## Practice set 2.1 Page 38

**1. Identify, with reason, which of the following are Pythagorean triplets.**
**(i)(3, 5, 4)**
**(ii)(4, 9, 12)**
**(iii)(5, 12, 13)**
**(iv) (24, 70, 74)**
**(v)(10, 24, 27)**
**(vi)(11, 60, 61)**

**Solution:**
(i)(3, 5, 4)
$3^2 = 9$
$4^2 = 16$
$5^2 = 25$
Here 9+16 = 25
$\therefore 5^2 = 3^2+4^2$
The square of largest number is equal to sum of squares of the other two numbers.
$\therefore$ (3, 5, 4) is a Pythagorean triplet.

(ii)(4, 9, 12)
$4^2 = 16$
$9^2 = 81$
$12^2 = 144$
Here $4^2+9^2 \neq 12^2$
The square of largest number is not equal to sum of squares of the other two numbers.
$\therefore$(4, 9, 12) is not a Pythagorean triplet.

(iii)(5, 12, 13)
$5^2 = 25$
$12^2 = 144$
$13^2 = 169$
Here $5^2+ 12^2 = 13^2$
The square of largest number is equal to sum of squares of the other two numbers.
$\therefore$(5, 12, 13) is a Pythagorean triplet.

(iv) (24, 70, 74)
$24^2 = 576$
$70^2 = 4900$
$74^2 = 5476$
Here $24^2+ 70^2 = 74^2$
The square of largest number is equal to sum of squares of the other two numbers.
$\therefore$(24, 70, 74)is a Pythagorean triplet.

(v)(10, 24, 27)
$10^2 = 100$
$24^2 = 576$
$27^2 = 729$
Here $10^2+24^2 \neq 27^2$
The square of largest number is not equal to sum of squares of the other two numbers.
$\therefore$(10, 24, 27) is not a Pythagorean triplet.

(vi)(11, 60, 61)
$11^2 = 121$
$60^2 = 3600$
$61^2 = 3721$
Here $11^2+60^2 = 61^2$
The square of largest number is equal to sum of squares of the other two numbers.
$\therefore$(11, 60, 61)is a Pythagorean triplet.

**2. In figure 2.17, ∠ MNP = 90°, seg NQ ⊥ seg MP, MQ = 9, QP = 4, find NQ.**

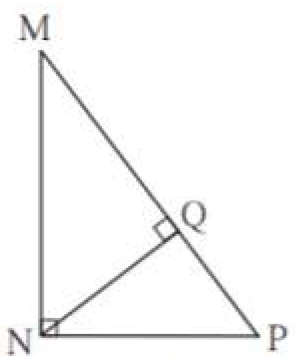


**Fig. 2.17**

**Solution:**
In △ MNP , ∠MNP = 90˚, seg NQ ⊥ seg MP
MQ = 9 , QP = 4 [Given]
NQ = $\sqrt{(MQ \times QP)}$ [Theorem of geometric mean]
$\therefore NQ = \sqrt{(9\times4)} = \sqrt{36} = 6$
Hence NQ = 6 units.

**3. In figure 2.18, ∠ QPR = 90°, seg PM ⊥ seg QR and Q-M-R, PM = 10, QM = 8, find QR.**

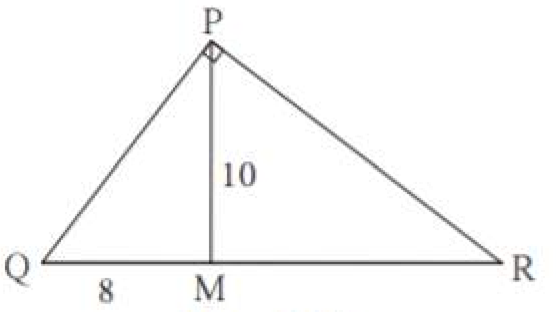



Fig. 2.18

**Solution:**

In △PQR , ∠QPR = 90˚

seg PM ⊥ seg QR [Given]

$PM^2 = QM \times MR$ [Theorem of geometric mean]

$10^2 = 8 \times MR$

∴ MR = 100/8 = 12.5

∴ QR = QM + MR

∴ QR = 8+12.5 = 20.5

Hence measure of QR is 20.5 units.

**4. See figure 2.19. Find RP and PS using the information given in △ PSR.**

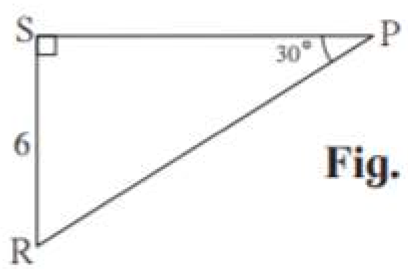



Fig. 2.19

**Solution:**

In △PSR , ∠P = 30˚ , ∠S = 90˚

∴ ∠R = 180 - (90+30) = 60˚ [Angle Sum property of triangle]

∴ △PSR is a 30˚ - 60˚ - 90˚ triangle.

∴ SR = (½)×PR [side opposite to 30˚]

6 = (½)× PR

⇒PR = 12

PS = $\sqrt{}(PR^2 - SR^2$ [Pythagoras theorem]

⇒ PS = $\sqrt{}(12^2-6^2)$

⇒ PS = √(144-36)

⇒ PS = √108

⇒PS = 6√3

Hence RP = 12 units and PS = 6√3 units.

