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NCERT Solutions for Class 10 Maths Chapter 11 Constructions

11. NCERT Solutions for Class 10 Maths Constructions
   11.1 Introduction
   11.2 Division Of A Line Segment
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NCERT Solutions for Class 10 Maths Chapter 11 Constructions Exercise 11.1
Question-1

In each of the following, give the justification of the construction also:
Draw a line segment of length 7.6 cm and divide it in the ratio 5 : 8.
Measure the two parts.

Solution:

Steps of construction
1. Draw any ray AX, making an acute angle with AB.
2. Locate 13 (= 5 + 8) points A₁, A₂, A₃ .......... A₁₃ on AX so that A₁A₂ ..........A₁₂ A₁₃.
3. Join BA₁₃
4. Through the point A₅ (m = 5), draw a line parallel to BA₁₃ (by making an angle equal to ∡ AA₁₃ B at A₅ intersecting AB at C. Then
   \[ \frac{AC}{CB} = \frac{5}{8} \]

Let us see how this method gives us the required division.
Since A₅C is parallel to A₁₃B therefore \[ \frac{A₅A₁₃}{A₅A₁₃} = \frac{AC}{CB} \]  (By the Basic proportionality theorem)
By construction, \[ \frac{A₅A₁₃}{A₅A₁₃} = \frac{5}{8} \] Therefore \[ \frac{AC}{CB} = \frac{5}{8} \]
This shows C divides AB in the ratio 5 : 8.

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**Question-2**

Construct a triangle of sides 4 cm, 5 cm and 6 cm and then a triangle similar to it whose sides are \( \frac{2}{3} \) of the corresponding sides of the first triangle.

**Solution:**

![Diagram of the construction process](diagram.png)

**Steps of construction**

1. Draw a line segment BC = 5 cm
2. With B as centre and radius equal to 4 cm draw an arc
3. With C as centre and radius equal to 6 cm draw an arc
4. Join AB and AC. Then, \( \triangle ABC \) is the required triangle.
5. Below BC, make an acute angle \( \angle CBX \)
6. Along BX, mark off three points \( B_1, B_2, B_3 \) such that \( BB_1 = B_1B_2 = B_2B_3 \)
7. Join \( B_3C \)
8. From \( B_2 \), draw \( B_2C'||B_3C \), meeting BC at \( C' \)
9. From \( C' \), draw \( C'A'||CA \), meeting BA at \( A' \)
10. Then \( \triangle A'BC' \) is the required triangle, each of whose sides is two-third of the corresponding sides of \( \triangle ABC \).

**Justification**

Since \( A'C'||AC \), so \( \triangle ABC \sim \triangle A'BC' \)
Question-3

Construct a triangle with sides 5 cm, 6 cm and 7 cm and then another triangle whose sides are \(\frac{7}{5}\) of the corresponding sides of the first triangle.

Solution:

Steps of construction
1. Draw a line segment BC = 6 cm
2. With B as centre and with radius 5 cm, draw an arc.
3. With C as centre and with radius 7 cm, draw another arc, intersecting the previously drawn arc at A.
4. Join AB and AC. Then, \(\Delta\ ABC\) is the required triangle.
5. Below BC, make an acute angle \(\angle\ CBX\).
6. Along BX, mark off seven points \(B_1, B_2, B_3, \ldots , B_7\) such that \(BB_1 = B_1B_2 = \cdots = B_6B_7\)
7. Join \(B_5\) to C (5 being smaller of 5 and 7 in \(\frac{7}{5}\)) and draw a line through \(B_7\) parallel to \(B_5C\), intersecting the extended line segment \(BC\) at \(C'\).
8. Draw a line through \(C'\) parallel to \(CA\) intersecting the extended line segment \(BA\) at \(A'\). Then \(\triangle A'BC'\) is the required triangle.

For justification of construction
\(\Delta\ ABC \sim \Delta\ A'BC'\)
Therefore \(\frac{AB}{A'B} = \frac{AC}{A'C'} = \frac{BC}{BC'}\)

But \(\frac{BC}{BC'} = \frac{BB_5}{BB_7} = \frac{5}{7}\)
So \(\frac{BC'}{BC} = \frac{7}{5}\) and thus \(\frac{A'B}{AB} = \frac{A'C'}{AC} = \frac{BC'}{BC} = \frac{5}{7}\)
Question-4

Draw a triangle ABC with side BC = 6 cm, AB = 5 cm and ∠ ABC = 60°. Then
construct a triangle whose sides are $\frac{3}{4}$ of the corresponding sides of the
triangle ABC.

