Practice Set 2.1 Geometry 10th Std Maths Part 2 Answers Chapter 2 Pythagoras Theorem

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

ii. Here, $12^2 = 144$
$4^2 + 9^2 = 16 + 81 = 97$
$\therefore 12^2 \neq 4^2 + 9^2$
The square of the largest number is not equal to the sum of the squares of the other two numbers.
∴ (4,9,12) is not a Pythagorean triplet.

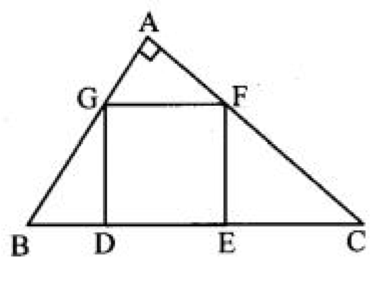
iii. Here, $13^2 = 169$
$5^2 + 12^2 = 25 + 144 = 169$
$\therefore 13^2 = 5^2 + 12^2$
The square of the largest number is equal to the sum of the squares of the other two numbers.
∴ (5,12,13) is a Pythagorean triplet.

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

v. Here, $27^2 = 729$
$10^2 + 24^2 = 100 + 576 = 676$
$\therefore 27^2 \neq 10^2 + 24^2$
The square of the largest number is not equal to the sum of the squares of the other two numbers.
∴ (10,24,27) is not a Pythagorean triplet.

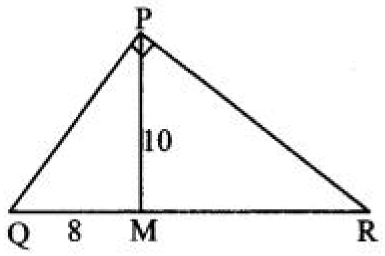
vi. Here, $61^2 = 3721$
$11^2 + 60^2 = 121 + 3600 = 3721$
$\therefore 61^2 = 11^2 + 60^2$
The square of the largest number is equal to the sum of the squares of the other two numbers.
∴ (11,60,61) is a Pythagorean triplet.

Question 2.
In the adjoining figure, $\angle MNP = 90°$, seg NQ ⊥ seg MP,MQ = 9, QP = 4, find NQ.



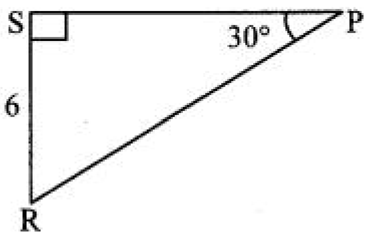
Solution:
In ΔMNP, $\angle MNP = 90°$ and [Given]
seg NQ ⊥ seg MP
$NQ^2 = MQ \times QP$ [Theorem of geometric mean]
$\therefore NQ = \sqrt{MQ \times QP}$ [Taking square root of both sides]
$= \sqrt{9 \times 4}$
$= 3 \times 2$
∴NQ = 6 units

Question 3.
In the adjoining figure, $\angle QPR = 90°$, seg PM ⊥ seg QR and Q – M – R, PM = 10, QM = 8, find QR.



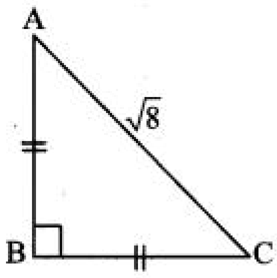
Solution:
In ΔPQR, ∠QPR = 90° and [Given]
seg PM ⊥ seg QR
∴ PM^2 = OM × MR [Theorem of geometric mean]
∴ 10^2 = 8 × MR
∴ MR = $\frac{100}{8}$
= 12.5
Now, QR = QM + MR [Q – M – R]
= 8 + 12.5
∴ QR = 20.5 units

Question 4.
See adjoining figure. Find RP and PS using the information given in ΔPSR.



