1. Construct a $\triangle ABC$, in which:
   (i) $m\overline{AB} = 3.2\text{cm}$, $m\overline{BC} = 4.2\text{cm}$, $m\overline{CA} = 5.2\text{cm}$

   **Given**
   The sides $m\overline{AB} = 3.2\text{cm}$, $m\overline{BC} = 4.2\text{cm}$, $m\overline{CA} = 5.2\text{cm}$ of $\triangle ABC$

   **Required**
   To construct the $\triangle ABC$

   **Construction**
   (i) Draw a line segment $m\overline{AB} = 3.2\text{cm}$.
   (ii) With centre B and radius 4.2cm, draw an arc.
   (iii) With centre A and radius 5.2cm, draw another arc which meet previous arc at point C.
   (iv) Join C to B and A.

   Then $\triangle ABC$ is the required $\triangle$.

   (ii) $m\overline{AB} = 4.2\text{cm}$, $m\overline{BC} = 3.9\text{cm}$, $m\overline{CA} = 3.6\text{cm}$

   **Given**
   The sides $m\overline{AB} = 4.2\text{cm}$, $m\overline{BC} = 3.9\text{cm}$, $m\overline{CA} = 3.6\text{cm}$ of $\triangle ABC$

   **Required**
   To construct the $\triangle ABC$

   **Construction**
   (i) Draw a line segment $m\overline{AB} = 4.2\text{cm}$
   (ii) With centre B and radius 3.9cm, draw an arc.
   (iii) With centre A and radius 3.6cm, draw another arc which meet previous arc at point C.
   (iv) Join A to C and B to C.

   Then $\triangle ABC$ is the required $\triangle$.

   (iii) $m\overline{AB} = 4.8\text{cm}$, $m\overline{BC} = 3.7\text{cm}$, $m\angle B = 60^\circ$

   **Given**
   The sides $m\overline{AB} = 4.8\text{cm}$, $m\overline{BC} = 3.7\text{cm}$ and $m\angle B = 60^\circ$ of $\triangle ABC$
To construct the $\triangle ABC$

(i) Draw a line segment $m\overline{AB} = 4.8\text{ cm}$
(ii) At the end point $B$ of $AB$ make $\angle B = 60^\circ$.
(iii) Cut off $m\overline{BC} = 3.7\text{ cm}$ from the terminal side of $\angle 60^\circ$.
(iv) Join $AC$
Then $ABC$ is the required $\triangle$.

$\text{Given}$

The sides $m\overline{AB} = 3\text{ cm}$,
$m\overline{AC} = 3.2\text{ cm}$ and $m\angle A = 45^\circ$ of $\triangle ABC$

$\text{Required}$

To construct the $\triangle ABC$

(i) Draw a line segment $m\overline{AB} = 3\text{ cm}$.

(ii) At the end point $A$ of $\overline{AB}$ make $m\angle A = 45^\circ$.
(iii) Cut off $m\overline{AC} = 3.2\text{ cm}$ from the terminal side of $\angle 45^\circ$.
(iv) Join $BC$
Then $ABC$ is the required $\triangle$.

$\text{Given}$

The sides $m\overline{BC} = 4.2\text{ cm}$,
$m\overline{CA} = 3.5\text{ cm}$ and $m\angle C = 75^\circ$ of $\triangle ABC$

$\text{Required}$

To construct the $\triangle ABC$

(i) Draw a line segment $m\overline{BC} = 4.2\text{ cm}$.
(ii) At the end point $C$ of $\overline{BC}$ make $m\angle C = 75^\circ$.
(iii) Cut off $m\overline{AC} = 3.5\text{ cm}$ from the terminal side of $\angle 75^\circ$.
(iv) Join $AB$
Then $ABC$ is the required $\triangle$.
(vi) $m\overline{AB} = 2.5\text{ cm}, m\angle A = 30^\circ$,
$m\angle B = 105^\circ$. 
The side $m\overline{AB} = 2.5\text{cm}$ and angles $m\angle A = 30^\circ$, $m\angle B = 105^\circ$ of $\triangle ABC$

**Required**

To construct the $\triangle ABC$

**Construction**

(i) Draw the line segment $m\overline{AB} = 2.5\text{cm}$.

(ii) At the end point $A$ of $\overline{AB}$ make $\angle A = 30^\circ$.

(iii) At the end point $B$ of $\overline{AB}$ make $m\angle B = 105^\circ$.

(iv) The terminal sides of these two angles meet in $C$.

Then $ABC$ is required $\triangle$.

(vii) $m\overline{AB} = 3.6\text{cm}$, $m\angle A = 75^\circ$, $m\angle B = 45^\circ$ of $\triangle ABC$

**Given**

The side $m\overline{AB} = 3.6\text{cm}$ and angles $m\angle A = 75^\circ$, $m\angle B = 45^\circ$ of $\triangle ABC$

**Required**

To construct the $\triangle ABC$

(i) Draw the line segment $m\overline{AB} = 3.6\text{cm}$.

