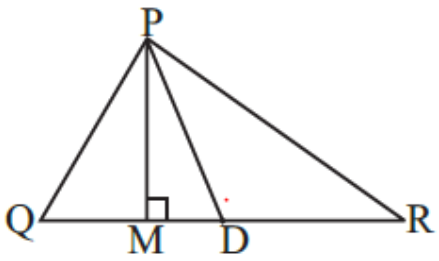
NCERT Solutions of Triangles and its Properties

Question 1

In Δ PQR, D is the mid-point of QR



PM is _____.

PD is _____.

Is QM = MR?

Solution

i) Altitude

ii) Median

iii) No

Question 2.

Draw rough sketches for the following:

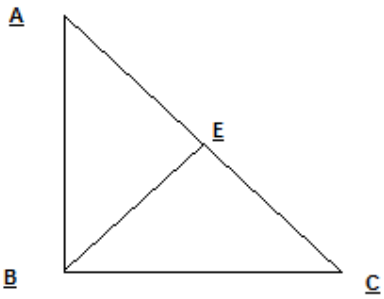
(a) In ΔABC, BE is a median.

(b) In ΔPQR, PQ and PR are altitudes of the triangle.

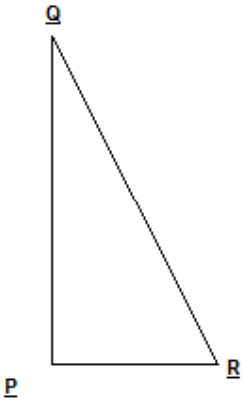
(c) In ΔXYZ, YL is an altitude in the exterior of the triangle.

Solutions

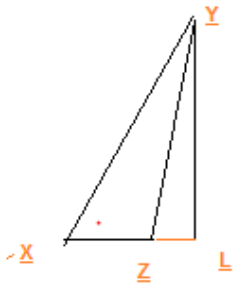
a)



b)



c)

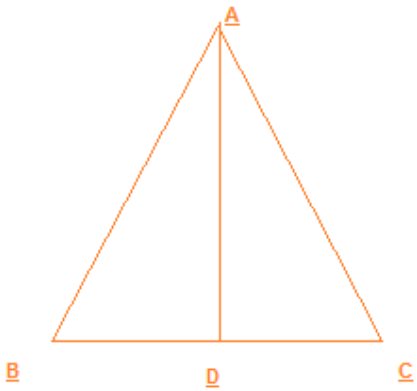


Question 3

Verify by drawing a diagram if the median and altitude of an isosceles triangle can be

same.

Solution

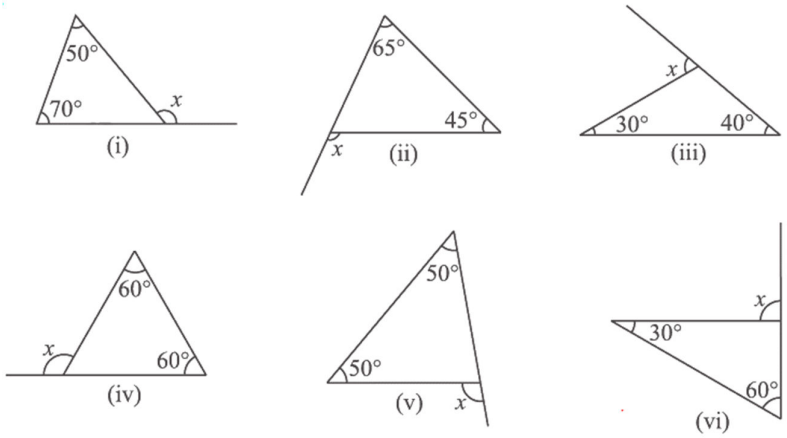


AD is the altitude in the Isosceles triangle and we can see that BD=DC, so it is also the median of the triangle

Exercise 6.2

Question 1

Find the value of the unknown exterior angle in the below figures



Solution

We know that an exterior angle of a triangle is equal to the sum of its interior opposite

angles.