Solution:
In ΔPSR, ∠S = 90°, ∠P = 30° [Given]
∴ ∠R = 60° [Remaining angle of a triangle]
∴ ΔPSR is a 30° – 60° – 90° triangle.
RS = $\frac{1}{2}$ RP [Side opposite to 30°]
∴6 = $\frac{1}{2}$ RP
∴ RP = 6 × 2 = 12 units
Also, PS = $\frac{\sqrt{3}}{2}$ RP [Side opposite to 60°]
= $\frac{\sqrt{3}}{2}$ × 12
= $6\sqrt{3}$ units
∴ RP = 12 units, PS = 6 $\sqrt{3}$ units

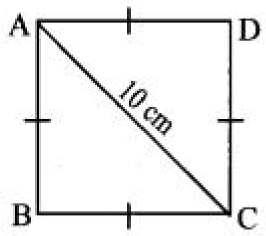
Question 5.
For finding AB and BC with the help of information given in the adjoining figure, complete the following activity.



Solution:
AB = BC [Given]
∴ ∠BAC = ∠BCA [Isosceles triangle theorem]
Let ∠BAC = ∠BCA = x (i)
In ΔABC, ∠A + ∠B + ∠C = 180° [Sum of the measures of the angles of a triangle is 180°]
∴ x + 90° + x = 180° [From (i)]
∴ 2x = 90°
∴ x = $\frac{90°}{2}$ [From (i)]
∴ x = 45°

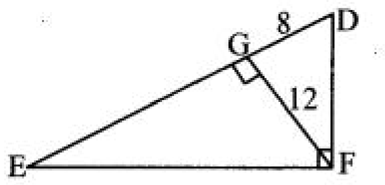
$$\therefore \quad AB = BC = \boxed{\frac{1}{\sqrt{2}}} \times AC \qquad \text{[Side opposite to 45°]}$$
$$= \boxed{\frac{1}{\sqrt{2}}} \times \sqrt{8}$$
$$= \boxed{\frac{1}{\sqrt{2}}} \times 2\sqrt{2}$$
$$\therefore \quad AB = BC = \boxed{\textbf{2 units}}$$

Question 6.
Find the side and perimeter of a square whose diagonal is 10 cm.



Solution:
Let □ ABCD be the given square.
l(diagonal AC) = 10 cm
Let the side of the square be 'x' cm.
In ΔABC,
$\angle B = 90°$ [Angle of a square]
$\therefore AC^2 = AB^2 + BC^2$ [Pythagoras theorem]
$\therefore 10^2 = x^2 + x^2$
$\therefore 100 = 2x^2$
$\therefore x^2 = \frac{100}{2}$
$\therefore x^2 = 50$
$\therefore x = \sqrt{50}$ [Taking square root of both sides]
$= \sqrt{25 \times 2} = 5\sqrt{2}$
$\therefore$ side of square is $5\sqrt{2}$ cm.
$= 4 \times 5\sqrt{2}$
$\therefore$ Perimeter of square = $20\sqrt{2}$ cm

Question 7.
In the adjoining figure, $\angle DFE = 90°$, $FG \perp ED$. If GD = 8, FG = 12, find
i. EG
ii. FD, and
iii. EF

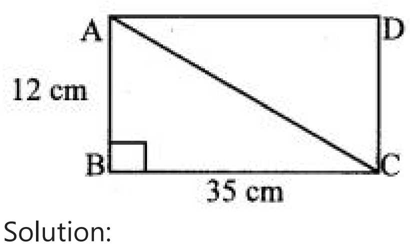


Solution:
i. In ΔDEF, $\angle DFE = 90°$ and $FG \perp ED$ [Given]
$\therefore FG^2 = GD \times EG$ [Theorem of geometric mean]
$\therefore 12^2 = 8 \times EG$.
$\therefore EG = \frac{144}{8}$
$\therefore$ EG = 18 units

ii. In ΔFGD, $\angle FGD = 90°$ [Given]
$\therefore FD^2 = FG^2 + GD^2$ [Pythagoras theorem]
$= 12^2 + 8^2 = 144 + 64$
$= 208$
$\therefore FD = \sqrt{208}$ [Taking square root of both sides]
$\therefore FD = 4\sqrt{13}$ units

iii. In ΔEGF, $\angle EGF = 90°$ [Given]
$\therefore EF^2 = EG^2 + FG^2$ [Pythagoras theorem]
$= 18^2 + 12^2 = 324 + 144$
$= 468$
$\therefore EF = \sqrt{468}$ [Taking square root of both sides]
$\therefore EF = 6\sqrt{13}$ units