**5. For finding AB and BC with the help of information given in figure 2.20, complete following activity.**

AB = BC ….____

∴∠ BAC = _____

∴ AB = BC = ____× AC

= ____ ×√8

= ____ × 2√2

= ____

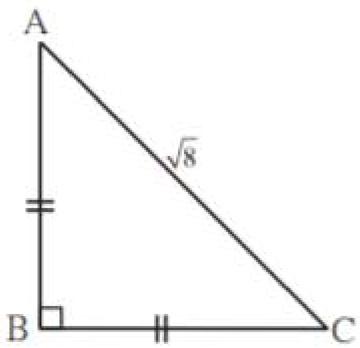



**Fig. 2.20**

**Solution:**

AB = AC [Given ]

∴∠ BAC = ∠ BCA [Angles opposite to equal sides of an isosceles triangle are equal]

∴ AB = BC = 1/√2× AC [By 45˚ - 45˚-90˚ theorem]

=(1/√2) ×√8

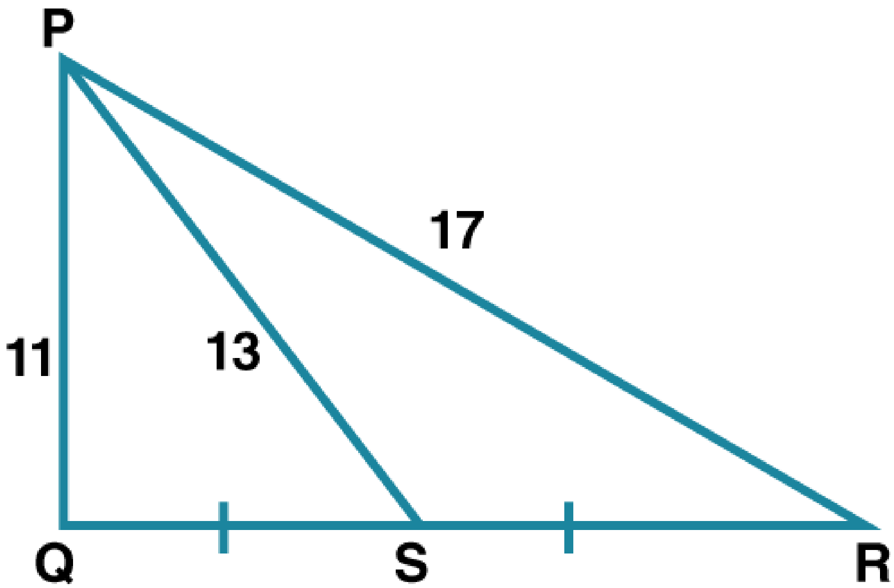
=(1/√2) × 2√2

= 2

## Practice set 2.2 Page 43

**1. In △ PQR, point S is the midpoint of side QR. If PQ = 11,PR = 17, PS =13, find QR.**

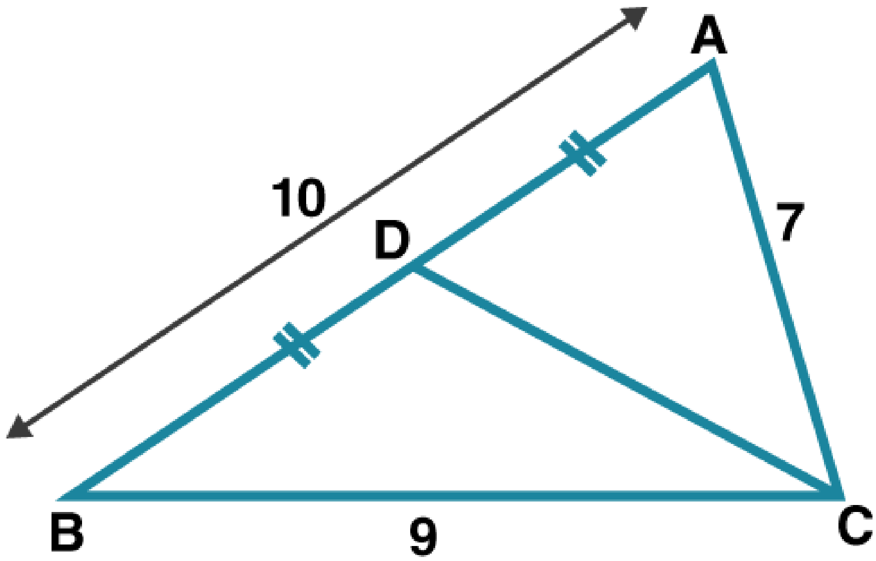
**Solution:**




Given , S is the midpoint of QR .
∴ PS is the median.
∴ $PQ^2+PR^2 = 2\ PS^2+2SR^2$ [By Apollonius theorem]
∴ $11^2+17^2 = 2\times13^2+2\times SR^2$
∴ $121+289 = 2\times169+2\times SR^2$
⇒ $2SR^2 = 121+289-338$
⇒ $2SR^2 = 72$
⇒ $SR^2 = 72/2 = 36$
⇒ $SR = 6$
Since S is the midpoint of QR , QR = 2SR
∴ $QR = 2\times6 = 12$
Hence QR = 12 units.

