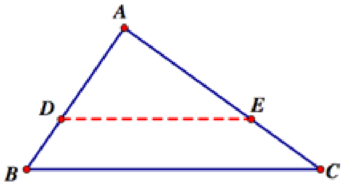
# 6. Geometry

## Exercise 6.1

### 1 A. Question

In a ΔABC, D and E are points on the sides AB and AC respectively such that DE || BC.

If AD = 6 cm, DB = 9 cm and AE = 8 cm, then find AC.




**Answer**

Given DE||BC and AD = 6cm, DB = 9cm and AE = 8 cm

Required: AC = ?

Here, DE||BC, ∴ By Thales theorem $\frac{AD}{DB} = \frac{AE}{EC}$

$\therefore \frac{6}{9} = \frac{8}{EC}$

$\Rightarrow EC = \frac{8\times9}{6}$

$\Rightarrow EC = \frac{8\times3}{2}$

$\Rightarrow EC = 4\times3 = 12$

∴ EC = 12cm

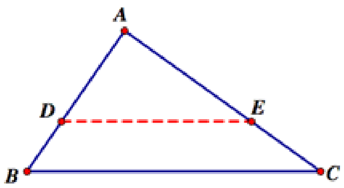
∴ AC = AE + EC = 8 + 12 = 20cm

∴ Length of AC = 20cm

### 1 B. Question

In a ΔABC, D and E are points on the sides AB and AC respectively such that DE || BC.

If AD = 8 cm, AB = 12 cm and AE = 12 cm, then find CE.




**Answer**

Given DE||BC and AD = 8cm, AB = 12cm and AE = 12 cm

Required: CE = ?

Here, DB = AB—AD = 12—8 = 4cm

Also, DE||BC, ∴ By Thales theorem $\frac{AD}{DB} = \frac{AE}{CE}$

$\therefore \frac{8}{4} = \frac{12}{CE}$

$\Rightarrow CE = \frac{12\times4}{8}$

$\Rightarrow CE = \frac{12}{2}$

$\Rightarrow CE = 6$

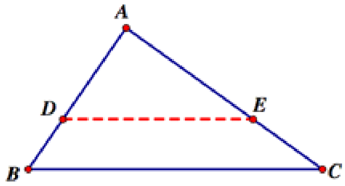
∴ CE = 6cm

∴ Length of CE = 6cm

**1 C. Question**

In a ΔABC, D and E are points on the sides AB and AC respectively such that DE || BC.

If AD = 4x-3, BD = 3x-1, AE = 8x-7 and EC = 5x-3, then find the value of x.




**Answer**

Given DE||BC and AD = 4x—3, BD = 3x—1, AE = 8x—7 and EC = 5x—3

Required: x = ?

Here, DE||BC, ∴ By Thales theorem $\frac{AD}{BD} = \frac{AE}{EC}$

$\therefore \frac{4x-3}{3x-1} = \frac{8x-7}{5x-3}$

$\Rightarrow (4x-3)(5x-3) = (8x-7)(3x-1)$

$\Rightarrow 20x^2 - 12x - 15x + 9 = 24x^2 - 8x - 21x + 7$

$\Rightarrow 24x^2 - 20x^2 + 12x + 15x - 8x - 21x - 9 + 7 = 0$

$\Rightarrow 4x^2 - 2x - 2 = 0$

$\Rightarrow 2(2x^2 - x - 1) = 0$

$\Rightarrow 2x^2 - x - 1 = 0$

$\Rightarrow 2x^2 - 2x + x - 1 = 0$

$\Rightarrow 2x(x-1) + 1(x-1) = 0$

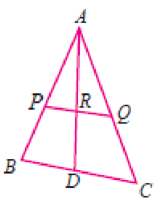
$\Rightarrow (2x+1)(x-1) = 0$

$\Rightarrow x = 1$ or $\frac{-1}{2}$

∴Values x can have are $x = 1$ and $\frac{-1}{2}$

**2. Question**

In the figure, AP = 3 cm, AR = 4.5 cm, AQ = 6 cm, AB = 5 cm, and AC = 10 cm. Find the length of AD.




**Answer**

Given: AP = 3 cm, AR = 4.5 cm, AQ = 6 cm, AB = 5 cm, and AC = 10 cm

Required: Find the length of AD

Consider the ΔABC

Here, PB = AB—AP = 5—3 = 2cm and QC = AC—AQ = 10—6 = 4cm

Now, $\frac{AP}{PB} = \frac{3}{2}$ and $\frac{AQ}{QC} = \frac{6}{4} = \frac{3}{2}$

Here, we can clearly see that $\frac{AP}{PB} = \frac{AQ}{QC}$

∴ By Converse Thales theorem PQ||BC ($\because \frac{AP}{PB} = \frac{AQ}{QC}$)

Now Consider Δ ABD

Here, PR|| BD

∴ BY Thales theorem $\frac{AP}{PB} = \frac{AR}{RD}$

$\Rightarrow \frac{3}{2} = \frac{4.5}{RD}$

$\Rightarrow RD = \frac{4.5 \times 2}{3}$

$\Rightarrow RD = 1.5 \times 2$

⇒ RD = 3cm

∴ AD = AR + RD = 4.5 + 3 = 7.5 cm

∴ Length of AD = 7.5cm

**3 A. Question**

E and F are points on the sides PQ and PR respectively, of a Δ PQR. For each of the following cases, verify EF||QR.

PE = 3.9 cm, EQ = 3 cm, PF = 3.6 cm and FR = 2.4 cm.

**Answer**

Given: E and F are points on the sides PQ and PR respectively, of a $\triangle$ PQR. PE = 3.9 cm, EQ = 3 cm, PF = 3.6 cm and FR = 2.4 cm

Required: To verify if EF||QR

Consider the ΔPQR

Here, $\frac{PE}{EQ} = \frac{3.9}{3} = \frac{1.3}{1}$ and $\frac{PF}{FR} = \frac{3.6}{2.4} = \frac{3}{2}$

We can clearly see that $\frac{PE}{EQ} \neq \frac{PF}{FR}$

∴ Converse Thales theorem is also not satisfied.

∴ No, EF is not parallel to QR

**3 B. Question**

E and F are points on the sides PQ and PR respectively, of a $\triangle$ PQR. For each of the following cases, verify EF||QR.

PE = 4 cm, QE = 4.5 cm, PF = 8 cm and RF = 9cm.

**Answer**

Given: E and F are points on the sides PQ and PR respectively, of a $\triangle$ PQR. PE = 4 cm, QE = 4.5 cm, PF = 8 cm and RF = 9cm

Required: To verify if EF||QR

Consider the ΔPQR

Here, $\frac{PE}{EQ} = \frac{4}{4.5}$ and $\frac{PF}{FR} = \frac{8}{9} = \frac{4}{4.5}$

We can clearly see that $\frac{PE}{EQ} = \frac{PF}{FR}$

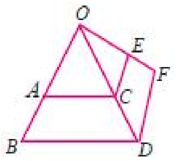
∴ Converse Thales theorem is satisfied and EF||QR.

∴ Yes, EF is parallel to QR(EF||QR)

**4. Question**

In the figure,

AC||BD and CE||DF. If OA = 12cm, AB = 9 cm, OC = 8 cm and EF = 4.5 cm, then find FO.




**Answer**

Given: AC||BD and CE||DF.OA = 12cm, AB = 9 cm, OC = 8 cm and EF = 4.5 cm

Required: Length of FO

Consider Δ BOD

Here, AC||BD

∴ By Thales theorem $\frac{OA}{AB} = \frac{OC}{CD}$

$\Rightarrow \frac{12}{9} = \frac{8}{CD}$

$\Rightarrow CD = \frac{8 \times 9}{12} = 6$

∴ CD = 6cm

Now, Consider ΔDOF

Here, CE||DF

∴ By Thales theorem $\frac{OC}{CD} = \frac{OE}{EF}$

$\Rightarrow \frac{8}{6} = \frac{OE}{4.5}$

$\Rightarrow OE = \frac{8 \times 4.5}{6} = 6$

∴ OE = 6cm

∴ FO = OE + EF = 6 + 4.5 = 10.5cm

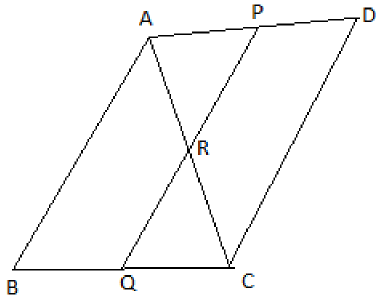
∴ Length of FO = 10.5 cm.

**5. Question**

ABCD is a quadrilateral with AB parallel to CD. A line drawn parallel to AB meets AD at P and BC at Q. Prove that $\frac{AP}{PD} = \frac{BQ}{QC}$.

**Answer**

Given: ABCD is a quadrilateral with AB parallel to CD and line drawn parallel to AB meets AD at P and BC at Q




Required: To prove $\frac{AP}{PD} = \frac{BQ}{QC}$

Construction: draw a diagonal AC, which intersects PQ at R

Now, in ΔABC

Here, QR||AB

∴ By Thales theorem $\frac{QC}{BQ} = \frac{CR}{AR}$

$\Rightarrow \frac{BQ}{QC} = \frac{AR}{RC}$ --eq(1)

Now, consider ΔACD

Here, RP||DC

∴ By Thales theorem $\frac{AR}{RC} = \frac{AP}{PD}$ --eq(2)

From --eq(1) and –eq(2)

We have,

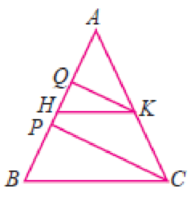
$\frac{AP}{PD} = \frac{BQ}{QC}$

$\therefore \frac{AP}{PD} = \frac{BQ}{QC}$

Hence Proved

**6. Question**

In the figure, PC||QK and BC||HK. If AQ = 6 cm, QH = 4 cm, HP = 5 cm, KC = 18 cm, then find AK and PB.