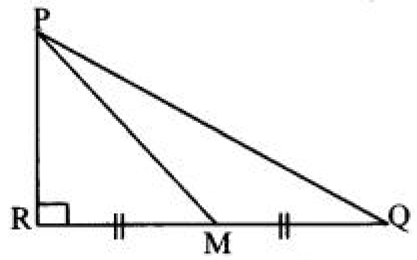
Question 8.
Find the diagonal of a rectangle whose length is 35 cm and breadth is 12 cm.



Solution:
Let □ ABCD be the given rectangle.
AB = 12 cm, BC 35 cm
In ΔABC, $\angle B = 90°$ [Angle of a rectangle]
$\therefore AC^2 = AB^2 + BC^2$ [Pythagoras theorem]

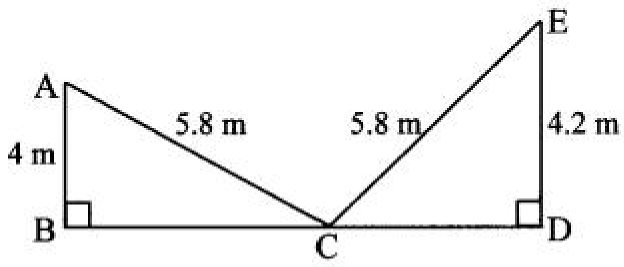
$= 12^2 + 35^2$
$= 144 + 1225$
$= 1369$
$\therefore AC = \sqrt{1369}$ [Taking square root of both sides]
$= 37$ cm
$\therefore$ The diagonal of the rectangle is 37 cm.

Question 9.
In the adjoining figure, M is the midpoint of QR. $\angle PRQ = 90°$.
Prove that, $PQ^2 = 4 PM^2 - 3 PR^2$.



Solution:
Proof:
In ΔPQR, $\angle PRQ = 90°$ [Given]
$PQ^2 = PR^2 + QR^2$ (i) [Pythagoras theorem]
$RM = \frac{1}{2} QR$ [M is the midpoint of QR]
$\therefore 2RM = QR$ (ii)
$\therefore PQ^2 = PR^2 + (2RM)^2$ [From (i) and (ii)]
$\therefore PQ^2 = PR^2 + 4RM^2$ (iii)
Now, in ΔPRM, $\angle PRM = 90°$ [Given]
$\therefore PM^2 = PR^2 + RM^2$ [Pythagoras theorem]
$\therefore RM^2 = PM^2 - PR^2$ (iv)
$\therefore PQ^2 = PR^2 + 4 (PM^2 - PR^2)$ [From (iii) and (iv)]
$\therefore PQ^2 = PR^2 + 4 PM^2 - 4 PR^2$
$\therefore PQ^2 = 4 PM^2 - 3 PR^2$

Question 10.
Walls of two buildings on either side of a street are parallel to each other. A ladder 5.8 m long is placed on the street such that its top just reaches the window of a building at the height of 4 m. On turning the ladder over to the other side of the street, its top touches the window of the other building at a height 4.2 m. Find the width of the street.
Solution:
Let AC and CE represent the ladder of length 5.8 m, and A and E represent windows of the buildings on the opposite sides of the street. BD is the width of the street.