(ii) At the end point $A$ of $\overline{AB}$ make $m\angle A = 75^\circ$.

(iii) At the end point $B$ of $\overline{AB}$ make $m\angle B = 45^\circ$.

(iv) The terminal sides of these two angles meet at $C$.

Then $ABC$ is the required $\triangle$.

Q.2. Construct a $\triangle$ $xyz$ in which

(i) $m\overline{YZ} = 7.6\text{cm}$, $m\overline{XY} = 6.1\text{cm}$, $m\angle X = 90^\circ$.

**Given**

The sides $m\overline{YZ} = 7.6\text{cm}$, $m\overline{XY} = 6.1\text{cm}$ and $m\angle X = 90^\circ$ of $\triangle XYZ$.

**Required**

To construct the $\triangle XYZ$

(i) Draw the line segment $m\overline{XY} = 6.1\text{cm}$

(ii) At the end point $X$ of $\overline{XY}$ make $m\angle X = 90^\circ$.

(iii) With $Y$ as centre and radius $7.6\text{cm}$, draw an arc which cut terminal side of $\angle 90^\circ$ at point $Z$.

(iv) Join $Z\overline{Y}$.
Then \( XYZ \) is the required \( \Delta \).

(ii) \( m\overline{ZX} = 6.4 \text{ cm}, \ m\overline{YZ} = 2.4 \text{ cm}, \ m\angle Y = 90^\circ \)

**Given**

The sides
\( m\overline{ZX} = 6.4 \text{ cm}, \ m\overline{YZ} = 2.4 \text{ cm} \) and
\( m\angle Y = 90^\circ \) of \( \Delta XYZ \).

**Required**

To construct the \( \Delta XYZ \)

**Construction**

(i) Draw the line segment \( m\overline{YZ} = 2.4 \text{ cm} \)

(ii) At the end point \( Y \) of \( \overline{YZ} \) make
\( m\angle Y = 90^\circ \).

(iii) With \( Z \) as centre and radius 6.4 cm draw an arc which cut terminal side of \( \angle 90^\circ \) at point \( X \).

(iv) Join \( XZ \).

Then \( XYZ \) is the required \( \Delta \).

(iii) \( m\overline{XY} = 5.5 \text{ cm}, m\overline{ZX} = 4.5 \text{ cm}, \ m\angle Z = 90^\circ \)

---

Given

The sides
\( m\overline{XY} = 5.5 \text{ cm}, m\overline{ZX} = 4.5 \text{ cm} \) and
\( m\angle Z = 90^\circ \) of \( \Delta XYZ \).

**Required**

To construct the \( \Delta XYZ \)

**Construction**

(i) Draw a line segment \( m\overline{ZX} = 4.5 \text{ cm} \)

(ii) At the end point \( Z \) of \( \overline{ZX} \) make
\( m\angle Z = 90^\circ \).

(iii) With \( X \) as centre and radius 5.5 cm draw an arc which cut terminal side of \( \angle 90^\circ \) at point \( Y \)

(iv) Join \( XY \).

Then \( XYZ \) is the required \( \Delta \).

**Q.3.** Construct a right angled \( \Delta \) measure of whose hypotenuse is 5 cm and one side is 3.2 cm.

**Given**

In right angled \( \Delta \) hypotenuse is 5 cm and one side is 3.2 cm

**Required**

To construct the \( \Delta XYZ \)
Q.4 Construct a right angled isosceles triangle. Whose hypotenuse is:

1) Hypotenuse 5.2 cm long

**Given**

In right angled isosceles triangle hypotenuse is 5.2 cm.

**Required**

To construct right angled isosceles triangle

Construction

(i) Take $\overline{AB} = 5.2$ cm.

(ii) Find mid-point $M$ of $\overline{AB}$.
(iii) With centre as $M$ and radius \( m\overline{AM} = m\overline{MB} \) draw a semi circle which intersects the bisector in C.
(iv) Join A to C and B to C.

Then $\triangle ABC$ is the required right angled isosceles triangle with $\angle C = 90^\circ$

(ii) Hypotenuse 4.8 cm

**Given**

In right angled isosceles triangle hypotenuse is 4.8 cm.

**Required**

To construct right angled isosceles triangle

Construction

(i) Take $\overline{AB} = 4.8$ cm.
(ii) Find mid-point $M$ of $\overline{AB}$.
(iii) With centre as $M$ and radius \( m\overline{AM} = m\overline{MB} \) draw a semi circle which intersects the bisector in C.
(iv) Join A to C and B to C.

Then $\triangle ABC$ is the required right angled isosceles triangle with $\angle C = 90^\circ$

(iii) Hypotenuse 6.2 cm

**Given**

In right angled isosceles triangle hypotenuse is 6.2 cm.
Required
To construct right angled isosceles triangle.

Construction
(i) Take $m\overline{AB} = 6.2\text{ cm}$.
(ii) Find mid-point $M$ of $AB$.
(iii) With centre as $M$ and radius $m\overline{AM} = m\overline{MB}$ draw a semi circle which intersects the bisector in $C$.
(iv) Join $A$ to $C$ and $B$ to $C$.