Solution:

Steps of construction

(i) Draw a triangle ABC with BC = 6 cm, AB = 5 cm and ∠ ABC = 60°.
(ii) Draw any ray BX making an acute angle with BC on the side opposite to
the vertex X.
(iii) Locate 4 (the greater of 3 and 4 in $\frac{3}{4}$) points B₁, B₂, B₃, B₄ on BX so that
BB₁ = B₁B₂ = B₂B₃ = B₃B₄.
(iv) Join B₄C and draw a line through B₃ (the 3rd point, 3 being smaller of 3
and 4 in $\frac{3}{4}$) parallel to B₄C to intersect BC at C'.
(v) Draw a line through C' parallel to the line CA to intersect BA at A'. Then Δ
A'BC' is the required triangle.

Justification of the construction

Δ ABC ~ Δ A'BC'. Therefore $\frac{AB}{A'B} = \frac{AC}{A'C'} = \frac{BC}{BC'}$

But $\frac{BC}{BC'} = \frac{BB_3}{BB_4} = \frac{3}{4}$

So $\frac{AB}{A'B} = \frac{AC}{A'C'} = \frac{BC}{BC'} = \frac{3}{4}$
Question-5

Draw a triangle ABC with side BC = 7 cm, \( \angle B = 45^\circ \), \( \angle A = 105^\circ \). Then, construct a triangle whose sides are \( \frac{4}{3} \) times the corresponding sides of \( \Delta ABC \).

Solution:

Steps of construction
(i) Draw a triangle ABC with BC = 7cm, \( \angle B = 45^\circ \) and \( \angle A = 105^\circ \).
(ii) Draw any ray BX making an acute angle with BC on the side opposite to

the vertex X.

(iii) Locate 4 (the greater of 3 and 4 in \( \frac{4}{3} \)) points B₁, B₂, B₃, B₄ on BX so that

\[ BB_1 = B_1B_2 = B_2B_3 = B_3B_4. \]

(iv) Join \( B_4C' \) and draw a line through \( B_3 \) (the 3rd point, 3 being smaller of 3 and 4 in \( \frac{4}{3} \)) parallel to \( B_4C' \) to intersect BC at C.

(v) Draw a line through C' parallel to the line CA to intersect BA at A'. Then \( \Delta A'BC' \) is the required triangle.

Justification of the construction
\( \Delta ABC \sim \Delta A'BC' \). Therefore \( \frac{A'B}{AB} = \frac{A'C'}{AC} = \frac{BC'}{BC} \)

But \( \frac{BC'}{BC} = \frac{BB_4 + BB_3}{BB_3} = \frac{4}{3} \)

So \( \frac{A'B}{AB} = \frac{A'C'}{AC} = \frac{BC'}{BC} = \frac{4}{3} \)
Question-6

Construct an isosceles triangle whose base is 8 cm and altitude 4 cm and then another triangle whose sides are $1\frac{1}{2}$ times the corresponding sides of the isosceles triangle.

Solution:

Given
An isosceles triangle whose base is 8 cm and altitude 4 cm. Scale factor: $1\frac{1}{2} = \frac{3}{2}$

Required
To construct a similar triangle to above whose sides are $1\frac{1}{2}$ times the above triangle.

Steps of construction
(i) Draw a line segment BC = 8 cm.
(ii) Draw a perpendicular bisector AD of BC.
(iii) Join AB and AC we get a isosceles \( \triangle ABC \).
(iv) Construct an acute angle \( \angle CBX \) downwards.
(v) On BX make 3 equal parts.
(vi) Join C to B_2 and draw a line through B_3 parallel to B_2C intersecting the extended line segment BC at C'.
(vii) Again draw a parallel line C'A' to AC cutting BP at A'.
(viii) \( \triangle A'BC' \) is the required triangle.
**Question-7**

Draw a circle of radius 6 cm. From a point 10 cm away from its centre, construct the pair of tangents to the circle and measure their lengths.

**Solution:**

![Diagram of circle and tangents](image)

**Steps of construction**
1. Draw a line segment of length $AB = 10$ cm. Bisect $AB$ by constructing a perpendicular bisector of $AB$. Let $M$ be the mid-point of $AB$.
2. With $M$ as centre and $AM$ as radius, draw a circle. Let it intersect the given circle at the points $P$ and $Q$.
3. Join $PB$ and $QB$. Thus $PB$ and $QB$ are the required two tangents.

**Justification of construction:**
Join $AP$. Here $\angle APB$ is an angle in the semi-circle. Therefore, $\angle APB = 90^\circ$.
Since $AP$ is a radius of a circle, $PB$ has to be a tangent to a circle. Similarly, $QB$ is also a tangent to a circle.

In a $\text{Rt } \Delta APB$, $AB^2 = AP^2 + PB^2$ (By using pythagoras Theorem)

$PB^2 = AB^2 - AP^2 = 10^2 - 6^2 = 100 - 36 = 64$

$\therefore \ PB = 8 \text{ cm.}$
Question-8

Construct a tangent to a circle of radius 4 cm from a point on the concentric circle of radius 6 cm and measure its length. Also verify the measurement by actual calculation.

