y^\circ$ (iii) [From (ii)]

line DE || line GF and EM is their transversal. [Given]



$\therefore \angle DEF = \angle GFM$ [Corresponding angles]

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$$\therefore \angle DEG + \angle FEG = \angle GFM \text{ [Angle addition property]}$$

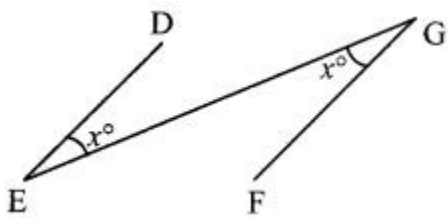
$$\therefore x^\circ + x^\circ = y^\circ \text{ [From (i) and (ii)]}$$

$$\therefore 2x^\circ = y^\circ$$

$$\therefore x^\circ = \frac{1}{2}y^\circ$$

$$\therefore \angle DEG = \frac{1}{2} \angle EDF \text{ [From (i) and (iii)]}$$

ii. line DE || line GF and GE is their transversal. [Given]



$$\therefore \angle DEG = \angle FGE \text{ ... (iv) [Alternate angles]}$$

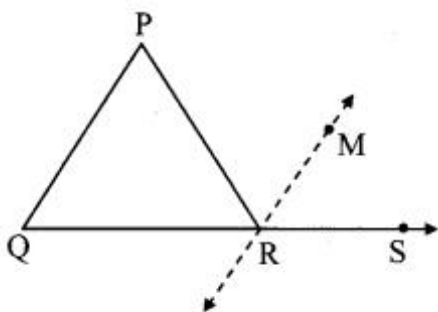
$$\therefore \angle FEG = \angle FGE \text{ (v) [From (i) and (iv)]}$$

$\therefore$ In $\triangle FEG$,

$$\angle FEG = \angle FGE \text{ [From (v)]}$$

$$\therefore EF = FG \text{ [Converse of isosceles triangle theorem]}$$

Question 1. Can you give an alternative proof of the above theorem by drawing a line through point R and parallel to seg PQ in the above figure? (Textbook pg. no. 25)



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Solution:

Yes.

Construction: Draw line RM parallel to seg PQ through a point R.

Proof:

seg PQ || line RM and seg PR is their transversal. [Construction]

$$\therefore \angle PRM = \angle QPR \text{(i) [Alternate angles]}$$

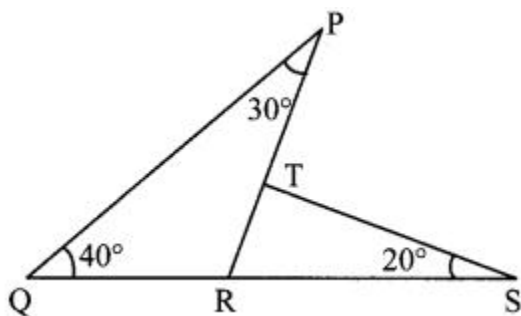
seg PQ || line RM and seg QR is their transversal. [Construction]

$$\therefore \angle SRM = \angle PQR \text{(ii) [Corresponding angles]}$$

$$\therefore \angle PRM + \angle SRM = \angle QPR + \angle PQR \text{ [Adding (i) and (ii)]}$$

$$\therefore \angle PRS = \angle PQR + \angle QPR \text{ [Angle addition property]}$$

Question 2. Observe the given figure and find the measures of $\angle PRS$ and $\angle RTS$. (Textbook pg. no.25)

**Solution:**

$\angle PRS$ is an exterior angle of ΔPQR .

So from the theorem of remote interior angles,

$$\angle PRS = \angle PQR + \angle QPR$$

$$= 40^\circ + 30^\circ$$

$$\therefore \angle PRS = 70^\circ$$

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$$\therefore \angle TRS = 70^\circ \dots [P - T - R]$$

In $\triangle RTS$,

$$\angle TRS + \angle RTS + \angle TSR = 180^\circ \dots [\text{Sum of the measures of the angles of a triangle is } 180^\circ]$$

$$\therefore 70^\circ + \angle RTS + 20^\circ = 180^\circ$$

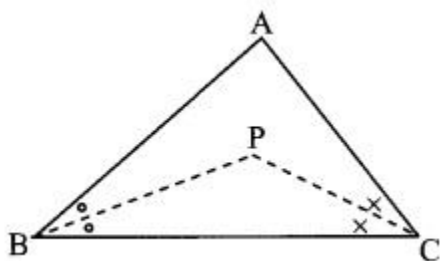
$$\therefore \angle RTS + 90^\circ = 180^\circ$$

$$\therefore \angle RTS = 180^\circ$$

$$\therefore \angle RTS = 90^\circ$$

Question 3. In the given figure, bisectors of $\angle B$ and $\angle C$ of $\triangle ABC$ intersect at point P. Prove that $\angle BPC = 90^\circ + \frac{1}{2} \angle BAC$.

Complete the proof by filling in the blanks. (Textbook pg. no.27)



Solution:

Proof:

In $\triangle ABC$,

$$\angle BAC + \angle ABC + \angle ACB = 180^\circ \dots [\text{Sum of the measures of the angles of a triangle is } 180^\circ]$$

$$\therefore \angle BAC + \angle ABC + \angle ACB = 180^\circ \dots [\text{Multiplying each term by } \frac{1}{2}]$$

$$\therefore \angle BAC + \angle PBC + \angle PCB = 90^\circ$$

$$\therefore \angle PBC + \angle PCB = 90^\circ - \frac{1}{2} \angle BAC \dots\dots\dots (i)$$

In $\triangle BPC$,

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$\angle BPC + \angle PBC + \angle PCB = 180^\circ$ [Sum of measures of angles of a triangle]

$\therefore \angle BPC + 90^\circ - \frac{1}{2} \angle BAC = 180^\circ$ [From (i)]

$\therefore \angle BPC = 180^\circ - 90^\circ + \frac{1}{2} \angle BAC$

$= 180^\circ - 90^\circ + \frac{1}{2} \angle BAC$

$= 90^\circ + \frac{1}{2} \angle BAC$



Maharashtra Board Solutions

Class 9 Maths

Part 2

- Chapter 1.1- Basic Concepts in Geometry
- Chapter 1.2- Basic Concepts in Geometry
- Chapter 1.3- Basic Concepts in Geometry
- Chapter 2.1- Parallel Lines
- Chapter 2.2- Parallel Lines
- Chapter 3.1- Triangles
- Chapter 3.2- Triangles
- Chapter 3.3- Triangles
- Chapter 3.4- Triangles
- Chapter 3.5- Triangles
- Chapter 4.1- Constructions of Triangles
- Chapter 4.2- Constructions of Triangles
- Chapter 4.3- Constructions of Triangles
- Chapter 5.1- Quadrilaterals
- Chapter 5.2- Quadrilaterals
- Chapter 5.3- Quadrilaterals
- Chapter 5.4- Quadrilaterals
- Chapter 5.5- Quadrilaterals
- Chapter 6.1- Circle
- Chapter 6.2- Circle
- Chapter 6.3- Circle
- Chapter 7.1- Co-ordinate Geometry
- Chapter 7.2- Co-ordinate Geometry
- Chapter 8.1- Trigonometry
- Chapter 8.2- Trigonometry
- Chapter 9.1- Surface Area and Volume
- Chapter 9.2- Surface Area and Volume
- Chapter 9.3- Surface Area and Volume

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