Then $\triangle ABC$ is the required right angled isosceles triangle with $\angle C = 90^\circ$.

Hypotenuse $5.4\text{ cm}$

Given
In right angled isosceles triangle hypotenuse is $5.4\text{ cm}$.

Required
To construct right angled isosceles triangle.

---

Construction
(i) Take $m\overline{AB} = 5.4\text{ cm}$.
(ii) Find mid-point $M$ of $AB$.
(iii) With centre as $M$ and radius $m\overline{AM} = m\overline{MB}$ draw a semi circle which intersects the bisector in $C$.
(iv) Join $A$ to $C$ and $B$ to $C$.

Then $\triangle ABC$ is the required right angled isosceles triangle with $\angle C = 90^\circ$.

Q.5. (Ambiguous case) construct a $\triangle ABC$ in which

(i) $m\overline{AC} = 4.2\text{ cm}, m\overline{AB} = 5.2\text{ cm},$
(ii) $m\angle B = 45^\circ$.

Given
In $\triangle ABC$ $m\overline{AC} = 4.2\text{ cm}, m\overline{AB} = 5.2\text{ cm},$
$m\angle B = 45^\circ$.

Required
To construct $\triangle ABC$

Construction
(i) Draw a line segment $m\overline{AB} = 5.2\text{ cm}$.
(ii) At the end point $B$ of $\overline{BA}$ make $m\angle B = 45^\circ$.
(iii) With centre $A$ and radius $4.2\text{ cm}$ draw an arc which cuts $\overline{BD}$ in two distinct points $C$ and $C'$.
(iv) Join $AC$ and $AC'$.
ΔABC and ΔABC’ are required triangles.

(ii) \( \overline{mBC} = 2.5\text{cm}, \overline{mAB} = 5.0\text{cm}, \) 
\( \overline{m} \angle A = 30^\circ. \)

**Given**

In ΔABC, \( \overline{mBC} = 2.5\text{cm}, \)
\( \overline{mAB} = 5.0\text{cm}, \) \( \overline{m} \angle A = 30^\circ. \)

**Required**

To construct ΔABC

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**Exercise 17.2**

1. Construct the following Δ’s ABC. Draw the bisectors of their angles and verify their concurrency.

(i) \( \overline{mAB} = 4.5\text{cm}, \overline{mBC} = 3.1\text{cm}, \)
\( \overline{mCA} = 5.2\text{cm}. \)

**Given**

The sides \( \overline{mAB} = 4.5\text{cm}, \)
\( \overline{mBC} = 3.1\text{cm}, \) and \( \overline{mCA} = 5.2\text{cm}. \)

**Required**

(i) To construct ΔABC.
(ii) To draw its angle bisectors and verify their concurrency.

---

**Construction**

(i) Take \( \overline{mAB} = 5\text{cm}. \)
(ii) At the end point A of \( \overline{AB} \) make
\( \overline{m} \angle A = 30^\circ. \)
(iii) With centre B and radius 2.5cm draw an arc which touches \( \overline{AX} \) at point C.
(iv) Join BC.
(v) ΔABC is required triangle.

---

**Construction**

(i) Take \( \overline{mAB} = 4.5\text{cm}. \)
(ii) With A as centre and radius 5.2cm draw an arc.
(iii) With B as centre and radius 3.1cm draw another arc which intersect the first arc at C.
(iv) Join AC and BC to complete the ΔABC.
(v) Draw bisectors of \( \angle A, \angle B \) and \( \angle C \) meeting each other in the point I.
Hence angle bisectors of the \( \triangle ABC \) are concurrent at \( I \) which lies within the triangle.

(ii) \( m\overline{AB} = 4.2\text{cm}, m\overline{BC} = 6\text{cm}, \)  
\( m\overline{CA} = 5.2\text{cm} \)

**Given**

The sides \( m\overline{AB} = 4.2\text{cm}, \)  
\( m\overline{BC} = 6\text{cm, mCA} = 5.2\text{cm} \) of a \( \triangle ABC \).

**Required**

(i) To construct \( \triangle ABC \).

(ii) To draw its angle bisectors and verify their concurrency.

**Construction**

(i) Take \( m\overline{AB} = 4.2\text{cm} \).

(ii) With \( A \) as centre and radius 5.2cm draw an arc.

(iii) With \( B \) as centre and radius 6cm draw another arc which intersect the first arc at \( C \).

(iv) Join \( BC \) and \( AC \) to complete the \( \triangle ABC \).

(v) Draw bisectors of \( \angle A, \angle B \) and \( \angle C \) meeting each other in the point \( I \). Hence angle bisectors of the \( \triangle ABC \) are concurrent at \( I \) which lies within the triangle.

(iii) \( m\overline{AB} = 3.6\text{cm}, m\overline{BC} = 4.2\text{cm}, \)  
\( m\angle B = 75^\circ \).