**Answer**

Given: PC||QK and BC||HK, AQ = 6 cm, QH = 4 cm, HP = 5 cm, KC = 18 cm

Required: Length of AK and PB

Consider the ΔAPC

Here, PC||QK

∴ By Thales theorem $\frac{AQ}{QP} = \frac{AK}{KC}$

Here, QP = QH + HP = 4 + 5 = 9cm

$\Rightarrow \frac{6}{9} = \frac{AK}{18}$

$\Rightarrow AK = \frac{6 \times 18}{9} = 12$

∴ AK = 12cm

Now, Consider ΔABC

Here, BC||HK

∴ By Thales theorem $\frac{AH}{HB} = \frac{AK}{KC}$

Here, AH = AQ + QH = 6 + 4 = 10cm

$\Rightarrow \frac{10}{HB} = \frac{12}{18}$

$\Rightarrow HB = \frac{10 \times 18}{12} = 15$

⇒ HB = 15cm

⇒ PB = HB—HP = 15—5 = 10cm

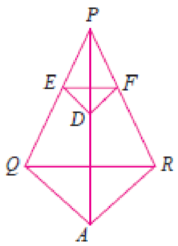
∴ PB = 10cm

∴ Length of AK and PB are 12 cm and 10 cm respectively.

**7. Question**

In the figure, DE||AQ and DF||AR

Prove that EF||QR.




**Answer**

Given: DE||AQ and DF||AR

Required: To prove EF||QR.

Consider ΔAPQ

Here, ED||QA

∴ By Thales theorem $\frac{PE}{EQ} = \frac{PD}{DA}$ --eq(1)

Now, Consider ΔPAR

Here, DF||AR

∴ By Thales theorem $\frac{PD}{DA} = \frac{PF}{FR}$ --eq(2)

From –eq(1) and –eq(2), we can see that

$\frac{PE}{EQ} = \frac{PF}{FR}$

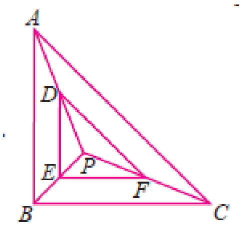
∴ By Converse Thales theorem we can say that EF||QR in ΔPQR ($\because \frac{PE}{EQ} = \frac{PF}{FR}$)

Hence Proved

**8. Question**

In the figure DE||AB and DF||AC.

Prove that EF||BC.




**Answer**

Given: DE||AB and DF||AC

Required: To prove EF||BC.

Consider ΔAPB

Here, ED||AB

∴ By Thales theorem $\frac{PE}{EB} = \frac{PD}{DA}$ --eq(1)

Now, Consider ΔPAC

Here, DF||AC

∴ By Thales theorem $\frac{PD}{DA} = \frac{PF}{FC}$ --eq(2)

From –eq(1) and –eq(2), we can see that

$\frac{PE}{EB} = \frac{PF}{Fc}$

∴ By Converse Thales theorem we can say that EF||BC in ΔPBC ($\because \frac{PE}{EB} = \frac{PF}{Fc}$)

Hence Proved

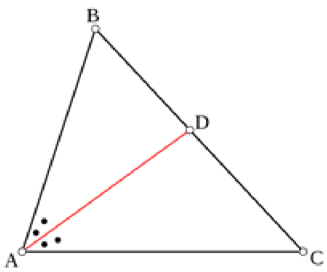
**9 A. Question**

In a ΔABC, AD is the internal bisector of ∠A, meeting BC at D.

If BD = 2 cm, AB = 5 cm, DC = 3 cm find AC.

**Answer**

Given: A ΔABC with AD as internal bisector of ∠A, meeting BC at D. and BD = 2 cm, AB = 5 cm, DC = 3 cm




Required: The length of AC

Here, In ΔABC AD is the internal bisector of ∠A

∴ By angle bisector theorem $\frac{BD}{DC} = \frac{AB}{AC}$

$\Rightarrow \frac{2}{3} = \frac{5}{AC}$

$\Rightarrow AC = \frac{5\times3}{2} = 7.5$

∴ AC = 7.5cm

∴ Length of AC = 7.5 cm

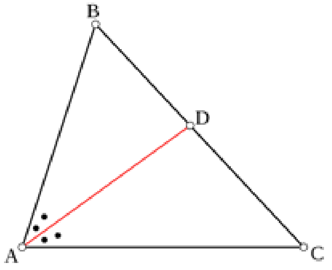
**9 B. Question**

In a ΔABC, AD is the internal bisector of ∠A, meeting BC at D.

If AB = 5.6 cm, AC = 6 cm and DC = 3 cm find BC.

**Answer**

Given: A △ABC with AD as internal bisector of ∠A, meeting BC at D. and AB = 5.6 cm, AC = 6 cm, DC = 3 cm




Required: The length of BC

Here, In ΔABC AD is the internal bisector of ∠A

∴ By angle bisector theorem $\frac{BD}{DC} = \frac{AB}{AC}$

$\Rightarrow \frac{BD}{3} = \frac{5.6}{6}$

$\Rightarrow BD = \frac{5.6\times3}{6} = 2.8$

∴ BD = 2.8cm

∴ Length of BD = 2.8 cm

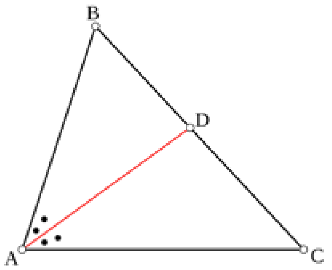
**9 C. Question**

In a ΔABC, AD is the internal bisector of ∠A, meeting BC at D.

If AB = x, AC = x–2, BD = x + 2 and DC = x–1 find the value of x.

**Answer**

Given: A ΔABC with AD as internal bisector of ∠A, meeting BC at D. and AB = x, AC = x–2, BD = x + 2, DC = x–1




Required: The length of BC

Here, In ΔABC AD is the internal bisector of ∠A

∴ By angle bisector theorem $\frac{BD}{DC} = \frac{AB}{AC}$

$\Rightarrow \frac{x+2}{x-1} = \frac{x}{x-2}$

⇒ (x + 2)(x—2) = x(x—1)

⇒ $x^2$—4 = $x^2$—x (∵ (a + b)(a—b) = $a^2$—$b^2$)

⇒ x = 4

∴The value of x = 4cm

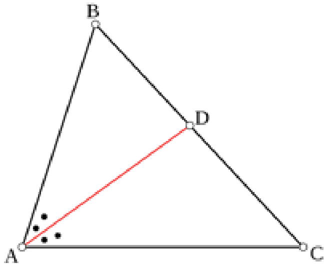
**10 A. Question**

Check whether AD is the bisector of ∠A of ΔABC in each of the following.

AB = 4 cm, AC = 6 cm, BD = 1.6 cm, and CD = 2.4 cm.

**Answer**

Given: AB = 4 cm, AC = 6 cm, BD = 1.6 cm, and CD = 2.4 cm




Required: To verify if AD is the bisector of ∠A of ΔABC

Consider the ΔABC,

Here, $\frac{BD}{DC} = \frac{1.6}{2.4} = \frac{2}{3}$ and $\frac{AB}{AC} = \frac{4}{6} = \frac{2}{3}$

Here, we can clearly see that $\frac{BD}{DC} = \frac{AB}{AC}$

∴We can say that AD is the angle bisector of ∠A using Converse angle bisector theorem.

∴ Yes, AD is the angle bisector of ∠A

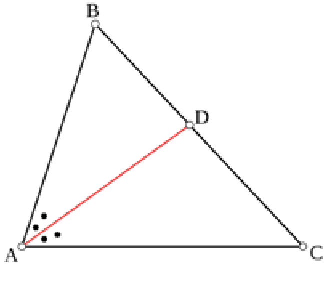
**10 B. Question**

Check whether AD is the bisector of ∠A of ΔABC in each of the following.

AB = 6 cm, AC = 8 cm, BD = 1.5 cm and CD = 3 cm.

**Answer**

Given: AB = 6 cm, AC = 8 cm, BD = 1.5 cm and CD = 3 cm




Required: To verify if AD is the bisector of ∠A of ΔABC

Consider the ΔABC,

Here, $\frac{BD}{DC} = \frac{1.5}{3} = \frac{1}{2}$ and $\frac{AB}{AC} = \frac{6}{8} = \frac{3}{4}$

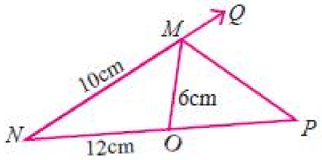
Here, we can clearly see that $\frac{BD}{DC} \neq \frac{AB}{AC}$

∴We can say that AD is not the angle bisector of ∠A using Converse angle bisector theorem.

∴ No, AD is not the angle bisector of ∠A

**11. Question**

In a ΔMNO, MP is the external bisector of ∠M meeting NO produced at P. If MN = 10 cm, MO = 6 cm, NO = 12 cm, then find OP.




**Answer**

Given: A $\triangle$ MNO with MP as external bisector of $\angle$M meeting NO produced at P, and MN = 10 cm, MO = 6 cm, NO = 12 cm

Required: Length of OP

In ΔMNP , MP is the external bisector of ∠M meeting NO ant produced at P.

Let OP = x cm , Now by angle bisector theorem, we have $\frac{NP}{OP} = \frac{MN}{MO}$

⇒ $\frac{x+12}{x} = \frac{10}{6}$

⇒ (x + 12)×6 = 10x

⇒ 6x + 72 = 10x

⇒ 10x—6x = 72

⇒ 4x = 72

⇒ x = $\frac{72}{4}$ = 18

∴The value of x = 18 cm.

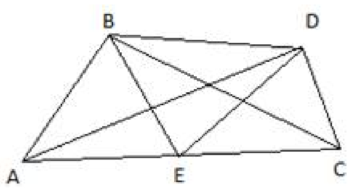
**12. Question**

In a quadrilateral ABCD, the bisectors of ∠B and ∠D intersect on AC at E.

Prove that $\frac{AB}{BC} = \frac{AD}{DC}$.