**2. In △ ABC, AB = 10, AC = 7, BC = 9 then find the length of the median drawn from point C to side AB**

**Solution:**




Let CD is the median drawn from C to AB.
Given AB = 10
AD = (1/2)×AB [D is the midpoint of side AB]
AD = 10/2 = 5
Since CD is the median
$AC^2+BC^2 = 2CD^2+2AD^2$ [Apollonius theorem]
$\therefore 7^2+9^2 = 2\ CD^2+2\times5^2$
$\Rightarrow 2\ CD^2 = 7^2+9^2-2\times5^2$
$\Rightarrow 2\ CD^2 = 80$
$\Rightarrow CD^2 = 40$
Taking square roots on both sides
$CD = 2\sqrt{10}$
Hence the length of median drawn from point C to side AB is $2\sqrt{10}$ units.

**3. In the figure 2.28 seg PS is the median of △PQR and PT⊥QR. Prove that,**
(1) $PR^2 = PS^2 + QR \times ST +( QR/ 2 )^2$

(ii) $PQ^2 = PS^2 - QR \times ST +( QR /2)^2$

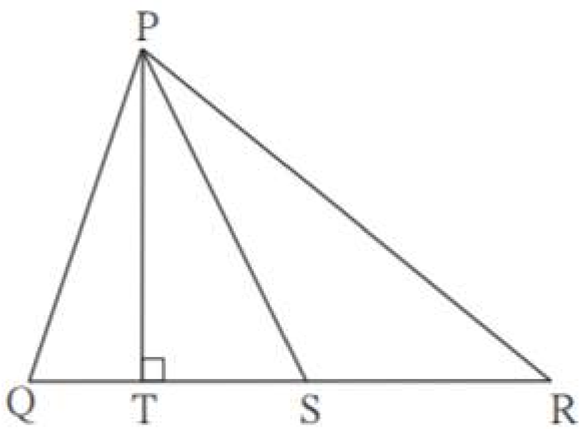
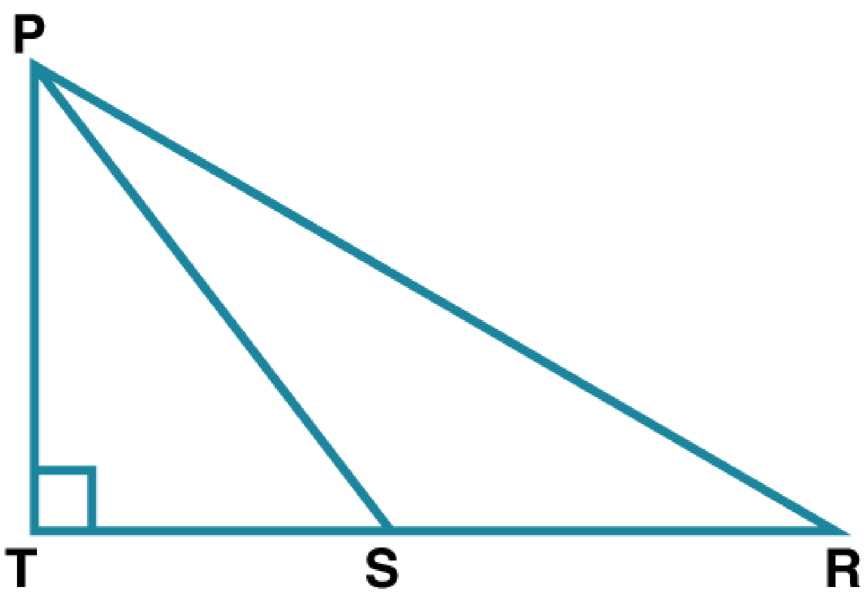


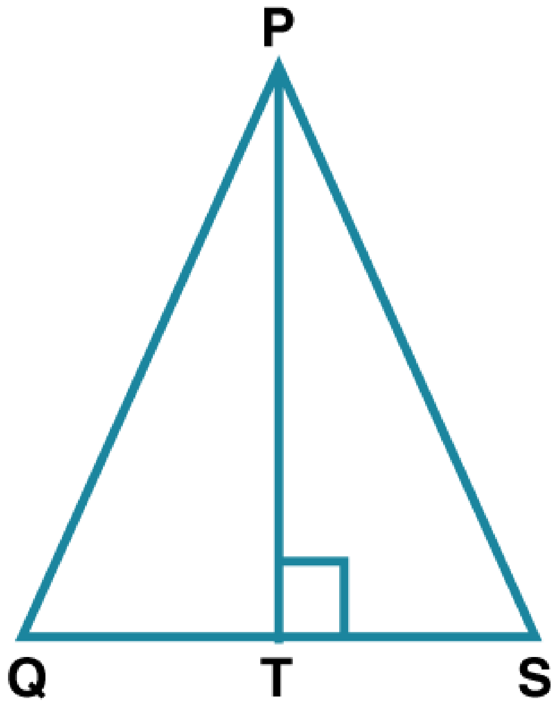

Fig. 2.28

**Solution:**




(1) QS = ½ QR ……(i) [S is the midpoint of QR]
SR = ½ QR ……(ii)
∴ QS = SR [From (i) and (ii)]
PT ⊥QR [Given]
∠PSR is an obtuse angle. [From figure]
∴ $PR^2 = SR^2+PS^2+2SR\times ST$ …..(iii) [Application of Pythagoras theorem]
Substitute SR = ½ QR in (iii)
∴ $PR^2 =[(½)QR]^2+PS^2+2(1/2)QR\times ST$
∴ $PR^2 =[(½)QR]^2+PS^2+QR\times ST$
∴ $PR^2 = PS^2 + QR\times ST +(QR/ 2 )^2$
Hence proved.