AB = 4 m and ED = 4.2 m
In ΔABC, $\angle B = 90°$ [Given]
$AC^2 = AB^2 + BC^2$ [Pythagoras theorem]
$\therefore 5.8^2 = 4^2 + BC^2$
$\therefore 5.8^2 - 4^2 = BC^2$
$\therefore (5.8 - 4) (5.8 + 4) = BC^2$
$\therefore 1.8 \times 9.8 = BC^2$

$$\therefore \frac{18 \times 98}{100} = BC^2$$

$$\therefore \frac{9 \times 2 \times 49 \times 2}{100} = BC^2$$

$$\therefore \frac{9 \times 4 \times 49}{100} = BC^2$$

$$\therefore BC = \frac{3 \times 2 \times 7}{10}$$ [Taking square root of both sides]

$$\therefore BC = \frac{42}{10} = 4.2 \text{ cm}$$ (i)

In ΔCDE, $\angle CDE = 90°$ [Given]
$CE^2 = CD^2 + DE^2$ [Pythagoras theorem]
$\therefore 5.8^2 = CD^2 + 4.2^2$
$\therefore 5.8^2 - 4.2^2 = CD^2$
$\therefore (5.8 - 4.2) (5.8 + 4.2) = CD^2$
$\therefore 1.6 \times 10 = CD^2$
$\therefore CD^2 = 16$
$\therefore CD = 4$m (ii) [Taking square root of both sides]

Now, BD = BC + CD [B – C – D]
= 4.2 + 4 [From (i) and (ii)]
= 8.2 m
∴ The width of the street is 8.2 metres.

Question 1.
Verify that (3,4,5), (5,12,13), (8,15,17), (24,25,7) are Pythagorean triplets. (Textbook pg. no. 30)
Solution:
i. Here, $5^2 = 25$
$3^2 + 4^2 = 9 + 16 = 25$
∴ $5^2 = 3^2 + 4^2$
The square of the largest number is equal to the sum of the squares of the other two numbers.
∴ 3,4,5 is a Pythagorean triplet.

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

iii. Here, $17^2 = 289$
$8^2 + 15^2 = 64 + 225 = 289$
∴ $17^2 = 8^2 + 15^2$
The square of the largest number is equal to the sum of the squares of the other two numbers.
∴ 8,15,17 is a Pythagorean triplet.

iv. Here, $25^2 = 625$
$7^2 + 24^2 = 49 + 576 = 625$
∴ $25^2 = 7^2 + 24^2$
The square of the largest number is equal to the sum of the squares of the other two numbers.
∴ 24,25, 7 is a Pythagorean triplet.

Question 2.
Assign different values to a and b and obtain 5 Pythagorean triplets. (Textbook pg. no. 31)
Solution:
i. Let a = 2, b = 1
$a^2 + b^2 = 2^2 + 1^2 = 4 + 1 = 5$
$a^2 – b^2 = 2^2 – 1^2 = 4 – 1 = 3$
$2ab = 2 \times 2 \times 1 = 4$
∴ (5, 3, 4) is a Pythagorean triplet.

ii. Let a = 4,b = 3
$a^2 + b^2 = 4^2 + 3^2 = 16 + 9 = 25$
$a^2 – b^2 = 4^2 – 3^2 = 16 – 9 = 7$
$2ab = 2 \times 4 \times 3 = 24$
∴ (25, 7, 24) is a Pythagorean triplet.

iii. Let a = 5, b = 2
$a^2 + b^2 = 5^2 + 2^2 = 25 + 4 = 29$
$a^2 – b^2 = 5^2 – 2^2 = 25 – 4 = 21$
$2ab = 2 \times 5 \times 2 = 20$
∴ (29, 21, 20) is a Pythagorean triplet.

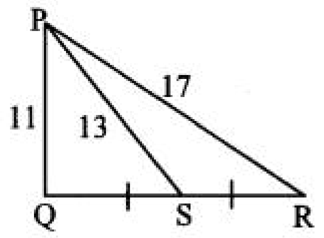
iv. Let a = 4,b = 1
$a^2 + b^2 = 4^2 + 1^2 = 16 + 1 = 17$
$a^2 – b^2 = 42 – 12 = 16 – 1 = 15$
$2ab = 2 \times 4 \times 1 = 8$
∴ (17, 15, 8) is a Pythagorean triplet.

v. Let a = 9, b = 7
$a^2 + b^2 = 92 + 72 = 81 + 49 = 130$
$a^2 – b^2 = 92 – 72 = 81 – 49 = 32$
$2ab = 2 \times 9 \times 7 = 126$
∴ (130,32,126) is a Pythagorean triplet.