i) x=50+70 =120^0

ii) x=45+65 =110^0

iii) x= 30+40=70^0

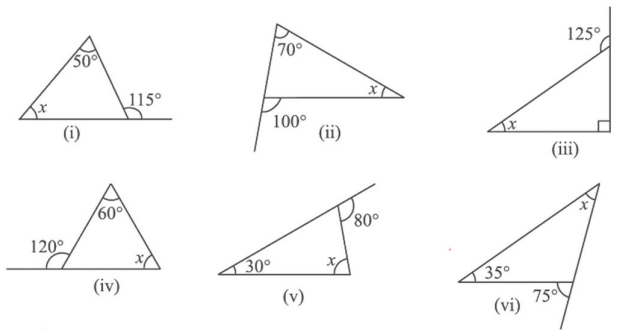
iv) x= 60+60 =120^0

v) x=50+50 =100

vi) x=30+60=90^0

Question 2

Find the value of the unknown interior angle x in the following figures:



Solutions

i) 115= x+50

x=115-50=65^0

ii) 100 + x=70

x=100-70=30^0

iii) x+90=125

x=35^0

iv) x+60=120

x=60^0

v) x+30=80

x=50^0

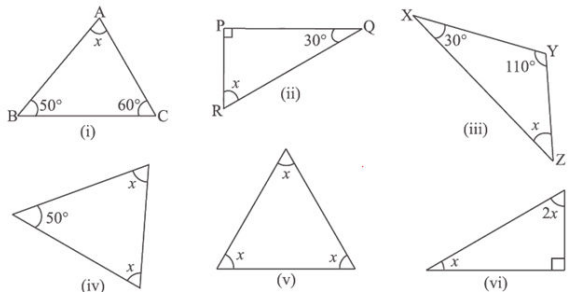
vi) x+35=75

x=40^0

Exercise 6.3

Question 1:

Find the value of the unknown x in the following diagrams:



Solution

<u>The sum of all interior angles of a triangle is 180°. By using this property, these</u>

<u>problems can be solved as follows.</u>

(I) x + 50° + 60° = 180°

x + 110° = 180°

x = 180° — 110° = 70°

ii) x + 90° + 30° = 180°

x +120° = 180°

x = 180° — 120° = 60°

iii) x +30° +110° = 180°

x+ *140*° = 180°

x = 180° — 140° = 40°

iv) 50° + x + x = 180°

50° +2x = 180°

2x = 180° — 50° = 130°

$x=65^0$

v) x + x + x = 180°

3x = 180°

$x=60^0$

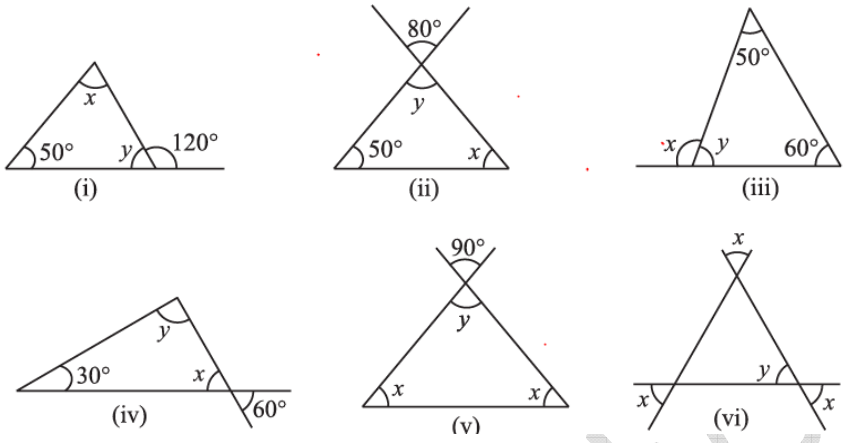
(vi) x + 2x + 90° = 180°

3x = 180° – 90° = 90^0

$x=30^0$

Question 2

Find the values of the unknown's *x* and *y* in the following diagrams:



Solution:

(i) y + 120° = 180° (Linear pair)

y = 180° — 120^0 = 60^0

x+ y + 50° = 180° (Angle sum property)

x+ 60° + 50° = 180°

x=70^0

(ii) y = 80° (Vertically opposite angles)

y + x + 50° = 180° (Angle sum property)

80° + x + 50° = 180°

x+ 130^0 = 180°

x=50^0

(iii) y + 50° + 60° = 180° (Angle sum property}

y = 180° — 60° – 50° = 70^0

x+ y = 180 (Linear pair)

x= 180° — y = 180° — 70° = 110°

iv) $x=60^0$ (Vertically opposite angles)

Now

x+y+30 =180

60+y+30=180

y=90

v) $x=90^0$ (Vertically opposite angles)

Now,

x+x+y=180

2x+90=180

$X=45^0$

vi)

y=x (Vertically opposite angles)

Other two angles are also angle x as vertically opposite angles

y+x+x=180

x+x+x=180

3x=180

$x=60^0$

Exercise 6.4

Question 1

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

(i) 2 cm, 3 cm, 5 cm

(ii) 3 cm, 6 cm, 7 cm

(iii) 6 cm, 3 cm, 2 cm

Solution

In a triangle, the sum of the lengths of either two sides is always greater than the third side.

(i) Given that, the sides of the triangle are 2 cm, 3 cm, 5 cm. It can be observed that,

2 + 3 = 5 cm

However, 5 cm = 5 cm

Hence, this triangle is not possible.

(ii) Given that, the sides of the triangle are 3 cm, 6 cm, 7 cm. Here, 3 + 9 =12 cm > 7 cm

6 + 7 = 13 cm > 3 cm

3 + 7 = 10 cm > 6 cm

Hence, this triangle is possible.

(iii) Given that, the sides of the triangle are 6 cm, 3 cm, 2 cm.

Here, 6 + 3 = 9 cm > 2 cm

However, 3 + 2 = 5 cm < 6 cm

Hence, this triangle is not possible.

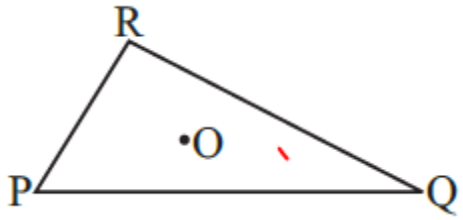
Question 2

Take any point O in the interior of a triangle PQR. Is

(i) OP + OQ > PQ?

(ii) OQ + OR > QR?

(iii) OR + OP > RP?



Solution

Joining the points, the OP, OP and OR

i) In ∆OPQ

Sum of two sides > third side

OP + OQ > PQ

ii) In ∆OQR

Sum of two sides > third side

OR + OQ > QR

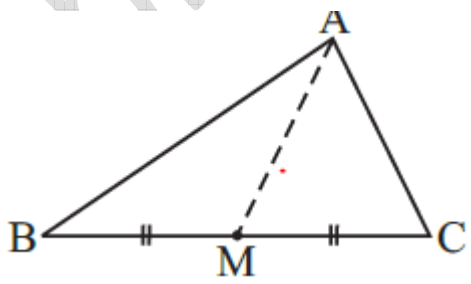
iii) In ∆OPR

Sum of two sides > third side

OP + OR > PR

Question 3

AM is a median of a triangle ABC.
Is AB + BC + CA > 2 AM?
(Consider the sides of triangles ∆ABM and □∆AMC.)



Solution

In a triangle, the sum of the lengths of either two sides is always greater than the third

side.

In ∆ABM,

AB + BM > AM (1)

Similarly, in ∆ACM,

AC + CM > AM (ii)

Adding equation (1) and (ii),

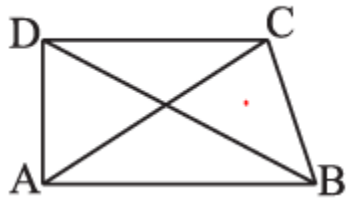
AB + BM + MC + AC > AM + AM

AB + BC + AC > 2AM

Question 4

ABCD is a quadrilateral.