(ii) PT⊥QS [Given]




∠PSQ is an acute angle [From figure]

$\therefore PQ^2 = QS^2+PS^2-2QS\times ST$ [Application of Pythagoras theorem]

$\therefore PR^2 = [(1/2)QR]^2+PS^2-2(1/2\ )QR\times ST$

$\therefore PR^2 = (QR/2)^2+PS^2-QR\times ST$

$\therefore PR^2 = PS^2-QR\times ST+(\ QR\ /2)^2$

Hence proved.

## Problem set 2 Page 43

**1. Some questions and their alternative answers are given. Select the correct alternative.**

**(1) Out of the following which is the Pythagorean triplet?**
**(A) (1, 5, 10)**
**(B) (3, 4, 5)**
**(C) (2, 2, 2)**
**(D) (5, 5, 2)**

**Solution:**

(A) (1, 5, 10)
Here $1^2+5^2 \neq 10^2$
The square of largest number is not equal to sum of squares of the other two numbers.
So (1, 5, 10) is not a Pythagorean triplet.

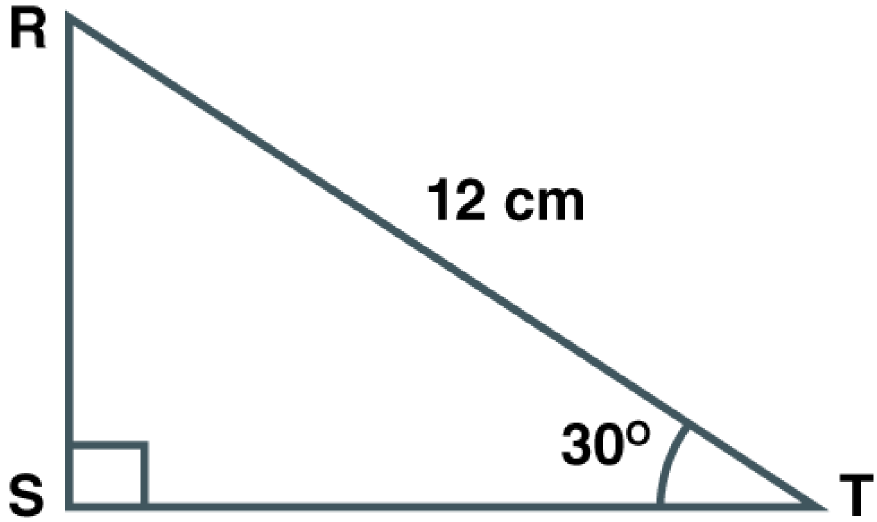
(B) (3, 4, 5)
Here $3^2+4^2 = 5^2$
The square of largest number is equal to sum of squares of the other two numbers.
So (3, 4, 5) is a Pythagorean triplet.

(C) (2, 2, 2)
Here $2^2+2^2 \neq 2^2$
The square of largest number is not equal to sum of squares of the other two numbers.
So (2, 2, 2) is not a Pythagorean triplet.

(D) (5, 5, 2)
Here $2^2+5^2 \neq 5^2$
The square of largest number is not equal to sum of squares of the other two numbers.
So (5, 5, 2) is not a Pythagorean triplet.
Hence option B is the correct answer.

**3. In △ RST, ∠ S = 90°, ∠ T = 30°, RT = 12 cm then find RS and ST.**

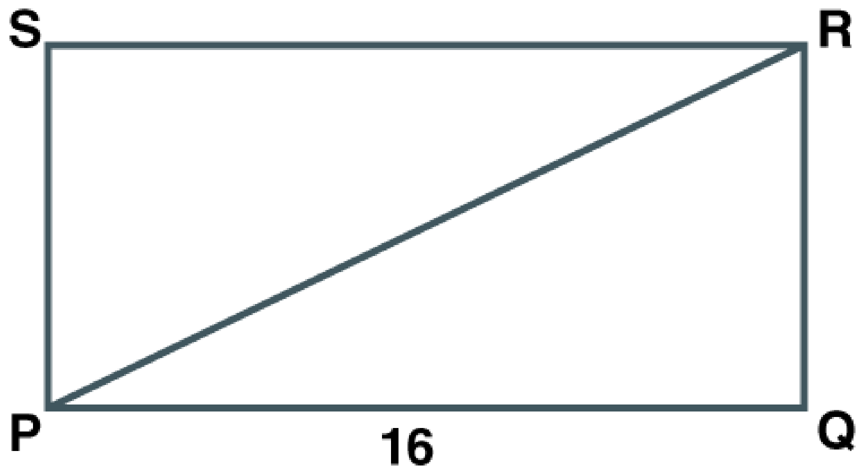
**Solution:**




Given ∠S = 90˚ , ∠T = 30˚
∴∠R = 180-(90+30) = 60˚ [Sum of angles of triangle is equal to 180˚]
△RST is a 30˚ - 60˚- 90˚ triangle
∴RS = ½ RT [Side opposite to 30˚]
⇒ RS = ½ ×12 = 6
ST = √3/2 RT [side opposite to 60˚]
∴ST = (√3/2 )×12
⇒ ST = 6√3
Hence RS = 6 cm and ST = 6√3cm.