**Answer**

Given: quadrilateral ABCD with bisectors at B and D intersecting at e on AC




Required: To Prove $\frac{AB}{BC} = \frac{AD}{DC}$

Consider ΔABC, here BE is the angle bisector of ∠B

∴ By Angle bisector theorem we have, $\frac{AE}{EC} = \frac{AB}{AC}$ --eq(1)

Now, Consider ΔADC, here DE is the angle bisector of ∠D

∴ By Angle bisector theorem we have, $\frac{AE}{EC} = \frac{AD}{DC}$ --eq(2)

From –eq(1) and –eq(2)

We have,

$\frac{AB}{AC} = \frac{AD}{DC}$

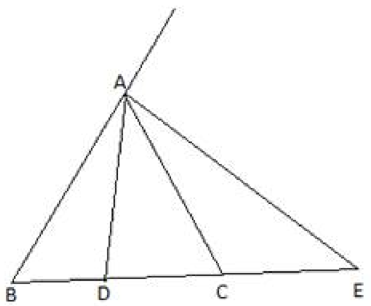
Hence proved

**13. Question**

The internal bisector of ∠A of Δ BC meets BC at D and the external bisector of ∠A meets BC produced at E. Prove that $\frac{BD}{BE} = \frac{CD}{CE}$.

**Answer**

Given: The internal bisector of ∠A of Δ ABC meets BC at D and the external bisector of ∠A meets BC produced at E




Required: To prove $\frac{BD}{BE} = \frac{CD}{CE}$

Consider ΔABC, here AD is the internal angle bisector of ∠A

∴ By Angle bisector theorem we have, $\frac{BD}{CD} = \frac{AB}{AC}$ --eq(1)

Again Consider ΔABC, Now AE is the External angle bisector of ∠A

∴ By Angle bisector theorem we have, $\frac{BE}{CE} = \frac{AB}{AC}$ --eq(2)

From –eq(1) and –eq(2)

We have,

$\frac{BD}{CD} = \frac{BE}{CE}$

$\Rightarrow \frac{BD}{BE} = \frac{CD}{CE}$

$\therefore \frac{BD}{BE} = \frac{CD}{CE}$

Hence Proved

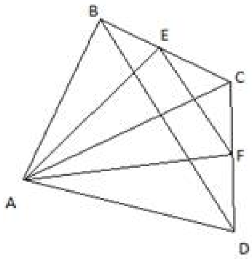
**14. Question**

ABCD is a quadrilateral with AB = AD. If AE and AF are internal bisectors of ∠BAC and ∠DAC respectively, then prove that EF||BD

**Answer**

Given: ABCD is a quadrilateral with AB = AD. If AE and AF are internal bisectors of ∠BAC and ∠DAC respectively

Required: To prove EF||BD




Consider the ΔABC,

Here, AE is the angle bisector of ∠A

∴ By angle bisector theorem $\frac{CE}{EB} = \frac{AC}{AB}$ --eq(1)

Now, In ΔACD,

Here, AF is the angle bisector of ∠A

∴ By angle bisector theorem $\frac{CF}{FD} = \frac{AC}{AD}$

$\Rightarrow \frac{CF}{FD} = \frac{AC}{AB}$ (∵ AD = AB) --eq(2)

From –eq(1) and –eq(2)

We have,

$\frac{CE}{EB} = \frac{CF}{FD}$

Now, Consider ΔBCD

Here, $\frac{CE}{EB} = \frac{CF}{FD}$

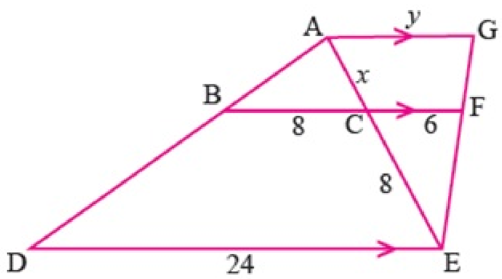
∴We can say that EF||BD by Converse Thales theorem.

Hence Proved

## Exercise 6.2

**1 A. Question**

Find the unknown values in each of the following figures. All lengths are given in centimeters. (All measures are not in scale)




**Answer**

In this question we must find the value of x and y, i.e. AC and AG respectively.

<u>In such questions where we are given with some sides or angles of one or more triangles and we need find the other remaining sides and angles of triangles. The concept generally used is of congruency and similarity.</u>

In this question we will be dealing only with sides.

Here,

In ΔADE and ΔABC

∠A is common

∠ACB = ∠AED by correspondence(BC∥DE),

∠ABC = ∠ADE by correspondence(FC∥DA)

∴ ΔADE ~ ΔABC

Similarly, ΔEGA~ΔEFC

$\Rightarrow \frac{AC}{AE} = \frac{BC}{DE}$(∵ ΔADE~ΔABC)

$\Rightarrow \frac{x}{x + 8} = \frac{8}{24}$

⇒ 24x = 8x + 64

⇒ 16x = 64

⇒ x = 4 cm

Also,

$\frac{EC}{EA} = \frac{FC}{GA}$(∵ΔEGA~ΔEFC)

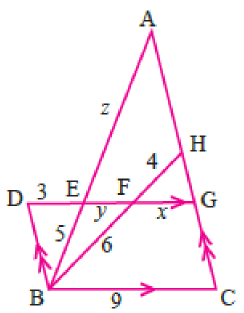
$\Rightarrow \frac{8}{12} = \frac{6}{y}$(∵EA = 8 + x, GA = y)

⇒ y = 9 cm

⇒ y = 4 cm

**1 B. Question**

Find the unknown values in each of the following figures. All lengths are given in centimeters. (All measures are not in scale)




**Answer**

We need to find x, y and z. i.e. FG and EF respectively.

Now,

In ΔHFG and ΔHBC

∠HFG = ∠HBC by corresponding angles (DG∥BC)

∠HGF = ∠HCB by corresponding angles (FG∥BC)

∴ ΔHFG ~ ΔHBC

$\Rightarrow \frac{FG}{BC} = \frac{HF}{HB}$(∵ ΔHFG ~ ΔHBC)

$\Rightarrow \frac{x}{9} = \frac{4}{4 + 6}$

⇒ x = 3.6 cm

Now,

In ΔFHG and ΔFBD

∠DFB = ∠HFG by vertically opposite angles

∠FDB = ∠FGH by alternate angles (DB∥AC)

∴ ΔFHG ~ ΔFBD

$\Rightarrow \frac{x}{3 + y} = \frac{4}{6}$

⇒ 6×3.6 = 12 + 4y (∵ x=3.6)

⇒ y = 2.4 cm

Now,

In ΔAEG and ΔABC

∠AEG = ∠ABC by corresponding angles (EG∥BC)

∠AGE = ∠ACB by corresponding angles (EG∥BC)

∴ ΔAEG ~ ΔABC

$\Rightarrow \frac{AE}{AB} = \frac{EG}{BC}$ (∵ ΔAEG ~ ΔABC)

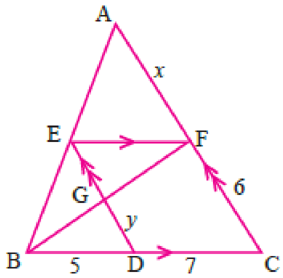
$\Rightarrow \frac{z}{z + 5} = \frac{x + y}{9}$

$\Rightarrow \frac{z}{z+5} = \frac{6}{9}$ (∵ x=3.6 and y=2.4)

⇒ z = 10 cm

**1 C. Question**

Find the unknown values in each of the following figures. All lengths are given in centimeters. (All measures are not in scale)




**Answer**

To find x and y i.e. AF and GD respectively.

Now,

In ΔFBC and ΔGBD

∠FBC = ∠GBD (common)

∠BFC = ∠BGD by corresponding angles (DE∥CF)

∴ ΔFBC ~ ΔGBD

$\Rightarrow \frac{GD}{FC} = \frac{BD}{DC}$ (∵ ΔFBC ~ ΔGBD)

$\Rightarrow \frac{y}{6} = \frac{5}{7 + 5}$

$\Rightarrow$ y = 2.5 cm

EF = DC ($\because$ EFCD is a parallelogram)

$\Rightarrow$ EF = 7 cm

Now,

In ΔAEF and ΔABC

∠AEF = ∠ABC by corresponding angles (EF∥BC)

∠AFE = ∠ACB by corresponding angles (EF∥BC)

∴ ΔAEF ~ ΔABC

$\Rightarrow \frac{AF}{AC} = \frac{EF}{BC}$ ($\because$ ΔAEF ~ ΔABC)

$\Rightarrow \frac{x}{x + 6} = \frac{7}{12}$

$\Rightarrow$ x = 8.4 cm

**2. Question**

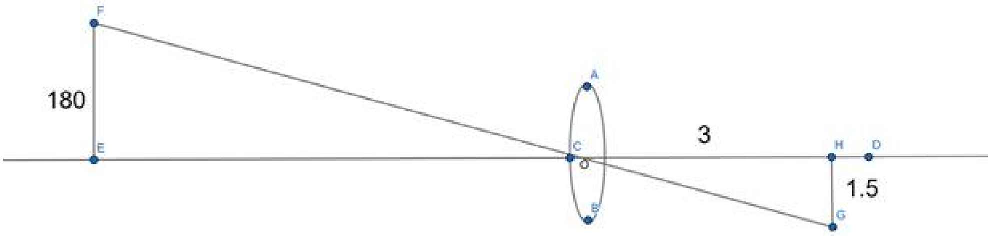
The image of a man of height 1.8 m, is of length 1.5 cm on the film of a camera. If the film is 3 cm from the lens of the camera, how far is the man from the camera?

**Answer**

The figure is given below. Here, FE is the man whose height is 180 cm.

HG is the image of the man, height of image = 1.5 cm

AB is the camera lens.




We need to find the length of EO.