Note: Numbers in Pythagorean triplet can be written in any order.

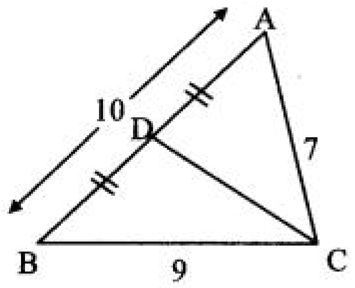
Practice Set 2.2 Geometry 10th Std Maths Part 2 Answers Chapter 2 Pythagoras Theorem

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



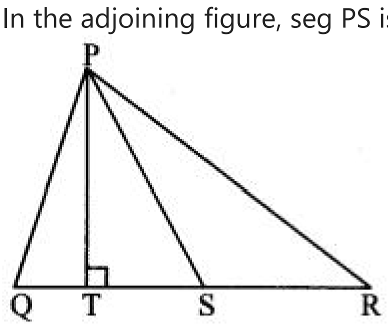
Solution:
In ΔPQR, point S is the midpoint of side QR. [Given]
∴ seg PS is the median.
∴ $PQ^2 + PR^2 = 2\ PS^2 + 2\ SR^2$ [Apollonius theorem]
∴ $11^2 + 17^2 = 2\ (13)^2 + 2\ SR^2$
∴ $121 + 289 = 2\ (169) + 2\ SR^2$
∴ $410 = 338 + 2\ SR^2$
∴ $2\ SR^2 = 410 - 338$
∴ $2\ SR^2 = 72$
∴ $SR^2 = \frac{72}{2} = 36$
∴ SR = $\sqrt{36}$ [Taking square root of both sides]
= 6 units Now, QR = 2 SR [S is the midpoint of QR]
= 2 × 6
∴ QR = 12 units

Question 2.
In ΔABC, AB = 10, AC = 7, BC = 9, then find the length of the median drawn from point C to side AB.
Solution:
Let CD be the median drawn from the vertex C to side AB.
BD = $\frac{1}{2}$ AB [D is the midpoint of AB]
= $\frac{1}{2}$ × 10 = 5 units

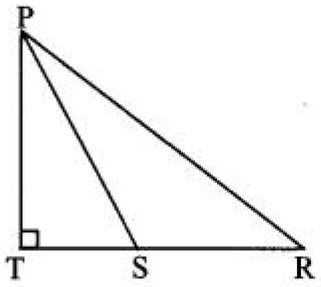


In ΔABC, seg CD is the median. [Given]
∴ $AC^2 + BC^2 = 2\ CD^2 + 2\ BD^2$ [Apollonius theorem]
∴ $7^2 + 9^2 = 2\ CD^2 + 2\ (5)^2$
∴ $49 + 81 = 2\ CD^2 + 2\ (25)$
∴ $130 = 2\ CD^2 + 50$
∴ $2\ CD^2 = 130 - 50$
∴ $2\ CD^2 = 80$
∴ $CD^2 = \frac{80}{2} = 40$
∴ CD = $\sqrt{40}$ [Taking square root of both sides]
= 2 $\sqrt{10}$ units
∴ The length of the median drawn from point C to side AB is 2 $\sqrt{10}$ units.

Question 3.
In the adjoining figure, seg PS is the median of APQR and PT ⊥ QR. Prove that,

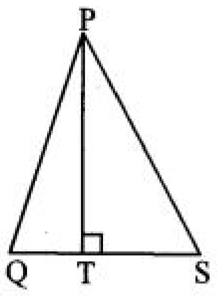


i. $PR^2 = PS^2 + QR \times ST + \left(\frac{QR}{2}\right)^2$
ii. $PQ^2 = PS^2 - QR \times ST + \left(\frac{QR}{2}\right)^2$
Solution:
i. QS = SR = $\frac{1}{2}$ QR (i) [S is the midpoint of side QR]