**Given**

The sides \( m\overline{AB} = 3.6\text{cm}, \)  
\( m\overline{BC} = 4.2\text{cm} \) and \( m\angle B = 75^\circ \) of \( \triangle ABC \)

**Required**

(i) To construct \( \triangle ABC \).

(ii) To draw its angle bisectors and verify their concurrency.

**Construction**

(i) Take \( m\overline{AB} = 3.6\text{cm} \).

(ii) At \( B \) draw angle of 75°

(iii) With \( B \) as centre and radius 4.2cm draw arc which intersect terminal arm of 75° in \( C \).

(iv) Join \( AC \) to complete the \( \triangle ABC \).

(v) Draw bisectors of \( \angle A, \angle B \) and \( \angle C \) meeting each other in the point \( I \).

Hence angle bisectors of the \( \triangle ABC \) are concurrent at \( I \) which lies within the triangle.
Q.2. Construct $\triangle PQR$. Draw their altitudes and show that they are concurrent.

(i) $m\overline{PQ} = 6\text{cm}, m\overline{QR} = 4.5\text{cm}$,
    $\overline{MPR} = 5.5\text{cm}$.

**Given**
The sides $m\overline{PQ} = 6\text{cm}$, $m\overline{QR} = 4.5\text{cm}$
and $m\overline{PR} = 5.5\text{cm}$ of $\triangle PQR$.

**Required**
(i) To construct $\triangle PQR$.
(ii) To draw its altitudes and verify their concurrency.

**Construction**
(i) Take $m\overline{PQ} = 6\text{cm}$
(ii) With $P$ as centre draw an arc of radius $5.5\text{cm}$.
(iii) With $Q$ as centre draw an arc of radius $4.5\text{cm}$, cutting the first in $R$.
(iv) Join $R$ with $P$ and $Q$.
(v) Draw the altitudes on, $\overline{PR}$, $\overline{QR}$ and
    $\overline{PQ}$ which cut each other in $I$.
(vi) All altitudes are concurrent.

(ii) $m\overline{PQ} = 4.5\text{cm}$, $m\overline{QR} = 3.9\text{cm}$,
    $m\angle R = 45^\circ$.

**Given**
The sides $m\overline{PQ} = 4.5\text{cm}$, $m\overline{QR} = 3.9\text{cm}$
and $m\angle R = 45^\circ$ of $\triangle PQR$

**Required**
(i) To construct $\triangle PQR$.
(ii) To draw its altitudes and verify their concurrency.

**Construction**
(i) Draw $\overline{QR} = 3.9\text{cm}$.
(ii) Make $\angle R = 45^\circ$
(iii) Cut $\overline{QP} = 4.5\text{cm}$ join $PQ$, $\triangle PQR$ is
    formed.
(iv) Draw altitudes on $\overline{PR}$, $\overline{QR}$ and
    $\overline{PQ}$ they cut each other in $I$.
    The altitudes are concurrent.
(iii) \[ m \overline{RP} = 3.6 \text{ cm}, m \angle Q = 30^\circ, \quad m \angle P = 105^\circ. \]

**Given**
\[
m \overline{RP} = 3.6 \text{ cm}, m \angle Q = 30^\circ, \quad m \angle P = 105^\circ.
\]

**Required**

(i) To construct \( \Delta PQR \).

(ii) To draw its altitudes and verify their concurrency.

**Construction**

\[ m \angle P + m \angle Q + m \angle R = 180^\circ \]
\[ 105^\circ + 30^\circ + m \angle R = 180^\circ \]
\[ m \angle R = 180^\circ - 135^\circ = 45^\circ \]

(i) Take \( m \overline{RP} = 3.6 \text{ cm} \).

(ii) At \( P \) draw an angle of \( 105^\circ \).

(iii) At \( R \) draw an angle of \( 45^\circ \).

(iv) Terminal arms of both angles meet in point \( Q \). It form \( \Delta PQR \).

(v) Draw the altitudes, of \( \overline{PQ} \) and \( \overline{QR} \) and \( \overline{RP} \) cutting each other in \( I \).

The altitudes are concurrent.

**Q.3. Construct the following triangles \( \Delta ABC \). Draw the perpendicular bisectors of their sides and verify their concurrency. Do they meet inside the triangle.**

(i) \[ m \overline{AB} = 5.3 \text{ cm}, \quad m \angle A = 45^\circ, \quad m \angle B = 30^\circ \]

**Given**

Side \( m \overline{AB} = 5.3 \text{ cm} \) and \( m \angle A = 45^\circ \).

**Required**

(i) To construct the \( \Delta ABC \).

(ii) To draw perpendicular bisectors of its sides and to verify that they are concurrent.