In ΔFEO and ΔHGO

∠GOH = ∠FOE (Vertically Opposite)

∠GHO = ∠FEO by alternate angles (FE∥GH)

∴ ΔFEO ~ ΔHGO

$\Rightarrow \frac{HG}{EF} = \frac{HO}{EO}$ ($\because$ ΔFEO ~ Δ HGO)

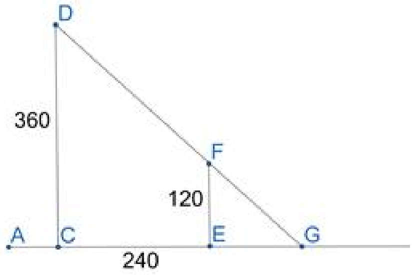
$\Rightarrow \frac{1.5}{180} = \frac{3}{EO}$

$\Rightarrow$ EO = 3.6 m

**3. Question**

A girl of height 120 cm is walking away from the base of a lamp-post at a speed of 0.6 m/sec. If the lamp is 3.6 m above the ground level, then find the length of her shadow after 4 seconds.

**Answer**




Here,

In the figure above,

FE is the height of the girl.

DC is the height of the lamp.

CE is the distance traveled by the girl in 4 seconds.

GE is the shadow of the girl after 4 seconds.

We need to find GE.

CE = 4 × 0.6 m

CE = 240 cm

In ΔGFE and ΔGDC

∠EFG = ∠CDG by corresponding angles (DC∥FE)

∠GFE = ∠GDC by corresponding angles (DC∥FE)

∴ ΔGFE ~ ΔGDC

$\Rightarrow \frac{GE}{GC} = \frac{FE}{DC}$(∵ ΔGFE ~ ΔGDC)

$$\Rightarrow \frac{GE}{240\ +\ GE} = \frac{120}{360}$$

$$\Rightarrow \frac{GE}{240\ +\ GE} = \frac{1}{3}$$

⇒ 3×GE = 240 + GE

⇒ 2×GE = 240

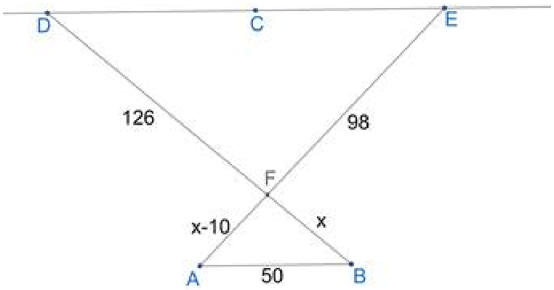
⇒ GE = 120 cm

⇒ GE = 1.2 m

**4. Question**

A girl is in the beach with her father. She spots a swimmer drowning. She shouts to her father who is 50 m due west of her. Her father is 10 m nearer to a boat than the girl. If her father uses the boat to reach the swimmer, he has to travel a distance 126 m from that boat. At the same time, the girl spots a man riding a water craft who is 98 m away from the boat. The man on the water craft is due east of the swimmer. How far must the man travel to rescue the swimmer? (Hint: see figure).

**Answer**




Here,

In the above figure,

B is the girl.

A is her father.

F is the boat.

D is the Drowning Man.

E is the man driving water craft.

We need to find the distance ED.

Now,

In ΔFAB and ΔFED

∠AFB = ∠EFD (vertically opposite angle)

∠FAB = ∠FED by alternate angles (AB∥DE)

∴ ΔFAB ~ ΔFED

$\Rightarrow \frac{BF}{DF} = \frac{FA}{FE}$ (∵ ΔFAB ~ ΔFED)

$\Rightarrow \frac{x}{126} = \frac{x-10}{98}$

⇒ x = 45 m

$\frac{FB}{FE} = \frac{AB}{ED}$ (∵ ΔFAB ~ ΔFED)

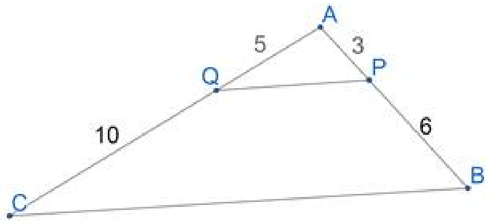
$\Rightarrow \frac{x}{98} = \frac{50}{ED}$

⇒ ED = 140 m (∵ x = 45 m)

**5. Question**

P and Q are points on sides AB and AC respectively, of ΔABC. If AP = 3 cm, PB = 6 cm, AQ = 5 cm and QC = 10 cm, show that BC = 3 PQ.

**Answer**




Now,

In ΔAPQ and ΔABC,

∠QAP = ∠CAB (common)

$\frac{AP}{AB} = \frac{AQ}{AC}$ (given)

∴ ΔACB ~ ΔAQP

$\Rightarrow \frac{AP}{AB} = \frac{PQ}{BC}$ (∵ ΔACB ~ ΔAQP)

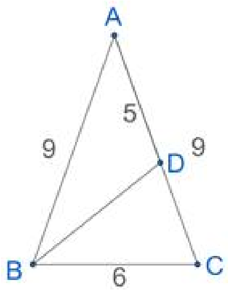
$\Rightarrow \frac{3}{3 + 6} = \frac{PQ}{BC}$

⇒ BC = 3PQ

**6. Question**

In ΔABC, AB = AC and BC = 6 cm. D is a point on the side AC such that AD = 5 cm and CD = 4 cm. Show that ΔBCD ~ ΔACB and hence find BD.

**Answer**




Here,

DC = (9 - 5) cm

DC = 4 cm

Now,

In ΔBCD and ΔACB

∠DCB = ∠ACB (common)

$\frac{DC}{BC} = \frac{BC}{AC} = \frac{2}{3}$

∴ ΔBCD ~ ΔACB

$\Rightarrow \frac{BD}{AB} = \frac{DC}{BC}$ (∵ ΔBCD ~ ΔACB)

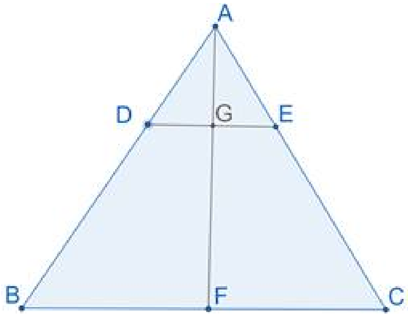
$\Rightarrow \frac{BD}{9} = \frac{4}{6}$

⇒ BD = 6 cm

**7. Question**

The points D and E are on the sides AB and AC of ΔABC respectively, such that DE || BC. If AB = 3 AD and the area of Δ ABC is 72 $cm^2$, then find the area of the quadrilateral DBCE.

**Answer**




Here,

In ΔADE and ΔABC

∠ADE = ∠ABC by corresponding angles (DE∥BC)

∠DEA = ∠BCA by corresponding angles (DE∥BC)

∴ ΔAED ~ ΔACB

Similarly,

ΔAGD ~ ΔAFB (where AF ⊥ BC)

⇒ AF = 3AG (∵ AB = 3AD which is given) ----(1)

Similarly,

⇒ BC = 3×DE ----(2)

⇒ $\frac{1}{2} \times \mathrm{BC} \times \mathrm{AF} \; = \; \frac{1}{2} \times (3 \times \mathrm{DE}) \times (3 \times \mathrm{AG})$ {by (1) and (2)}

⇒ $\frac{1}{2}\mathrm{BC} \times \mathrm{AF} \; = \; 9 \times \frac{1}{2}\mathrm{DE} \times \mathrm{AG}$

⇒ Area of ΔABC = 9 × Area of ΔADE

⇒ $\text{Area of } \Delta\text{ADE} \; = \; \frac{72}{9}\mathrm{cm}^2$ (∵ Area of ΔABC = 72 $cm^2$)

⇒ Area of ΔADE = 8 $cm^2$

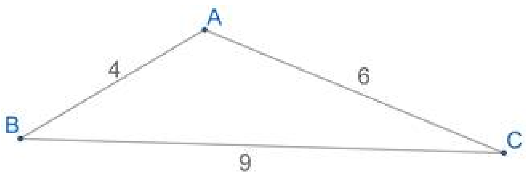
⇒ Area of DCEB = Area of ΔABC - Area of ΔADE

⇒ Area of DCEB = 72 – 8 = 64$cm^2$

**8. Question**

The lengths of three sides of a triangle ABC are 6 cm, 4 cm and 9 cm. ΔPQR ~ ΔABC. One of the lengths of sides of ΔPQR is 35cm. What is the greatest perimeter possible for ΔPQR?

**Answer**




One of the length should be 35cm.

So, for perimeter to be greatest the smallest length of PQR should be 35 cm so that the other 2 sides could be greater than 35 cm hence greatest Perimeter achieved in that case.

ΔPQR ~ ΔABC (given)

⇒ PQ = 35 cm (∵ It corresponds AB which is the smaller side of ΔABC)

$\Rightarrow \frac{PQ}{PR} = \frac{AB}{AC}$

$\Rightarrow \frac{35}{PR} = \frac{4}{6}$

⇒ PR = 52.5 cm

$\Rightarrow \frac{PQ}{QR} = \frac{AB}{BC}$

$\Rightarrow \frac{35}{QR} = \frac{4}{9}$

⇒ QR = 78.75 cm

⇒ Perimeter = PQ + PR + QR

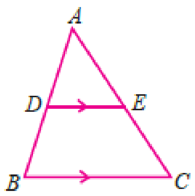
⇒ Perimeter = 35 + 52.5 + 78.75

⇒ Perimeter = 166.25 cm

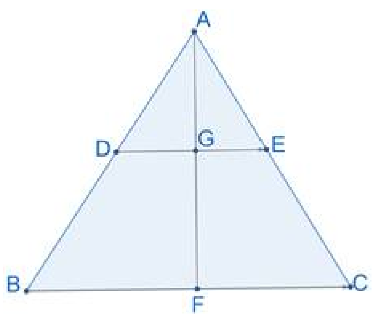
**9. Question**

In the figure, DE || BC and $\frac{AD}{BD} = \frac{3}{5}$, calculate the value of

(i) $\frac{\text{area of } \Delta ADE}{\text{area of } \Delta ABC}$ (ii) $\frac{\text{area of trapezium BCED}}{\text{area of } \Delta ABC}$




**Answer**




i) In ΔADG and ΔABF

∠ADE = ∠ABC by corresponding angles (DG∥BF)

∠AED = ∠ACB by corresponding angles (DG∥BF)

∴ ΔADE ~ ΔABC

Let AD = 3x, so BD = 5x.