Is AB + BC + CD + DA > AC + BD?



Solution

Considering ∆ABC,

AB + BC > CA (i)

In ∆BCD,

BC + CD > DB (ii)

In ∆CDA,

CD + DA > AC (iii)

In ∆DAB,

DA + AB > DB (iv)

Adding equations (I), (//), (iii), and (iv), we obtain

AB + BC + BC + CD + CD + DA + DA + AB > AC + BD + AC + BD

2AB + 2BC + 2CD +2DA > 2AC + 2BD

AB + BC + CD + DA > AC + BD

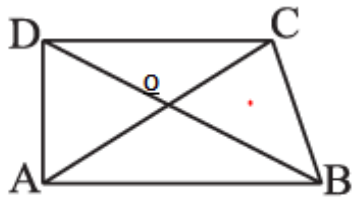
Question 5

ABCD is quadrilateral.

Is AB + BC + CD + DA < 2 (AC + BD)?

Solution

Let O be the point of intersection of diagonals



In a triangle, the sum of the lengths of either two sides is always greater than the third

side.

In ∆OAB

OA +OB > AB

In ∆OBC

OB + OC > BC

In ∆OCD

OC + OD > CD

In ∆OAD

OA + OD > AD

Adding all these we get

OA + OB + OB +OC + OC +OD + OA +OD > AB + BC + CD + DA

2(AC + BD) > AB + BC + CD + DA

Question 6

The lengths of two sides of a triangle are 12 cm and 15 cm. Between what two measures should the length of the third side fall?

Solution

There are two things for the triangle

i) sum of the lengths of any two sides of a triangle is greater than the length of the third side.

ii) difference between the length of any two sides of a triangle is smaller than the length of the third side.

Let x be the third side

So, from first point

12+15 > x

Or x < 27 cm

Now from second point

15-12 < x

Or x > 3

So, x lies between 3 cm and 27 cm

Exercise 6.5

Question 1

PQR. is a triangle right angled at P. If PQ = 10 cm and PR. = 24 cm, find QR

Solution

In ∆PQR, right angles at P

$PQ^2 + PR^2 = QR^2$

$100 + 576 = QR^2$

QR=26 cm

Question 2

ABC is a triangle, right-angled at C. If AB = 25cm and AC = 7 cm, find BC.

Solution

In ΔABC, right angles at C

$AC^2 + BC^2 = AB^2$

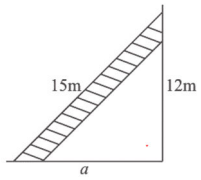
$BC^2 = AB^2 - AC^2$

$BC^2 = 625 - 49 = 576$

BC=24 cm

Question 3

A 15m long ladder reached a window 12 m high from the ground on placing it against a wall at a distance a. Find the distance of the foot of the ladder from the wall.



Solution

By applying Pythagoras theorem,

$(15)^2 = (12)^2 + a^2$

$225 = 144 + a^2$

$a^2 = 225 - 144 = 81$

a = 9 m

Question 4

Which of the following can be the sides of a right triangle?

(i) 2.5 cm,6.5 cm, 6 cm.

(ii) 2 cm, 2 cm, 5 cm.

(iii) 1.5 cm, 2cm, 2.5 cm.

In the case of right-angled triangles, identify the right angles.

Solution

i) 2.5cm,6.5cm,6cm

We see that

$(2.5)^2+6^2=6.25+36=42.25= (6.5)^2$

Therefore, the given lengths can be the sides of a right triangle. Also, the angle between the lengths, 2.5 cm and 6 cm is a right angle

ii) 2 cm, 2 cm, 5 cm.