**4. Find the diagonal of a rectangle whose length is 16 cm and area is 192 sq.cm.**

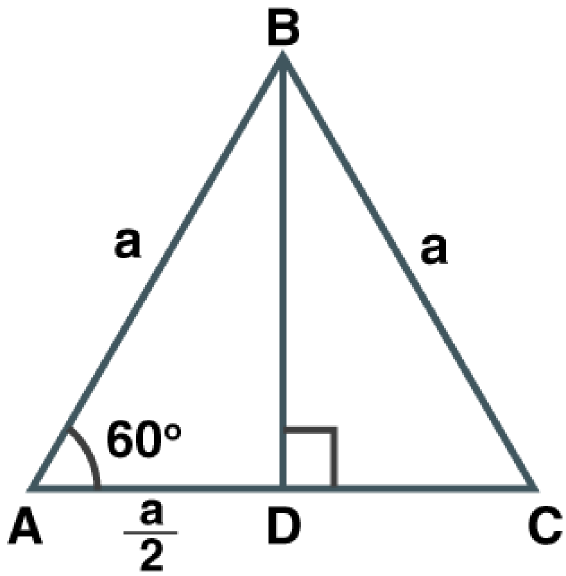
**Solution:**




Let PQRS be the rectangle.
Let length be PQ = 16 cm
Area of rectangle = Length × Breadth
Area of rectangle PQRS = PQ×QR
$\therefore 192 = 16 \times QR$
$\Rightarrow QR = 192/16 = 12$cm
Now in $\triangle PQR$, $\angle Q = 90^\circ$ [Angles of a rectangle are $90^\circ$]
$\therefore PR^2 = PQ^2 + QR^2$ [Pythagoras theorem]
$\therefore PR^2 = 16^2 + 12^2$
$\therefore PR^2 = 256 + 144 = 400$
$\Rightarrow PR = 20$
Hence the diagonal of the rectangle is 20cm long.

**5*. Find the length of the side and perimeter of an equilateral triangle whose height is √3 cm.**

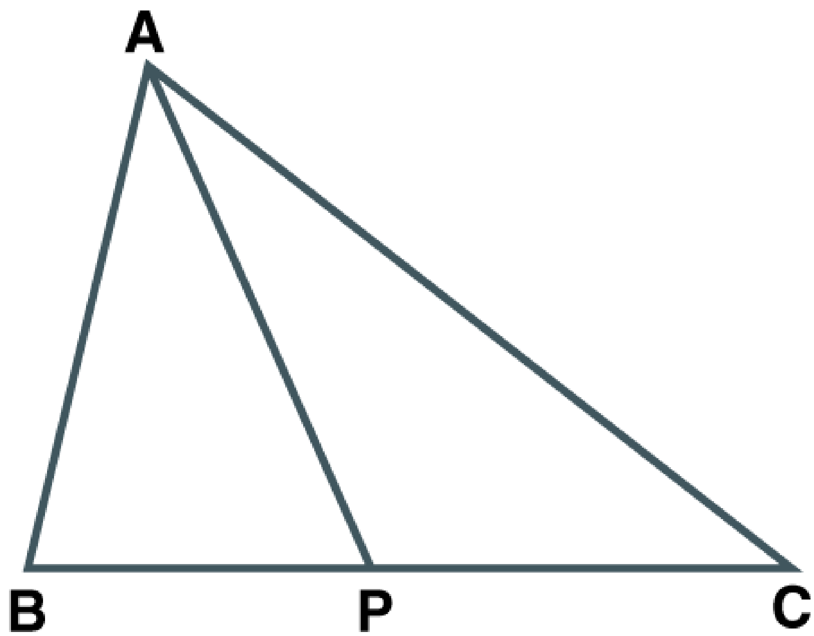
**Solution:**




Let ABC be the equilateral triangle with side a.
Let BD be height of the triangle.
Since △ABC is equilateral, BD is a perpendicular bisector.
∴ AD = a/2
BD = √3 [given height = √3]
AB = a
Applying Pythagoras theorem in △ABD
$AB^2 = AD^2+BD^2$
$\therefore a^2 = (a/2)^2+(\sqrt{3})^2$
$a^2 = (a^2/4)+3$
$(3/4)a^2 = 3$
$\Rightarrow a^2 = 4$
$\Rightarrow a = 2$
Hence length of side of equilateral triangle is 2 cm.
∴ Perimeter = 3×2 = 6 [Perimeter of equilateral triangle = 3×side]
Hence perimeter of equilateral triangle is 6 cm.