Solution:

Steps of construction
1. Draw a line segment of length OA = 4 cm. With O as centre and OA as radius, draw a circle.
2. With O as centre draw a concentric circle of radius 6 cm(OD).
3. Let C be any point on the circle of radius 5 cm, join OC.
4. Bisect OC such that M is the mid point of OC.
5. With M as centre and OM as radius, draw a circle. Let it intersect the given circle of radius 4 cm at the points P and Q.
6. Join CP and CQ. Thus CP and CQ are the required two tangents.

Justification of construction:
Join OP. Here \( \angle OPC \) is an angle in the semi-circle. Therefore, \( \angle OPC = 90^\circ \).
Since OP is a radius of a circle, CP has to be a tangent to a circle.
Similarly, CQ is also a tangent to a circle.
\[ \angle COP = 90^\circ \]
\[ CO^2 = CP^2 + OP^2 \]
\[ CP^2 = CO^2 - OP^2 = 6^2 - 4^2 \]
\[ CP = 2\sqrt{5} \text{ cm} \]
Question-9

Draw a circle of radius 3 cm. Take two points P and Q on one of its extended diameter each at a distance of 7 cm from its centre. Draw tangents to the circle from these two points P and Q.

Solution:

![Diagram showing the construction of tangents]

Given
Two points P and Q on the diameter of a circle with radius 3 cm.
OP = OQ = 7 cm.

Required
To construct the tangents to the circle from the given points P and Q.

Steps of construction
1. Draw a circle of radius 3 cm with centre O.
2. Extend its diameter both sides and cut OP = OQ = 7 cm.
3. Bisect OP and OQ. Let M and N be the mid-points of OP and OQ respectively.
4. With M as centre and OM as radius, draw a circle. Let it intersect (0, 3) at two points A and B. Again taking N as centre ON as radius draw a circle to intersect circle(0, 3) at two points C and D.
5. Join PA, PB, QC and QD. These are the required tangents from P and Q to circle (0, 3).
Question-10

Draw a pair of tangents to a circle of radius 5 cm which are inclined to each other at an angle of 60°.

Solution:

We have to draw tangents at the ends of two radius which are inclined to each other at 120°

Steps of Construction
(i) Draw a circle of radius 5 cm with centre O.
(ii) Take a point Q on the circle and join it to O.
(iii) From OQ, Draw $\angle QOR = 120^\circ$.
(iv) Take an external point P.
(v) Join PR and PQ perpendicular to OR and OQ respectively intersecting at P.
Therefore the required tangents are RP and QP.
Question-11

Draw a line segment AB of length 8 cm. Taking A as centre, draw a circle of radius 4 cm and taking B as centre, draw another circle of radius 3 cm. Construct tangents to each circle from the centre of the other circle.

Solution:

Steps of construction
1. Draw a line segment AB of length 8 cm. Also bisects AB such that, M is the mid point of AB.
2. With M as centre draw a circle such that it touches A and B.
3. With A as centre draw a circle of radius 4 cm, and with B as centre draw a circle of radius 3 cm.
4. These two circles touches the bigger circle at P, Q, R and S.
5. Now join RB and SB they are the tangents from the point B.
6. Similarly join PA and QA they are the tangents from the point A.
Question-12

Let ABC be a right triangle in which \( AB = 6 \text{ cm}, \ BC = 8 \text{ cm} \) and \( \angle B = 90^\circ \). BD is the perpendicular from B on AC. The circle through B, C, D is drawn. Construct the tangents from A to this circle.

Solution:

Steps of construction
1. Draw a triangle with \( AB = 6 \text{ cm}, \ BC = 8 \text{ cm} \) and \( \angle B = 90^\circ \).
2. Construct BD perpendicular to AC.
3. Draw a circle through B, C, D.
4. Let M be the mid-point of BC obtained by bisecting BC.
5. Join AM and bisect it. Let N be the mid point of AM.
6. With N as centre and AN as radius draw a circle such that it touches the circle through B, C, D at the points E and F.
7. Join AE and AF.
8. Thus AE and AF are the required tangents.
Question-13

Draw a circle with the help of a bangle. Take a point outside the circle. Construct the pair of tangents from this point to the circle.

Solution:

Given
Bangle, Point P outside the circle.

Required
To construct the pair of tangents from P to the circle.

Steps of construction
1. Draw a circle with the help of a bangle.
2. Draw two chords AB and AC. Perpendicular bisectors of AB and AC intersect each other at O, which is the centre of the circle.
3. Taking a point P, outside the circle, join OP.
4. Let M be the mid point of OP. Taking M as centre and OM as radius draw a circle which intersect the given circle at Q and R.
5. Join PQ and PR. Thus PQ and PR are the required tangents.