**Construction**

(i) Take \( m \overline{AB} = 5.3 \text{ cm} \)

(ii) At the end point \( A \) of \( \overline{AB} \) make \( m \angle A = 45^\circ \).
(iii) At the end point B of $\overline{AB}$ make $m\angle B = 30^\circ$.
(iv) The terminal sides of these two angles meet at C. Then $\triangle ABC$ is required $\Delta$.
(v) Draw perpendicular bisectors of $\overline{AB}$, $\overline{BC}$ and $\overline{CA}$ meeting each other in the point O. Hence the three perpendicular bisectors of sides of $\triangle ABC$ are concurrent at O.

(ii) $m\overline{BC} = 2.9\text{cm}$, $m\angle A = 30^\circ$,
$m\angle B = 60^\circ$ of $\triangle ABC$.

**Given**

(i) To construct the $\triangle ABC$.
(ii) To draw perpendicular bisectors of its sides and to verify that they are concurrent.

```
\begin{align*}
\text{Construction} \quad & m\angle A + m\angle B + m\angle C = 180^\circ \\
& 30^\circ + 60^\circ + m\angle C = 180^\circ \\
& 90^\circ + m\angle C = 180^\circ \\
\end{align*}
```

(i) Take $m\overline{BC} = 2.9\text{cm}$
(ii) At the end point B of $\overline{BC}$ make $m\angle B = 60^\circ$.
(iii) At the end point C of $\overline{BC}$ make $m\angle C = 90^\circ$.
(iv) The terminal sides of these two angles meet in A. Then $\triangle ABC$ is required $\Delta$.
(v) Draw perpendicular bisectors of $\overline{AB}$, $\overline{BC}$ and $\overline{CA}$ meeting each other in the point O. Hence the three perpendicular bisectors of sides of $\triangle ABC$ are concurrent at O.

(iii) $m\overline{AB} = 2.4\text{cm}$, $m\overline{AC} = 3.2\text{cm}$,
$m\angle A = 120^\circ$ of a $\triangle ABC$

**Required**

(i) To construct the $\triangle ABC$.
(ii) To draw perpendicular bisectors of its sides and to verify that they are concurrent.

```
\begin{align*}
\text{Construction} \quad & \text{Take } m\overline{AB} = 2.4\text{cm}
\end{align*}
```
(ii) At the end point A of $\overline{AB}$ make $\angle A = 120^\circ$.

(iii) With centre A, draw an arc of radius 3.2 cm which cut terminal arm of $\angle A$ at C.

(iv) Join B to C

Then ABC is required $\Delta$.

(v) Draw perpendicular bisectors of $\overline{AB}, \overline{BC}$ and $\overline{CA}$ meeting each other at the point O.

Hence the three perpendicular bisectors of sides of $\Delta ABC$ are concurrent at O.

Q.4. Construct following $\Delta$’s XYZ.

Draw their three medians and show that they are concurrent.

(i) $m\overline{YZ} = 4.1 \text{cm, } m\angle Y = 60^\circ$ and $m\angle X = 75^\circ$

$\text{Given}$

The side $m\overline{YZ} = 4.1 \text{ cm, } m\angle Y = 60^\circ$ and $m\angle X = 75^\circ$

$\text{Required}$

(i) Construct the $\Delta XYZ$.

(ii) Draw its medians and verify their concurrency.

$\text{Construction}$

$m\angle X + m\angle Y + m\angle Z = 180^\circ$

$75^\circ + 60^\circ + m\angle Z = 180^\circ$

$135^\circ + m\angle Z = 180^\circ$

$m\angle Z = 180^\circ - 135^\circ$

$m\angle Z = 45^\circ$

(i) Take $m\overline{YZ} = 4.1 \text{ cm.}$

(ii) At the end point y of $\overline{YZ}$ make $m\angle Y = 60^\circ$.

(iii) At the end point Z of $\overline{ZY}$ make $m\angle Z = 45^\circ$

(iv) The terminal sides of these angles meet at X. Then $\Delta XYZ$ is required $\Delta$.

(v) Draw perpendicular bisectors of the sides $\overline{YZ}$, $\overline{Zx}$ and $\overline{XY}$ of $\Delta XYZ$ and make their midpoints A, B and C respectively.

(vi) Join Y to midpoint B to get median $\overline{YB}$.

(vii) Join Z to midpoint C to get median $\overline{ZC}$.

(viii) Join X to midpoint A to get median $\overline{AX}$. The medians of $\Delta XYZ$ pass through the same point G.

All medians intersect at point G.

Hence medians are concurrent at G.

(ii) $m\overline{XY} = 4.5 \text{cm, } m\overline{YZ} = 3.4 \text{cm, } m\overline{ZX} = 5.6 \text{ cm}$

$\text{Given}$

The sides $m\overline{XY} = 4.5 \text{ cm}, \ m\overline{YZ} = 3.4 \text{ cm}$ and $m\overline{ZX} = 5.6 \text{ cm}$ of a $\Delta XYZ$.

$\text{Required}$

(i) Construct the $\Delta XYZ$.

(ii) Draw its medians and verify their concurrency.
Construction

(i) Take $m\overline{XY} = 4.5\text{cm}$.  