Here 2+ 2= 4 < 5, So sum of two sides less than third side. So, this is not a triangle

iii) 1.5 cm, 2cm, 2.5 cm

We see that

$(1.5)^2+2^2=2.25+4=6.25= (2.5)^2$

Therefore, the given lengths can be the sides of a right triangle. Also, the angle between the lengths, 1.5 cm and 2 cm is a right angle

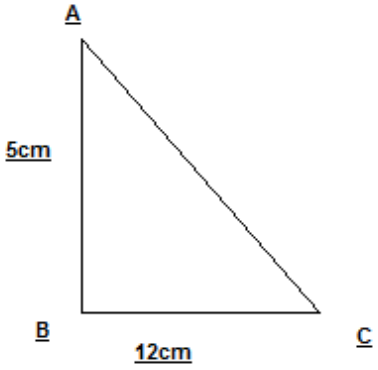
Question 5

A tree is broken at a height of 5 m from the ground and its top touches the ground at 12 m from the base of the tree. Find the original height of the tree

Solution

Let the tree be broken at point A

Then tree length = AB + AC



In ∆ABC, right angle at B

$AB^2 + BC^2 = AC^2$

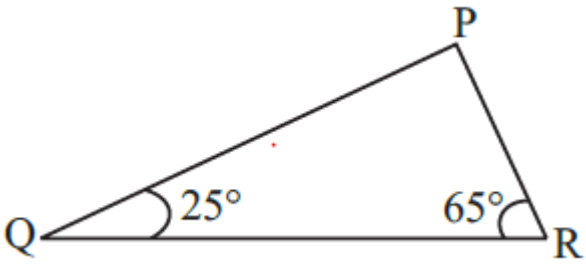
$AC^2 = 25 + 144 = 169$

AC=13 m

So original length of tree= 5+13 =18 m

Question 6

Angles Q and R of a ☐∆PQR are 25º and 65º.
Write which of the following is true:
(i) $PQ^2 + QR^2 = RP^2$
(ii) $PQ^2 + RP^2 = QR^2$
(iii) $RP^2 + QR^2 = PQ^2$



Solution

From angle property of triangle

Angle P = $180 - 25 - 65 = 90^0$

So ∆ PQR is right angle at P

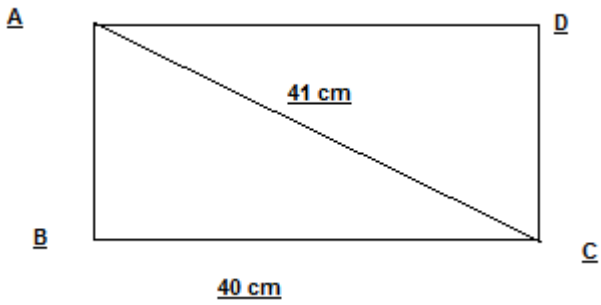
So

$PQ^2 + RP^2 = QR^2$

Question 7

Find the perimeter of the rectangle whose length is 40 cm and a diagonal is 41 cm.

Solution



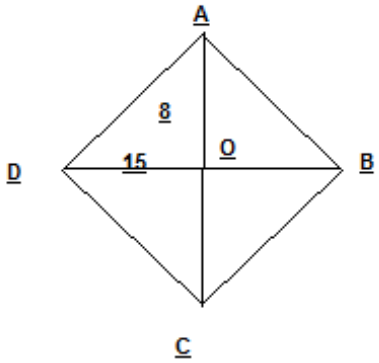
Let ABCD is the rectangle as shown above
Now ∆ABC is right angle triangle, So
$BC^2 + AB^2 = AC^2$
$AB^2 = 1681 - 1600 = 81$
AB=9 cm
So, perimeter of rectangle
= 2(AB + BC) = 98 cm

Question 8

The diagonals of a rhombus measure 16 cm and 30 cm. Find its perimeter.

Solution

Let ABCD is the rhombus and the diagonals bisect at right angles



In Δ OAD

$AD^2 = OA^2 + OD^2 = 64 + 225 = 289$

AD = 17 cm

So, perimeter of rhombus = 4 X AD= 68 cm