$\frac{AD}{AB} = \frac{DE}{BC}$

$\Rightarrow \frac{AD}{AD + BD} = \frac{DE}{BC}$

$\Rightarrow \frac{3}{8} = \frac{DE}{BC}$----(1)

Similarly, ΔADG ~ ΔABF

$$\frac{AD}{AB} = \frac{AG}{AF}$$

$$\Rightarrow \frac{AD}{AD + BD} = \frac{AG}{AF}$$

$\Rightarrow \frac{3}{8} = \frac{AG}{AF}$----(2)

Now, $\frac{\text{Area of } \Delta ADE}{\text{Area of } \Delta ABC} = \frac{\frac{1}{2} DE \times AG}{\frac{1}{2} AC \times AF}$

$\Rightarrow \frac{\text{Area of } \Delta ADE}{\text{Area of } \Delta ABC} = \frac{9}{64}$ (by (1) and (2)) ----(3)

ii) Area of BCED = Area of ΔABC – Area of ΔADE

$\text{Area of BCED} = \text{Area of } \Delta ABC - \frac{9}{64} \times \text{Area of } \Delta ABC$(by (3))

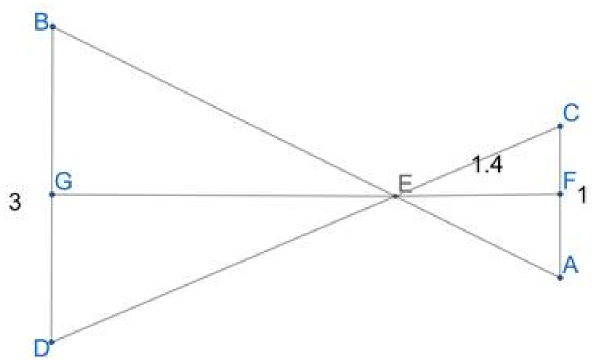
$$\text{Area of BCED} = \frac{55}{64} \times \text{Area of } \Delta ABC$$

$$\frac{\text{Area of BCED}}{\text{Area of } \Delta ABC} = \frac{55}{64}$$

**10. Question**

The government plans to develop a new industrial zone in an unused portion of land in a city. The shaded portion of the map shown on the right, indicates the area of the new industrial zone. Find the area of the new industrial zone.


**Answer**




To find the Area of ΔEBD.

EF = 1.4 Km

In ΔEBD and ΔEAC

∠EBD = ∠EAC by alternate angles (BD∥CA)

∠EDB = ∠ECA by alternate angles (BD∥CA)

$\therefore$ ΔEBD ~ ΔEAC

$\Rightarrow \frac{BE}{AE} = \frac{BD}{AC}$

$\Rightarrow \frac{BE}{AE} = 3$(∵ BD = 3, AC = 1)

Similarly,

ΔEBG ~ ΔEAF

$\Rightarrow \frac{EG}{EF} = \frac{3}{1}$ ---(1)

$$\Rightarrow \frac{\text{Area of } \Delta EBD}{\text{Area of } \Delta EAC} = \frac{\frac{1}{2} \times EG \times BD}{\frac{1}{2} \times EF \times AC}$$

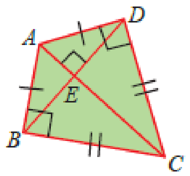
$\Rightarrow \frac{\text{Area of } \Delta EBD}{\text{Area of } \Delta EAC} = 9$ (by (1))

$$\Rightarrow \text{Area of } \Delta EBD = 9 \times \frac{1}{2} \times 1.4 \times 1\text{Km}^2$$

⇒ Area of ΔEBD = 6.3

**11. Question**

A boy is designing a diamond shaped kite, as shown in the figure where AE = 16 cm, EC = 81 cm. He wants to use a straight cross bar BD. How long should it be?




**Answer**

To find DB

Let ∠EAD = x ----(1)

⇒ ∠ADE = 90 – x (∵ AED = 90 and sum of angles of triangle is 180)

⇒ ∠EDC = x (∵ ∠ADC = 90) ----(2)

⇒ ∠EAD = ∠EDC (by (1) and (2)) ----(3)

Now,

In ΔAED and ΔDEC

∠AED = ∠DEC (both perpendicular to AC)

∠EAD = ∠EDC (by (3))

$\therefore$ ΔAED ~ ΔDEC

$\Rightarrow \frac{EA}{ED} = \frac{ED}{EC}$(∵ ΔAED ~ ΔDEC)

⇒ 16×81 = $ED^2$

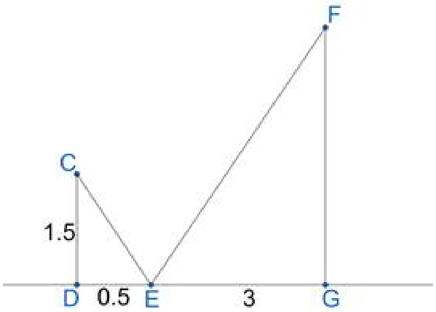
⇒ ED = 36 cm

⇒ 2×ED = DB = 72 cm

**12. Question**

A student wants to determine the height of a flagpole. He placed a small mirror on the ground so that he can see the reflection of the top of the flagpole. The distance of the mirror from him is 0.5 m and the distance of the flagpole from the mirror is 3 m. If his eyes are 1.5 m above the ground level, then find the height of the flagpole. (The foot of student, mirror and the foot of flagpole lie along a straight line).

**Answer**




Here,

In the above Figure,

DE is the distance of student and mirror.

EG is the distance of mirror and flagpole.

CD is the height of student till its eyes.

FG is the height of flagpole which we need to find.

Now,

In ΔCDE and ΔFGE

∠FEG = ∠CED (by mirror property)

∠CDE = ∠FGE (both perpendicular given)

∴ ΔCDE ~ ΔFGE

⇒ $\frac{DE}{GE} = \frac{CD}{FG}$(∵ ΔCDE ~ ΔFGE)

⇒ $\frac{0.5}{3} = \frac{1.5}{FG}$

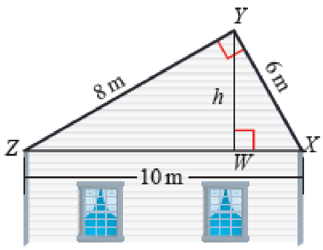
⇒ FG = 9 m

**13. Question**

A roof has a cross section as shown in the diagram,

(i) Identify the similar triangles

(ii) Find the height h of the roof.




**Answer**

In ΔYZW

Let ∠YZW = x

⇒ ∠ZYW = 90-x (∵ It is a right-angled triangle)

⇒ ∠XYW = x (∵ ∠ZYX is 90)

⇒ ∠YZW = ∠XYW ----(1)

Similarly,

∠XYW = ∠XZY ----(2)

Now,

In ΔYWZ and ΔXYZ

∠WXY = ∠ZXY (common)

∠YWZ = ∠XYZ (by (1))

∴ ΔYWZ ~ ΔXYZ ----(3)

Now,

In ΔXWY and ΔXYZ

∠YXW = ∠ZXY (common)

∠XYW = ∠XZY (by (2))

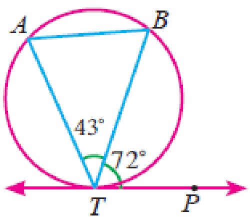
∴ ΔXWY ~ ΔXYZ ----(4)

⇒ ΔXWY ~ ΔXYZ ~ ΔYWZ (by (3) and (4))

## Exercise 6.3

**1. Question**

In the figure TP is a tangent to a circle. A and B are two points on the circle. If ∠BTP = 72° and ∠ATB = 43° find ∠ABT.




**Answer**

The alternate segment theorem (also known as the tangent-chord theorem) states that in any circle, the angle between a chord and a tangent through one of the end points of the chord is equal to the angle in the alternate segment.

Therefore by above theorem,

∠BAT = ∠BTP = 72°

Sum of all angles of a triangle = 180°

In ΔABT,

∠ABT + ∠BTA + ∠TAB = 180°

⇒ ∠ABT + 43° + 72° = 180°

⇒ ∠ABT + 115° = 180°

⇒ ∠ABT = 180° – 115°

⇒ ∠ABT = 65°

Hence, ∠ABT = 65°

**2. Question**

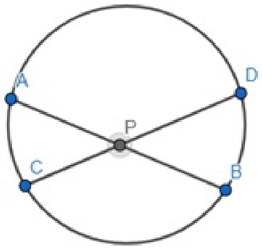
AB and CD are two chords of a circle which intersect each other internally at P.

(i) If CP = 4 cm, AP = 8 cm, PB = 2 cm, then find PD.

(ii) If AP = 12 cm, AB = 15 cm, CP = PD, then find CD

**Answer**

If two chords of a circle intersect each other internally or externally, then area of rectangle contained by the segment of one chord is equal to the area of rectangle contained by the segment of other chord.




Using above theorem,

PA × PB = PC × PD ...(1)

(i) Given: CP = 4 cm

AP = 8 cm

PB = 2 cm

Putting the values in (1),

8 cm × 2 cm = 4 cm × PD

$\Rightarrow \text{ PD } = \dfrac{8\text{ cm } \times \text{ 2 cm}}{4\text{ cm}}$

$\Rightarrow \text{ PD } = \dfrac{16}{4}\text{cm}$

⇒ PD = 4 cm

Hence, PD = 4 cm

(ii) Given: AP = 12 cm

AB = 15 cm

CP = PD

∵ AB = AP + PB

⇒ PB = AB – AP

⇒ PB = 15 cm – 12 cm

⇒ PB = 3 cm

Putting the values in (1),

12 cm × 3 cm = PD × PD

⇒ $PD^2 = 36\text{ cm}^2$ ⇒ PD = 6 cm

Hence, PD = 6 cm

**3. Question**

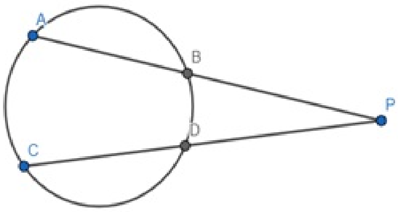
AB and CD are two chords of a circle which intersect each other externally at P

(i) If AB = 4 cm BP = 5 cm and PD = 3 cm, then find CD.