**6. In △ ABC seg AP is a median. If BC = 18, $AB^2 + AC^2 = 260$ Find AP.**

**Solution:**

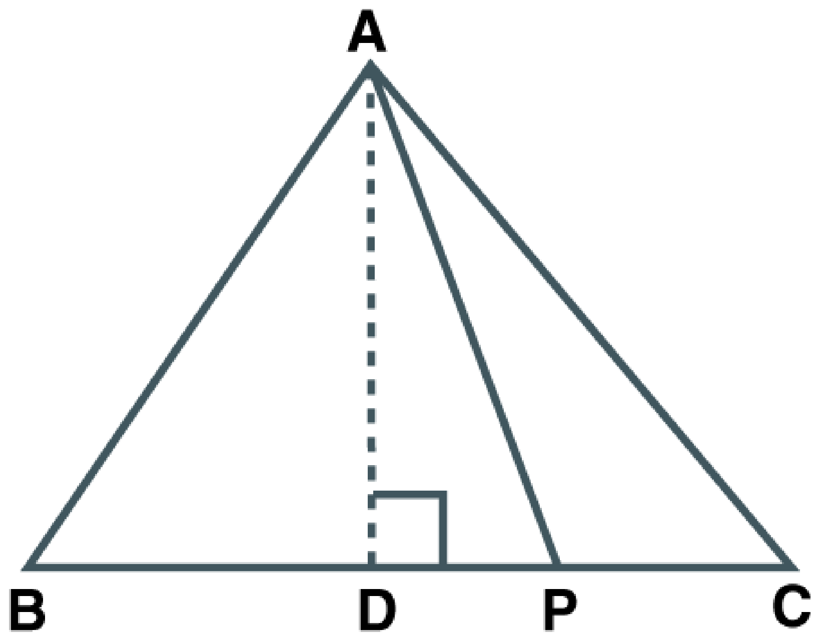



Given AP is the median.
$\therefore PC = BC/2$
$PC = 18/2 = 9$
$AB^2+AC^2 = 2AP^2+2PC^2$ [Apollonius theorem]
$\therefore 260 = 2AP^2+2\times9^2$
$\Rightarrow 2AP^2 = 260-2\times9^2$
$\Rightarrow 2AP^2 = 260-162$
$\Rightarrow AP^2 = 68/2 = 49$
Taking square roots on both sides
AP = 7
Hence AP = 7 units.

**7*. △ ABC is an equilateral triangle. Point P is on base BC such that PC = 1/3 BC, if AB = 6 cm find AP.**

**Solution:**

Given △ABC is an equilateral triangle.
$PC = (1/3)\ BC$
$\therefore PC = (1/3)\times6$ [BC = 6, side of equilateral triangle]
PC = 2
Construction:
Draw segment $AD \perp BC$




In $\triangle ADC$, $\angle C = 60^\circ$
$\angle D = 90^\circ$
$\angle CAD = 30^\circ$
$\triangle ADC$ is a $30^\circ$- $60^\circ$- $90^\circ$triangle
$\therefore AD = (\sqrt{3}/2)\times AC$ [Side opposite to $60^\circ$]
$\Rightarrow AD = (\sqrt{3}/2)\times 6$
$\Rightarrow AD = 3\sqrt{3}$cm
$DC = (1/2)BC$ [$AD\perp BC$]
$\therefore DC = (1/2)\times 6 = 3$cm
$DC = DP+PC$ [D-P-C]
$3 = DP +2$
$\Rightarrow DP = 1$
In $\triangle ADP$ , $\angle D = 90^\circ$
Applying Pythagoras theorem
$AP^2 = AD^2+DP^2$
$\therefore AP^2 = (3\sqrt{3})^2+1^2$
$AP^2 = 28$
$\Rightarrow AP = 2\sqrt{7}$ cm
Hence $AP = 2\sqrt{7}$cm.