(ii) With Y as centre and radius $3.4\text{ cm}$ draw an arc.  

(iii) With X as centre and radius $5.6\text{ cm}$ draw another arc cutting first in Z join Z to Y and X to Z.  

(iv) Draw perpendicular bisectors of the sides $\overline{XY}$, $\overline{YZ}$ and $\overline{XZ}$ of $\triangle XYZ$ and make their midpoints A, B and C respectively.  

(v) Join X to mid point B to get median $\overline{XB}$.  

(vi) Join Y to mid point C to get medians $\overline{YC}$.  

(vii) Join Z to mid point A to get median $\overline{ZA}$.  

All medians intersect at point G.  

Hence medians are concurrent at G.  

For construction, we have: 

$\overline{mZ}\overline{X} = 4.3\text{cm}$, $m\angle X = 75^\circ$ and $m\angle Y = 45^\circ$.  

Required  

(i) Construct the $\triangle XYZ$.  

(ii) Draw its medians and verify their concurrency.

Construction

(i) Take $m\overline{ZX} = 4.3\text{cm}$.  

(ii) At the end point $Z$ of $\overline{ZX}$ make $m\angle Z = 60^\circ$.  

(iii) At the end point $X$ of $\overline{XY}$ make $m\angle X = 75^\circ$.  

(iv) The terminal sides of these angles meet at Y. Then $\triangle XYZ$ is required $\Delta$.  

(v) Draw perpendicular bisectors of the sides $\overline{ZX}$, $\overline{XY}$ and $\overline{YZ}$ of $\triangle XYZ$ and make their midpoints A, B and C respectively.  

(vi) Join Y to midpoint $A$ to get median $\overline{YA}$.  

(vii) Join Z to the midpoint B to get median $\overline{ZB}$.  

(viii) Join $X$ to the midpoint $B$ to get median $XC$.

1. (i) **Construct a quadrilateral** $ABCD$, having
   \[ m_{AB} = m_{AC} = 5.3\, \text{cm}, \]
   \[ m_{BC} = m_{CD} = 3.8\, \text{cm} \]
   \[ m_{AD} = 2.8\, \text{cm}. \]
(ii) **On the side $BC$ construct a $\Delta$ equal in area to the quadrilateral $ABCD$.**

- **Given**
  Sides of quadrilateral $ABCD$
  \[ m_{AB} = m_{BC} = 5.3\, \text{cm} \]
  \[ m_{BC} = m_{CD} = 3.8\, \text{cm} \]
  \[ m_{AD} = 2.8\, \text{cm} \]

- **Required**
  (i) To make the quadrilateral $ABCD$.
  (ii) On the side $BC$ construct a $\Delta$ equal in area to the quadrilateral $ABCD$.

- **Construction**
  (i) Take $m_{AB} = 5.3\, \text{cm}$.
  (ii) With centre $A$ and $B$ draw arcs with radii $5.3\, \text{cm}$ and $3.8\, \text{cm}$ respectively cutting each other in $C$.
  (iii) With $C$ as centre draw an arc of radius $3.8\, \text{cm}$, then with $A$ as centre draw an arc of radius $5.3\, \text{cm}$.

All medians intersect at point $G$. Hence medians are concurrent at $G$.

(iv) Join $AD$, $DC$, $BC$ $ABCD$ is the required quadrilateral.
(ii)
(i) Draw $\overline{AC}$
(ii) Through $D$ draw a line $\parallel \overline{AC}$
(iii) Produce $\overline{AB}$ which meet parallel line in $P$.
(iv) Join $P$ with $C$ $PCB$ is the required triangle equal in area to quadrilateral $ABCD$.

2. **Construct a $\Delta$ equal in area to the quadrilateral $PQRS$, having**
   \[ m_{QR} = 7\, \text{cm}, \; m_{RS} = 6\, \text{cm}, \]
   \[ m_{SP} = 2.75\, \text{cm}, \; m_{\angle QRS} = 60^\circ \]
   \[ m_{\angle RSP} = 90^\circ \].

- **Given**
  Parts of the quadrilateral $PQRS$ are given.

- **Required**
  (i) To make the quadrilateral $PQRS$.
  (ii) To make a $\Delta$ equal in area to the quadrilateral $PQRS$. 

![Diagram](image-url)
Construction
(i) Take $m\angle QR = 7\text{cm}$
(ii) Make $\angle QRS = 60^\circ$
(iii) With R as centre draw an arc of 6 cm radius which cuts terminal arm of $\angle 60^\circ$ in S.
(iv) Make $\angle RSP = 90^\circ$
(v) With S as centre draw an arc of 2.75 cm radius which cuts terminal arm of 90° in P.
(vi) Join QP.
(vii) Join PR
(viii) Through S draw a line parallel to PR which meet QR produced in A.
(ix) Join AP.
ΔAPQ is the required triangle equal in area to quadrilateral PQRS.