(ii) If BP = 3 cm, CP = 6 cm and CD = 2 cm, then find AB.

**Answer**

If two chords of a circle intersect each other internally or externally, then area of rectangle contained by the segment of one chord is equal to the area of rectangle contained by the segment of other chord.




Using above theorem,

PA × PB = PC × PD ...(1)

(i) Given: AB = 4 cm

BP = 5 cm

PD = 3 cm

∵ AP = AB + BP

⇒ AP = 4 cm + 5 cm

⇒ AP = 9 cm

Putting the values in (1),

9 cm × 5 cm = PC × 3 cm

$$\Rightarrow \text{PC} = \frac{9\text{ cm} \times 5\text{ cm}}{3\text{ cm}}$$

$$\Rightarrow \text{PC} = \frac{45}{3}\text{cm}$$

⇒ PC = 15 cm

∵ PC = CD + DP

⇒ 15 cm = CD + 3 cm

⇒ CD = 15 cm – 3 cm

⇒ CD = 12 cm

Hence, CD = 12 cm

(ii) Given: BP = 3 cm

CP = 6 cm

CD = 2 cm

∵ CP = CD + DP

⇒ DP = CP – CD

⇒ DP = 6 cm – 2 cm

⇒ DP = 4 cm

Putting the values in (1),

PA × 3 cm = PC × PD

⇒ PA × 3 cm = 6 cm × 4 cm $\Rightarrow \text{PA} = \frac{6\text{ cm} \times 4\text{ cm}}{3\text{ cm}}$

$\Rightarrow \ PA = \frac{24}{3} cm$

⇒ PA = 8 cm

∵ AP = AB + BP

⇒ 8 cm = AB + 3 cm

⇒ AB = 8 cm – 3 cm

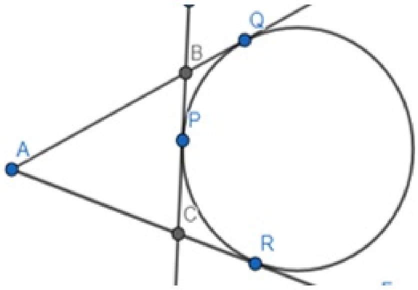
⇒ AB = 5 cm

Hence, AB = 5 cm

**4. Question**

A circle touches the side BC of ΔABC at P, AB and AC produced at Q and R respectively, prove that AQ = AR $= \frac{1}{2}$( perimeter of ΔABC)

**Answer**




Lengths of tangents drawn from an exterior point to the circle are equal.

From the above theorem,

AR = AQ …(1)

BP = BQ …(2)

CP = CR …(3)

Now,

Perimeter of ΔABC = AB + BC + CA

⇒ Perimeter of ΔABC = AB + BP + PC + CA

⇒ Perimeter of ΔABC = (AB + BQ) + (CR + CA) [Using (2) and (3)]

⇒ Perimeter of ΔABC = AQ + AR

⇒ Perimeter of ΔABC = AQ + AQ

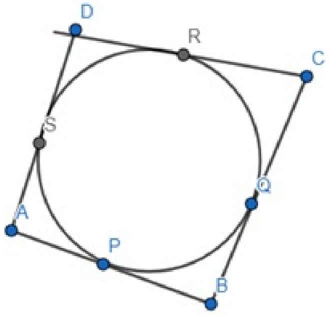
⇒ Perimeter of ΔABC = 2AQ [Using (1)]

$\Rightarrow \ \frac{\text{Perimeter of } \Delta ABC}{2} = AQ$∴ AQ = AR = 1/2Perimeter of ΔABC

Hence, Proved.

**5. Question**

If all sides of a parallelogram touch a circle, show that the parallelogram is a rhombus.




**Answer**

Lengths of tangents drawn from an exterior point to the circle are equal.

From the above theorem,

AP = AS

DS = DR

CR = CQ

BQ = BP

Adding above equations,

AP + DR + CR + BP = AS + DS + CQ + BQ

⇒ (AP + BP) + (DR + CR) = (AS + DS) + (CQ + BQ)

⇒ AB + CD = AD + BC

Also,

AB = CD

AD = BC

[∵ Parallel sides of a parallelogram are equal]

⇒ AB + CD = AD + BC

⇒ AB + AB = BC + BC

⇒ 2AB = 2BC

⇒ AB = BC

⇒ AB = BC = CD = AD

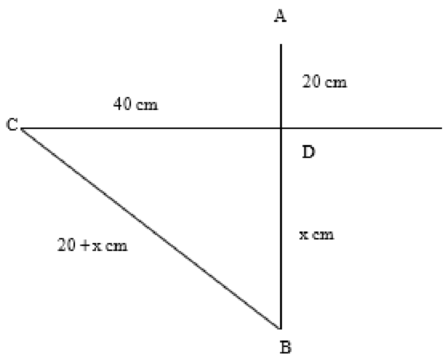
⇒ ABCD is a rhombus

Hence, Proved

**6. Question**

A lotus is 20 cm above the water surface in a pond and its stem is partly below the water surface. As the wind blew, the stem is pushed aside so that the lotus touched the water 40 cm away from the original position of the stem. How much of the stem was below the water surface originally?

**Answer**




Let AB be the length of stem

D is the point of lotus that touch the ground

x cm be the length of stem that lies below the ground

AD = 20 cm

Clearly,

AB = AD + DB

⇒ AB = 20 cm + x cm

⇒ AB = (20 + x)cm

Also,

BC = AB [∵ length of stem]

⇒ BC = (20 + x)cm

Now by Pythagoras theorem,

$BC^2 = BD^2 + DC^2$

$\Rightarrow (20 + x)^2 = x^2 + 40^2$

$\Rightarrow 20^2 + x^2 + 2 \times 20 \times x = x^2 + 40^2$

$\Rightarrow 400 + x^2 + 40x = x^2 + 1600$

$\Rightarrow x^2 + 1600 - x^2 - 400 - 40x = 0$

$\Rightarrow x^2 + 1600 - x^2 - 400 - 40x = 0$

$\Rightarrow 1200 - 40x = 0$

$\Rightarrow 40x = 1200$

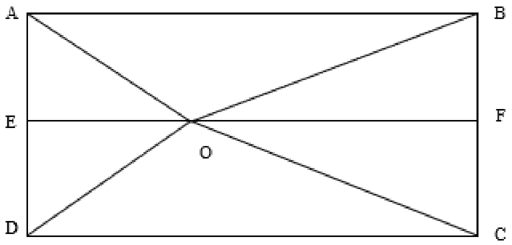
$\Rightarrow x = 30$

Hence, length of stem below water = 30 cm

**7. Question**

A point O in the interior of a rectangle ABCD is joined to each of the vertices A, B, C and D. Prove that $OA^2 + OC^2 = OB^2 + OD^2$

**Answer**




Draw EF || AB || DC passing through O.

Also AB = EF = DC

∴ ABCD and CDEF are rectangles

Now by Pythagoras theorem,

$BO^2 = BF^2 + OF^2$ ...(1)

And,

$OD^2 = OE^2 + ED^2$ ...(2)

Adding (1) and (2),

$BO^2 + OD^2 = BF^2 + OF^2 + OE^2 + ED^2$

$\Rightarrow BO^2 + OD^2 = AE^2 + OF^2 + OE^2 + CF^2$

$\Rightarrow BO^2 + OD^2 = AE^2 + OE^2 + OF^2 + CF^2$

$\Rightarrow BO^2 + OD^2 = AO^2 + OC^2$

Hence, Proved

## Exercise 6.4

**1. Question**

If a straight line intersects the sides AB and AC of a ΔABC at D and E respectively and is parallel to BC, then $\frac{AE}{AC} =$

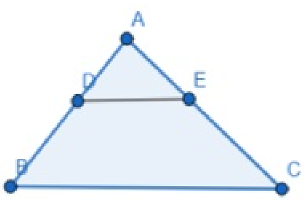
A. $\frac{AD}{DB}$

B. $\frac{AD}{AB}$

C. $\frac{DE}{BC}$

D. $\frac{AD}{EC}$

**Answer**




Given: DE intersect AB and AC and DE || BC

Using Basic Proportionality theorem which states that if a straight line is drawn parallel to one side of a triangle intersecting the other two sides, then it divides the two sides in the ratio

$\Rightarrow \frac{AE}{EC} = \frac{AD}{DB}$

$\Rightarrow \frac{EC}{AE} = \frac{DB}{AD}$ {Reciprocal of above}

$\Rightarrow \frac{EC}{AE} + 1 = \frac{DB}{AD} + 1$ {Adding 1 on both sides}

$\Rightarrow \frac{EC + AE}{AE} = \frac{DB + AD}{AD}$

$\Rightarrow \frac{AC}{AE} = \frac{AB}{AD}$

$\Rightarrow \frac{AE}{AC} = \frac{AD}{AB}$ {Reciprocal of above}

**2. Question**

In Δ ABC, DE is || to BC, meeting AB and AC at D and E.