**8. From the information given in the figure 2.31, prove that PM = PN = $\sqrt{3}\times a$**

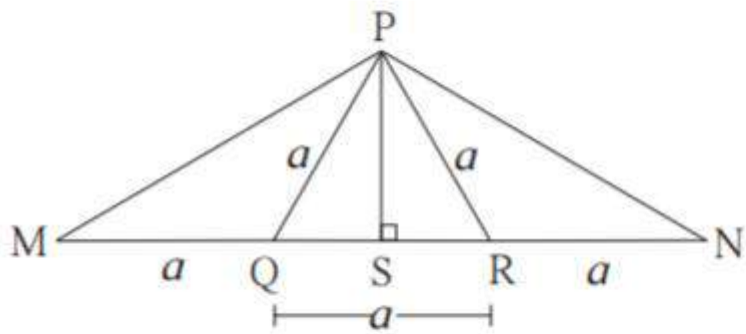
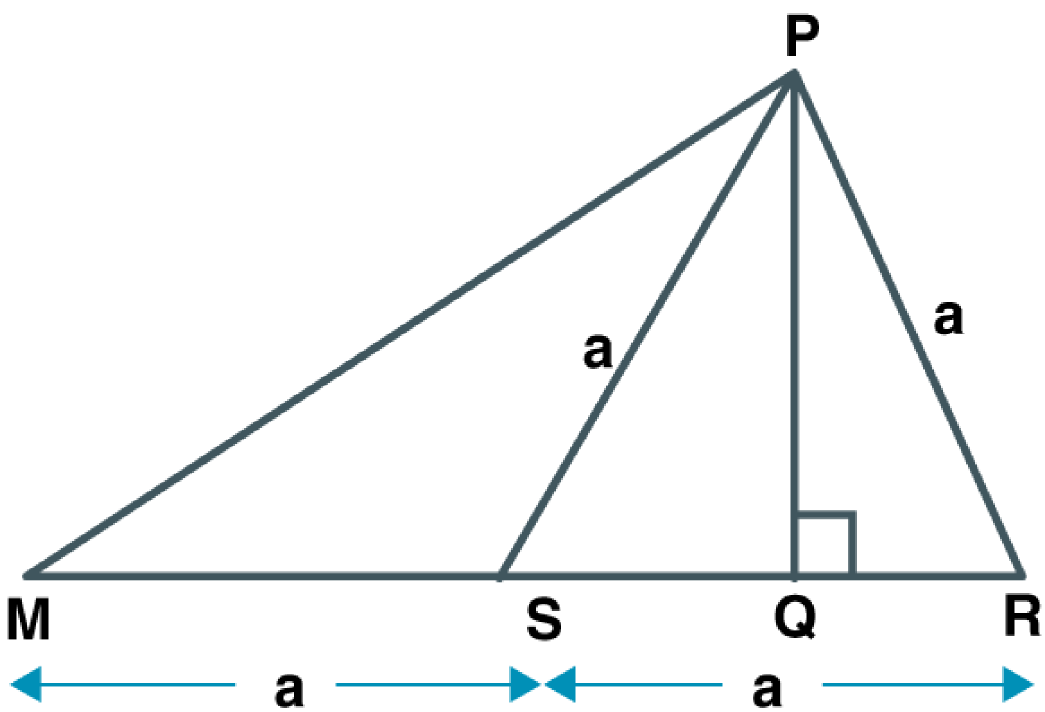
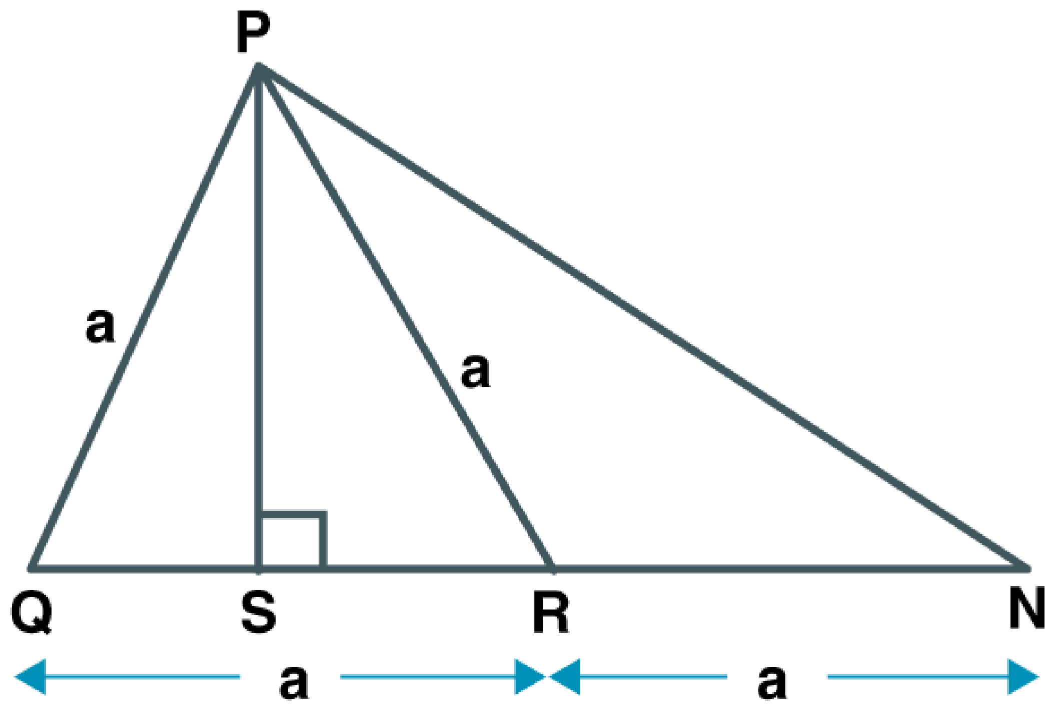



**Fig. 2.31**

**Solution:**
Proof:




In △PRM
Given MQ = QR = a
∴Q is the midpoint of MR .
∴PQ is the median.
$\therefore PR^2+PM^2 = 2PQ^2+2QM^2$ [Apollonius theorem]
$\therefore a^2+PM^2 = 2a^2+2a^2$
$\Rightarrow PM^2 = 3a^2$
$\Rightarrow PM = \sqrt{3}a$…………(i)




In △PQN

Given NR = QR = a

∴R is the midpoint of QN.

∴PR is the median.