3. Construct a Δ equal in area to the quadrilateral ABCD, having $m\overline{AB} = 6\text{cm}$, $m\overline{BC} = 4\text{cm}$,
$m\overline{AC} = 7.2\text{cm}$, $m\angle BAD = 105^\circ$
and $m\overline{BD} = 8\text{cm}$.

Given

Required
(i) To make the quadrilateral ABCD.
(ii) To make aΔ with area equal to that of quadrilateral ABCD.

Construction
(i) Take $m\overline{AB} = 6\text{cm}$.
(ii) Make $\angle A = 105^\circ$.
(iii) With B as centre draw an arc of radius 8cm, cutting the arm of $\angle A$ in D.
(iv) With A as centre draw an arc of radius 7.2cm, with B as centre draw an arc of radius 4cm, cutting the first in C. Join C with B and D.
ΔABCD is the required quadrilateral.
(v) Join AC.
(vi) Join DB. Draw a line parallel to DB which meet $\overline{AB}$ produced in P.
(vii) Join PD.
ΔADP is the required triangle equal in area to the quadrilateral ABCD.

4. Construct a right-angled triangle equal in area to a given square.
1. Construct a $\triangle$ with sides 4 cm, 5 cm and 6 cm and construct a rectangle having its area equal to that of the $\triangle$. Measure its diagonals. Are they equal?

Given

Square $ABCD$

Required

To make a rectangle with area equal to that of the $\triangle$.

Exercise 17.4

(i) Draw $AB = 4$ cm.

(ii) Draw an arc of radius 5 cm with centre $B$ and another arc of radius 6 cm with centre $A$ cutting the first in $C$.

(iii) Join $CA$, $CB$.

(iv) $ABC$ is the required $\triangle$.

(v) Draw a line $\ell$ through $C \parallel AB$.

(vi) Draw the $\perp$ bisector of $AB$ in $D$ and cutting the line $\ell$ at $P$.

(vii) Draw $BQ \perp$ on the line $\ell$.

$PQDB$ is the required rectangle.

2. Transform an isosceles $\triangle$ into a rectangle.
Construction

(i) Take a line $BC$
(ii) Draw the $\perp$ bisector of $BC$ take any point $A$ on it.
(iii) Join $AB$ and $AC$.
(iv) $\triangle ABC$ is the isosceles $\triangle$ with $m_{AB} = m_{AC}$.
(v) Through $A$ draw a line $\ell \parallel BC$.
(vi) Draw $CD \perp \ell$
$\square CDAB$ is the required rectangle equal in area to $\triangle ABC$

3. Construct a $\triangle ABC$ such that $m_{AB}=3\text{cm}$, $m_{BC}=3.8\text{cm}$, $m_{AC}=4.8\text{cm}$.

Construct a rectangle equal in area to the $\triangle ABC$, and measure its sides.

Exercise 17.5

1. Construct a rectangle whose adjacent sides are $2.5$ cm and $5$ cm respectively. Construct a square having area equal to the given rectangle.

Given

Three sides of the $\triangle ABC$

Required

To construct a rectangle with area equal to that of the $\triangle ABC$.

Construction

(i) Take $m_{AB} = 3\text{cm}$
(ii) With $B$ as centre draw an arc of radius $3.8\text{cm}$, with $A$ as centre draw another arc of radius $4.8\text{cm}$, cutting the first in $C$.
(iii) Join $B$ with $C$ and $A$.
(iv) $\square ABCD$ is the required $\square$.
(v) Through $C$ draw a line $\ell \parallel AB$.
(vi) Draw the $\perp$ bisector of $AB$ cutting the line $\ell$ in $P$.
(vii) $\square CDAB$ is the required rectangle.

Measures of sides of rectangle $\square CDAB$ are; $m_{PD} = 3.8\text{cm}$, $m_{DB} = 1.5\text{cm}$
Construction

(i) Make the rectangle ABCD with given lengths of sides.
(ii) Produce BC and cut mCE = mCD
(iii) Bisect BE at O.
(iv) With O as centre and OB radius draw a semicircle cutting DC produced in M.
(v) With CM as side complete the square CMNL.

2. Construct a square equal in area to a rectangle whose adjacent sides are 4.5 cm and 2.2 cm respectively. Measure the sides of the square and find its area and compare with the area of the rectangle.

Construction

(i) Make the rectangle ABCD with given sides.
(ii) Produce AD and cut mDE = mDC
(iii) Bisect AE at O.
(iv) With O as centre and OA radius draw a semicircle cutting CD produced in M.
(v) With DM as side complete the square DFLM.

(vi) Side of the square (average) = 3.15 cm
Area = $3.15 \times 3.15 = 9.9\text{cm}^2$
Area of the rectangle = $2.2 \times 4.5 = 9.9\text{cm}^2$ (equal to area of square)

3. In Q.2 above verify by measurement that the perimeter of the square is less than that of the rectangle.

Solution

(i) Side of the square $= 3.15\text{cm}$
Perimeter $P_1 = 4 \times 3.15 = 12.60\text{cm}$

Sides of the rectangle are 4.5cm, 2.2cm
Perimeter $P_2 = 2(4.5 + 2.2)$
$= 2(6.7)$
$= 13.4\text{cm}$
4. Construct a square equal in area to the sum of two squares having sides 3 cm and 4 cm respectively.