If AD = 3 cm, DB = 2 cm and AE = 2.7 cm, then AC is equal to

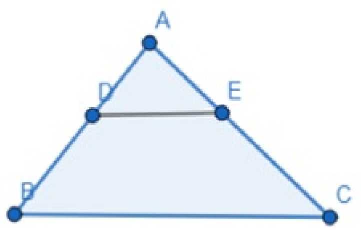
A. 6.5 cm

B. 4.5 cm

C. 3.5 cm

D. 5.5 cm

**Answer**




Given: DE intersect AB and AC and DE || BC

AD = 3 cm, DB = 2 cm and AE = 2.7 cm

Using Basic Proportionality theorem which states that if a straight line is drawn parallel to one side of a triangle intersecting the other two sides, then it divides the two sides in the ratio

$\Rightarrow \frac{AE}{EC} = \frac{AD}{DB}$

Putting the values,

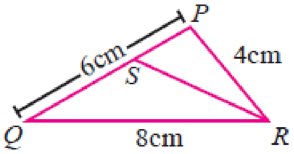
$\Rightarrow \frac{2.7}{EC} = \frac{3}{2}$

$\Rightarrow EC = \frac{2.7 \times 2}{3} = 1.8 \text{ cm}$

Now, AC = AE + EC = 2.7 +1.8 = 4.5 cm

**3. Question**

In ΔPQR, RS is the bisector of ∠R. If PQ = 6 cm, QR = 8 cm, RP = 4 cm then PS is equal to




A. 2 cm

B. 4 cm

C. 3 cm

D. 6 cm

**Answer**

Given: ∠ PRS =∠ SRQ and PQ = 6 cm, QR = 8 cm, RP = 4 cm

Using Angle Bisector Theorem which states that the internal bisector of an angle of a triangle divides the opposite side internally in the ratio of the corresponding sides containing the angle

Here, RS is the bisector of ∠ A so

$$\frac{PS}{SQ} = \frac{PR}{RQ}$$

Let PS be x then SQ will be 6– x.

$$\Rightarrow \frac{x}{6-x} = \frac{4}{8}$$

$$\Rightarrow 8x = 24 - 4x$$

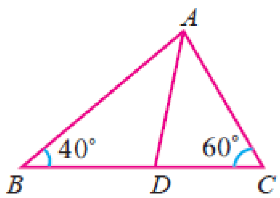
$$\Rightarrow 12x = 24$$

$$\Rightarrow x = 2$$

So, PS = 2 cm

**4. Question**

In figure, if $\frac{AB}{AC} = \frac{BD}{DC}$, ∠B = 40°, and ∠C = 60°, then ∠BAD =




A. 30°

B. 50°

C. 80°

D. 40°

**Answer**

Given: $\frac{AB}{AC} = \frac{BD}{DC}$ and ∠ B =40°, ∠ C =60°

We know that Converse of Angle Bisector Theorem states that if a straight line through one vertex of a triangle divides the opposite side internally in the ratio of the other two sides, then the line

bisects the angle internally at the vertex.

Here, $\frac{AB}{AC} = \frac{BD}{DC}$ {Given}

So, AD is the bisector of $\angle$ A

$\because \angle A + \angle B + \angle C = 180°$ {Angle sum property}

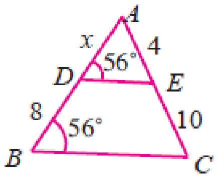
$\Rightarrow \angle A = 180° - 40° - 60°$

$\Rightarrow \angle A = 80°$

Also, $\angle BAD = \angle DAC = \frac{\angle A}{2} = 40°$

**5. Question**

In the figure, the value x is equal to




A. 4 · 2

B. 3 · 2

C. 0 · 8

D. 0 · 4

**Answer**

Here, DE intersect AB and AC and DE || BC

AD = x, DB = 8, EC =10 and AE = 4

Using Basic Proportionality theorem which states that if a straight line is drawn parallel to one side of a triangle intersecting the other two sides, then it divides the two sides in the ratio

$\Rightarrow \frac{AE}{EC} = \frac{AD}{DB}$

Putting the values,

$\Rightarrow \frac{4}{10} = \frac{x}{8}$

$\Rightarrow x = \frac{4 \times 8}{10} = 3.2$

**6. Question**

In triangles ABC and DEF, ∠B = ∠E, ∠C = ∠F, then

A. $\frac{AB}{DE} = \frac{CA}{EF}$

B. $\frac{BC}{EF} = \frac{AB}{FD}$

C. $\frac{AB}{DE} = \frac{BC}{EF}$

D. $\frac{CA}{FD} = \frac{AB}{EF}$

**Answer**


Given: ∠ B =∠ E and ∠ C =∠ F

By the criterion of similar triangle AA which says that

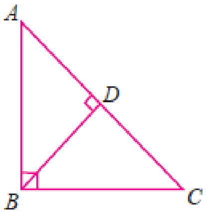
if two angles of one triangle are respectively equal to two angles of another triangle then the two triangles are similar

Hence, ABC~DEF (AA similarity criterion)

$\therefore \frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF}$ {Corresponding sides of the similar triangles are in same ratio}

**7. Question**

From the given figure, identify the wrong statement.




A. ΔADB ~ ΔABC

B. ΔABD ~ ΔABC

C. ΔBDC ~ ΔABC

D. ΔADB ~ ΔBDC

**Answer**

In ΔABC and ΔADB,

∠ A = ∠ A {Common}

∠ B = ∠ D {90° each}

By the criterion of similar triangle AA which says that

if two angles of one triangle are respectively equal to two angles of another triangle then the two triangles are similar

ΔABC ~ ΔADB ...(1)

In ΔABC and ΔBDC,

∠ C = ∠ C {Common}

∠ B = ∠ D {90° each}

By the criterion of similar triangle AA which says that

if two angles of one triangle are respectively equal to two angles of another triangle then the two triangles are similar

ΔABC ~ ΔBDC .....(2)

From (1) and (2),

ΔBDC ~ ΔADB

Hence, option (B) is wrong.

**8. Question**

If a vertical stick 12 m long casts a shadow 8 m long on the ground and at the same time a tower casts a shadow 40 m long on the ground, then the height of the tower is

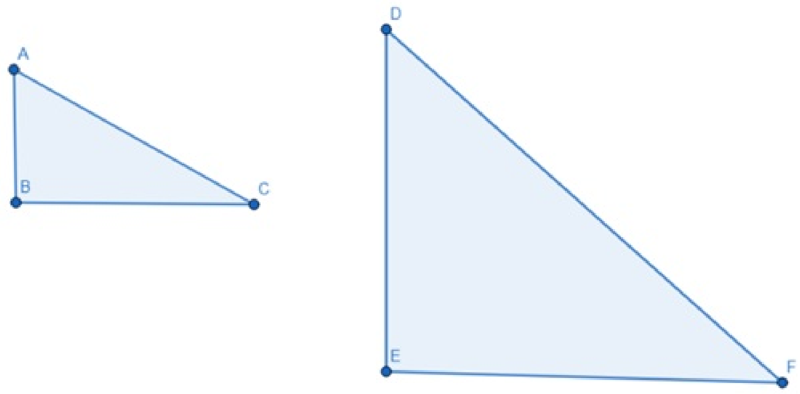
A. 40 m

B. 50 m

C. 75 m

D. 60 m

**Answer**




Let AB be the stick of length 12 m and BC be the shadow 8 m long. Similarly DE be the tower with shadow 40 m long.

In ΔABC and ΔDEF,

∠ ABC =∠ DEF {90° each}

∠ BCA = ∠ EFD {angular elevation is same at the same instant}

By the criterion of similar triangle AA which says that

if two angles of one triangle are respectively equal to two angles of another triangle then the two triangles are similar

ΔABC ~ ΔDEF

$\therefore \frac{AB}{DE} = \frac{BC}{EF}$ {Corresponding sides of the similar triangles are in same ratio}

$\Rightarrow \frac{12}{8} = \frac{DE}{40}$

$\Rightarrow DE = 60 \text{ m}$

**9. Question**

The sides of two similar triangles are in the ratio 2:3, then their areas are in the ratio

A. 9:4

B. 4:9

C. 2:3

D. 3:2

**Answer**

Given: Sides of two similar triangles are in the ratio 2:3

We know that the ratio of the areas of two similar triangles is equal to the ratio of the squares of their corresponding sides

Ratio of their area $= \frac{2^2}{3^2} = \frac{4}{9}$ = 4:9

**10. Question**

Triangles ABC and DEF are similar. If their areas are 100 cm$^2$ and 49 cm$^2$ respectively and BC is 8.2 cm then EF =

A. 5.47 cm

B. 5.74 cm

C. 6.47 cm

D. 6.74 cm

**Answer**

Given: ar(ABC) = 100 cm$^2$, ar(DEF) = 49 cm$^2$ and BC = 8.2 cm

Areas of two similar triangles are in the ratio 100:49

We know that the ratio of the areas of two similar triangles is equal to the ratio of the squares of

their corresponding sides

Ratio of their corresponding sides $\frac{BC}{EF} = \frac{\sqrt{100}}{\sqrt{49}} = \frac{10}{7}$

Putting the values

$\Rightarrow \frac{8.2}{EF} = \frac{10}{7}$

$\Rightarrow EF = \frac{57.4}{10} = 5.74$ cm

**11. Question**

The perimeters of two similar triangles are 24 cm and 18 cm respectively. If one side of the first triangle is 8 cm, then the corresponding side of the other triangle is

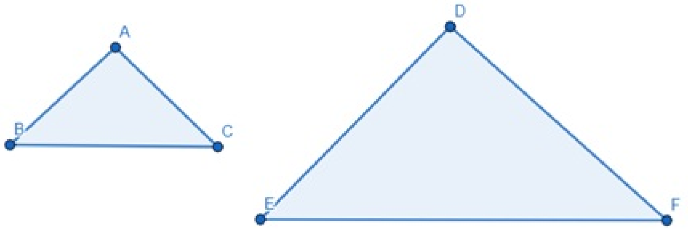
A. 4 cm

B. 3 cm

C. 9 cm

D. 6 cm

**Answer**




Given: Perimeter (ABC) = 24 cm$^2$, Perimeter (DEF) = 18 cm$^2$ and BC = 8 cm

Perimeters of two similar triangles are in the ratio 24:18 = 4:3

We know that if two triangles are similar, then the ratio of the corresponding sides is equal to the

ratio of the corresponding perimeters.