∴ $PN^2+PQ^2 = 2PR^2+2RN^2$ [Apollonius theorem]

∴$PN^2+a^2 = 2a^2+2a^2$

⇒$PN^2 = 3a^2$

⇒$PN = \sqrt{3}a$…………..(ii)

From (i) and (ii) $PM = PN = \sqrt{3}\times a$

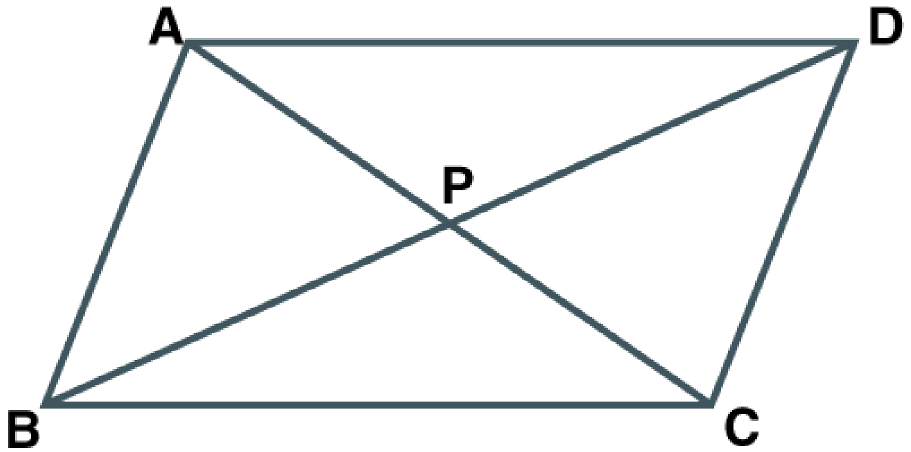
Hence proved.

**9. Prove that the sum of the squares of the diagonals of a parallelogram is equal to the sum of the squares of its sides.**

**Solution:**

Construction:

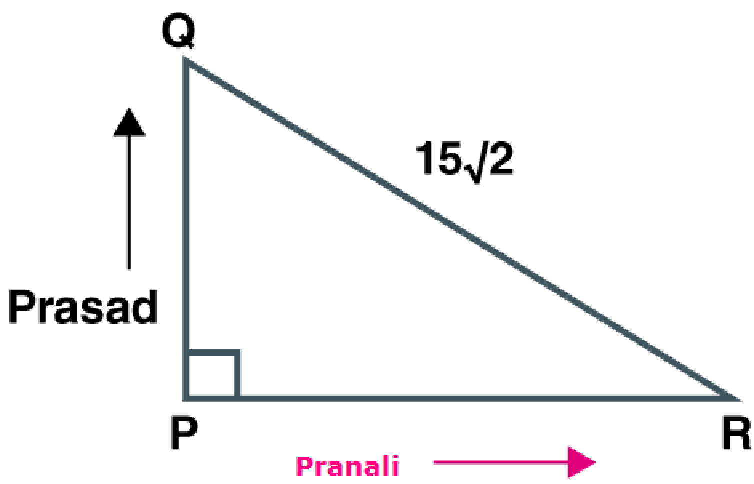
Draw a parallelogram ABCD. Let diagonals AC and BD meet at P.




To prove : $AC^2+BD^2 = AB^2+BC^2+CD^2+DA^2$
AB = CD [Opposite sides of parallelogram are equal]
BC = DA [Opposite sides of parallelogram are equal]
Since diagonals of a parallelogram bisect each other,
AP = ½ AC
BP = ½ BD
P is the midpoint of diagonals AC and BD.
In△ABC , BP is the median.
$AB^2+BC^2 = 2AP^2+2BP^2$ [Apollonius theorem]
$\therefore AB^2+BC^2 = 2[(1/2)AC]^2+2[(1/2)BD]^2$
$\therefore AB^2+BC^2 = AC^2/2+BD^2/2$
$2(AB^2+BC^2) = AC^2+BD^2$
$2AB^2+2BC^2 = AC^2+BD^2$
$AB^2+ AB^2+ BC^2+BC^2 = AC^2+BD^2$
$\therefore AB^2+ CD^2+ BC^2+DA^2 = AC^2+BD^2$
$\therefore AC^2+BD^2 = AB^2+BC^2+CD^2+DA^2$
Hence proved.

**10. Pranali and Prasad started walking to the East and to the North respectively, from the same point and at the same speed. After 2 hours distance between them was 15√2 km. Find their speed per hour.**

**Solution:**




Distance between Pranali and Prasad after 2 hours = $15\sqrt{2}$ km
Since they travel at same speed, they have covered same distance.
Construction: Draw a triangle PQR such that PQ = PR = x and QR = $15\sqrt{2}$
$\angle P = 90^\circ$
In $\triangle PQR$ , $PQ^2+PR^2 = QR^2$ [Pythagoras theorem]
$\therefore x^2+x^2 = (15\sqrt{2})^2$
$2x^2 = 2\times225$
$x^2 = 225$
$\Rightarrow x = 15$
$\therefore$ Distance covered by them is 15 km.
Given time = 2 hours
Speed = Distance / time
Speed = 15/2 = 7.5km/hr
$\therefore$ Speed of Pranali and Prasad is 7.5km/hr.