Construction

(i) Make a right angled $\triangle ABC$ with $AC = 3\text{ cm}$, $BC = 4\text{ cm}$.

(ii) Using Pythagoras theorem

$$\sqrt{AC^2 + BC^2} = \sqrt{AB^2}$$

$$\sqrt{3^2 + 4^2} = \sqrt{|AB|^2}$$

5 cm = $|AB|$

(iii) With $AB$ as side make square $ABDE$.

(iv) $ABDE$ is the required area of square equal in area to the sum of the areas of two squares.

5. Construct a $\triangle$ having base 3.5 cm and other two sides equal to 3.4 cm

6. Construct a $\triangle$ having base 5 cm and other sides equal to 5 cm and 6 cm. Construct a square equal in area to given $\triangle$.

and 3.8 cm respectively. Transform it into a square of equal area.

Construction

(i) Make the $\triangle ABC$ with the given sides.

(ii) Draw the $\perp$ bisector of $AB$ and a line $\ell$ through $C \parallel AB$ cutting each other in $E$.

(iii) Draw $BD \perp \ell$.

(iv) $BDEF$ is a rectangle.

(v) Produce $ED$, cut $DH = DB$.

(vi) Bisect $EH$ at $O$.

(vii) With $O$ as centre and $OE$ radius draw a semicircle cutting $BD$ produced in $M$.

(viii) With $DM$ as side, complete the square $DNLM$. This is the required square equal in area to $\triangle ABC$. 
Construction
(i) Draw $BC = 5\text{cm}$.
(ii) Draw an arc of radius $6\text{cm}$ with centre $C$ and another arc of radius $5\text{cm}$ with centre $B$ cutting first in $A$.
(iii) Through $A$ draw a line $\ell \parallel BC$.
(iv) Draw the bisector of $BC$ cutting the line $\ell$ in $E$.
(v) Draw $CF \perp \ell$. $CDEF$ is the rectangle.

(vi) Produce $DE$ and cut $\overline{EL} = \overline{EF}$, bisect $\overline{DL}$ at $O$.
(vii) Draw a semicircle with centre $O$ and radius $\overline{OL} = \overline{OD}$, cutting $\ell$ in $M$.
(viii) Draw a square $EMNR$ with side $EM$.
This is the required square equal in area to $\triangle ABC$.

OBJECTIVE

1. A triangle having two sides congruent is called:
   (a) Scalene (b) Right angled
   (c) Equilateral (d) Isosceles

2. A quadrilateral having each angle equal to $90^\circ$ is called
   (a) Parallelogram (b) Rectangle
   (c) Trapezium (d) Rhombus

3. The right bisectors of the three sides of a triangle are
   (a) Congruent (b) Collinear
   (c) Concurrent (d) Parallel

4. The altitudes of an isosceles triangle are congruent:
   (a) Two (b) Three
   (c) Four (d) None
5. A point equidistant from the end points of a line segment is on its (a) Bisector (b) Right bisector (c) Perpendicular (d) Median

6. ___ congruent triangles can be made by joining the mid points of the sides of a triangle:
   (a) Three  (b) Four  (c) Five  (d) Two

7. The diagonals of a parallelogram ___ each other:
   (a) Bisect (b) Trisect  
   (c) Bisect at right angle  (d) None of these

8. The median of a triangle cut each other in the ratio:
   (a) 4:1  (b) 3:1  (c) 2:1  (d) 1:1

9. One angle on the base of an isosceles triangle is 30°. What is the measure of its vertical angle:
   (a) 30°  (b) 60°  (c) 90°  (d) 120°

10. If the three altitudes of a triangle are congruent then the triangle is (a) Equilateral (b) Right angled (c) Isosceles (d) Acute angled

11. If two medians of a triangle are congruent then the triangle will be:
   (a) Isosceles (b) Equilateral (c) Right angled (d) Acute angled

12. A line segment joining a vertex of a triangle to the midpoint of its opposite side is called a ___ of the triangle:
   (a) Altitude (b) Median (c) Angle bisector (d) Right bisector

13. A line segment from a vertex of triangle perpendicular to the line containing the opposite side, is called an ___ of the triangle:
   (a) Altitude  (b) Median  (c) Angle bisector (d) Right bisector

14. The point of concurrency of the three altitudes of a Δ is called its ___
   (a) Ortho centre (b) In centre (c) Circum centre (d) None

15. The internal bisector of the angle of a triangle meet at a point called the ___ of the triangle:
   (a) In centre  (b) Ortho centre (c) Circum centre (d) None

16. The point of concurrency of the three perpendicular bisectors of the sides of a triangle is called the ___ of the triangle.
   (a) Circum centre (b) In centre (c) Ortho centre (d) None

**ANSWER KEY**

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