Ratio of their corresponding sides $\frac{BC}{EF} = \frac{4}{3}$

Putting the values

$\Rightarrow \frac{8}{EF} = \frac{4}{3}$

$\Rightarrow EF = 2 \times 3 = 6 \text{ cm}$

**12. Question**

AB and CD are two chords of a circle which when produced to meet at a point P such that AB = 5 cm, AP = 8 cm, and CD = 2 cm then PD =

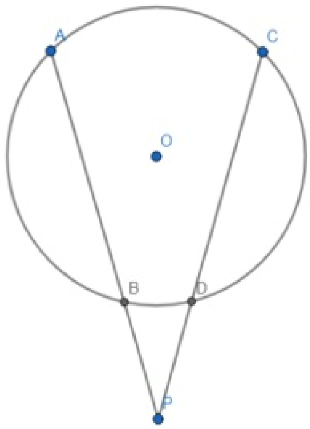
A. 12 cm

B. 5 cm

C. 6 cm

D. 4 cm

**Answer**




Given: AB = 5 cm, AP = 8 cm, and CD = 2 cm

We know that two chords AB and CD intersect at P inside the circle with centre at O.

Then PA× PB = PC× PD.

PB =AP – AB = 8 – 5 =3 cm

Let PD = x then PC = PD + CD = 2 + x

⇒ 8 × 3 = x (2+x)

⇒ 2x +$x^2$ =24

⇒ $x^2$ + (6–4)x – 24 = 0

⇒ (x+6)(x –4) =0

⇒ x = 4 and –6

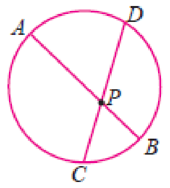
x = –6 is not possible because length is always positive

⇒ PD = 4 cm

**13. Question**

In the adjoining figure, chords AB and CD intersect at P.

If AB = 16 cm, PD = 8 cm, PC = 6 and AP >PB, then AP =




A. 8 cm

B. 4 cm

C. 12 cm

D. 6 cm

**Answer**

Given: AB = 16 cm, PD = 8 cm, and PC = 6 cm

We know that two chords AB and CD intersect at P inside the circle with centre at O.

Then PA× PB = PC× PD.

Let PA = x then PB = AB – AP = 16 – x

⇒ x × (16–x) = 6× 8

⇒ 16x – $x^2$ =48

⇒ $x^2$ – (12+4)x + 48 = 0

⇒ (x–12)(x –4) =0

⇒ x = 4 and 12

x = 4 is not possible because AP >PB

⇒ AP = 12 cm

**14. Question**

A point P is 26 cm away from the centre O of a circle and PT is the tangent drawn from P to the circle is 10 cm, then OT is equal to

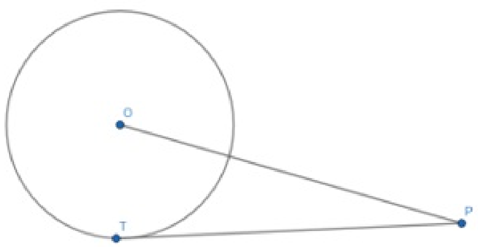
A. 36 cm

B. 20 cm

C. 18 cm

D. 24 cm

**Answer**




Given: OP = 26 cm, PT = 10 cm

We know that a tangent at any point on a circle is perpendicular to the radius through the point of contact

⇒ ∠ OTP = 90°

Using Pythagoras theorem,

$OP^2 = PT^2 + OT^2$

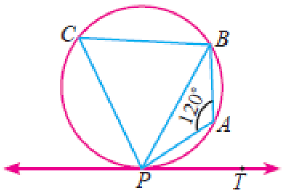
⇒ $OT^2 = OP^2 – PT^2$

⇒ $OT^2 = 26^2 – 10^2$

⇒ OT = 24 cm

**15. Question**

In the figure, if ∠PAB = 120° then ∠BPT =




A. 120°

B. 30°

C. 50°

D. 60°

**Answer**

From the figure, we find that ABCP is a cyclic quadrilateral

∵Opposite angles are supplementary

∴∠ BAP + ∠ PCB = 180°

⇒ ∠ PCB = 180° – ∠ BAP

⇒ ∠ PCB = 180° – 120°

⇒ ∠ PCB = 60°

Now, using Tangent–Chord theorem

∠ PCB = ∠ BPT

⇒ ∠ BPT = 60°

**16. Question**

If the tangents PA and PB from an external point P to circle with centre O are inclined to each other at an angle of 40° then ∠POA =

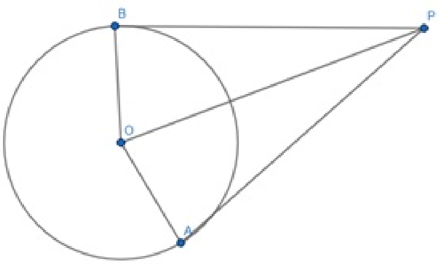
A. 70°

B. 80°

C. 50°

D. 60°

**Answer**




In ΔAOP and ΔBOP,

OP = OP {Common}

PB = PA {Tangents from the same external point are equal}

OB =OA {Radii}

⇒ ΔAOP ≅ ΔBOP

⇒ ∠ BPO = ∠ APO {Corresponding parts of congruent triangles}

Given: ∠ BPA = 40°

⇒ ∠ APO=20°

Also, ∠ OAP = 90° {a tangent at any point on a circle is perpendicular to the radius through the point of contact}

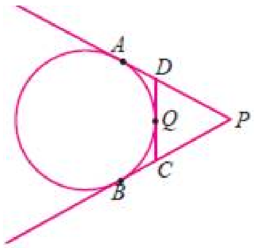
So, By angle sum property

∠ POA = 180° – 90° – 20°

⇒ ∠ POA = 70°

**17. Question**

In the figure, PA and PB are tangents to the circle drawn from an external point P. Also CD is a tangent to the circle at Q. If PA = 8 cm and CQ = 3 cm, then PC is equal to




A. 11 cm

B. 5 cm

C. 24 cm

D. 38 cm

**Answer**

Given: PA = 8 cm and CQ = 3 cm

We know that the lengths of the two tangents from an exterior point to a circle

are equal.

DA = DQ, PA = PB and CQ = BC

PB = 8 cm BC = 3 cm

PC = PB – BC = 8 – 3 = 5 cm

**18. Question**

Δ ABC is a right angled triangle where ∠B = 90° and BD ⊥ AC**.** If BD = 8 cm, AD = 4 cm, then CD is

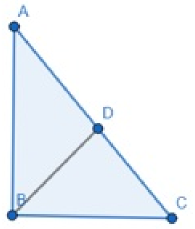
A. 24 cm

B. 16 cm

C. 32 cm

D. 8 cm

**Answer**




In ΔABC and ΔADB,

∠ A = ∠ A {Common}

∠ B = ∠ D {90° each}

By the criterion of similar triangle AA which says that

if two angles of one triangle are respectively equal to two angles of another triangle then the two triangles are similar

ΔABC ~ ΔADB ...(1)

In ΔABC and ΔBDC,

∠ C = ∠ C {Common}

∠ B = ∠ D {90° each}

By the criterion of similar triangle AA which says that

if two angles of one triangle are respectively equal to two angles of another triangle then the two triangles are similar

ΔABC ~ ΔBDC .....(2)

From (1) and (2),

ΔBDC ~ ΔADB

$\Rightarrow \frac{AD}{BD} = \frac{DB}{CD}$ {Corresponding sides are in same ratio}

Putting the values,

$\Rightarrow \frac{4}{8} = \frac{8}{CD}$

⇒ CD = 16 cm

**19. Question**

The areas of two similar triangles are 16 cm$^2$ and 36 cm$^2$ respectively. If the altitude of the first triangle is 3 cm, then the corresponding altitude of the other triangle is

A. 6.5 cm

B. 6 cm

C. 4 cm

D. 4.5 cm

**Answer**

Given: ar(ABC) = 16 cm$^2$, ar(DEF) = 36 cm$^2$ and altitude of first triangle = 3 cm

Areas of two similar triangles are in the ratio 16:36 = 4: 9

We know that the ratio of the areas of two similar triangles is equal to the ratio of the squares of

their corresponding sides or altitudes

Ratio of their corresponding altitudes $= \frac{\sqrt{4}}{\sqrt{9}} = \frac{2}{3}$

Putting the values

$\Rightarrow \frac{3}{\text{altitude of second triangle}} = \frac{2}{3}$

$\Rightarrow \text{altitude of second triangle} = \frac{9}{2} = 4.5 \text{ cm}$

**20. Question**

The perimeter of two similar triangles ΔABC and ΔDEF are 36 cm and 24 cm respectively. If DE = 10 cm, then AB is

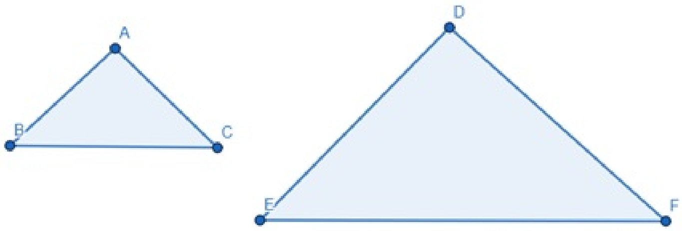
A. 12 cm

B. 20 cm

C. 15 cm

D. 18 cm

**Answer**




Given: Perimeter (ABC) = 36 $cm^2$, Perimeter (DEF) = 24 $cm^2$ and DE = 10 cm

Perimeters of two similar triangles are in the ratio 36:24 = 3:2

We know that if two triangles are similar, then the ratio of the corresponding sides is equal to the

ratio of the corresponding perimeters.

Ratio of their corresponding sides $\frac{AB}{DE} = \frac{3}{2}$

Putting the values

$\Rightarrow \frac{AB}{10} = \frac{3}{2}$

$\Rightarrow AB = 5 \times 3 = 15 \text{ cm}$