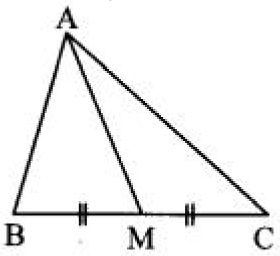
∴ In ΔPSR, ∠PSR is an obtuse angle [Given]
and PT ⊥ SR [Given, Q-S-R]
∴ $PR^2 = SR^2 + PS^2 + 2\ SR \times ST$ (ii) [Application of Pythagoras theorem]
∴ $PR^2 = (\frac{1}{2} QR)^2 + PS^2 + 2 (\frac{1}{2} QR) \times ST$ [From (i) and (ii)]
∴ $PR^2 = (\frac{QR}{2})^2 + PS^2 + QR \times ST$
∴ $PR^2 = PS^2 + QR \times ST + (\frac{QR}{2})^2$

ii. In.ΔPQS, ∠PSQ is an acute angle and [Given]



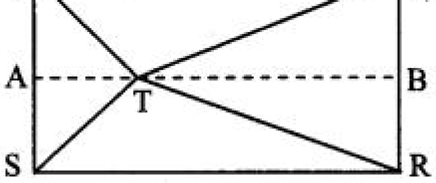
PT ⊥QS [Given, Q-S-R]
∴ $PQ^2 = QS^2 + PS^2 – 2\ QS \times ST$ (iii) [Application of Pythagoras theorem]
∴ $PR^2 = (\frac{1}{2} QR)^2 + PS^2 – 2 (\frac{1}{2} QR) \times ST$ [From (i) and (iii)]
∴ $PR^2 = (\frac{QR}{2})^2 + PS^2 – QR \times ST$
∴ $PR^2 = PS^2 – QR \times ST + (\frac{QR}{2})^2$

Question 4.
In ΔABC, point M is the midpoint of side BC. If $AB^2 + AC^2 = 290$ cm, AM = 8 cm, find BC.



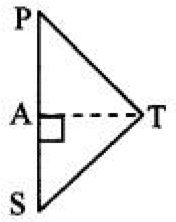
Solution:
In ΔABC, point M is the midpoint of side BC. [Given]
∴ seg AM is the median.
∴ $AB^2 + AC^2 = 2\ AM^2 + 2\ MC^2$ [Apollonius theorem]
∴ $290 = 2 (8)^2 + 2\ MC^2$
∴ $145 = 64 + MC^2$ [Dividing both sides by 2]
∴ $MC^2 = 145 – 64$
∴ $MC^2 = 81$
∴ MC = $\sqrt{81}$ [Taking square root of both sides]
MC = 9 cm
Now, BC = 2 MC [M is the midpoint of BC]
= 2 × 9
∴ BC = 18 cm

Question 5.
In the adjoining figure, point T is in the interior of rectangle PQRS. Prove that, $TS^2 + TQ^2 = TP^2 + TR^2$. (As shown in the figure, draw seg AB || side SR and A – T – B)

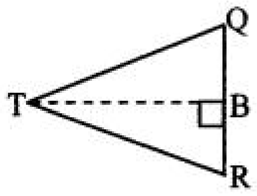


Given: □ PQRS is a rectangle.
Point T is in the interior of □ PQRS.
To prove: $TS^2 + TQ^2 = TP^2 + TR^2$
Construction: Draw seg AB || side SR such that A – T – B.
Solution:
Proof:
□ PQRS is a rectangle. [Given]
∴ PS = QR (i) [Opposite sides of a rectangle]
In □ ASRB,

$\angle S = \angle R = 90°$ (ii) [Angles of rectangle PQRS]
side AB || side SR [Construction]
Also $\angle A = \angle S = 90°$ [Interior angle theorem, from (ii)]
$\angle B = \angle R = 90°$
$\therefore \angle A = \angle B = \angle S = \angle R = 90°$ (iii)
∴ ⌡ ASRB is a rectangle.
∴ AS = BR (iv) [Opposite sides of a rectanglel

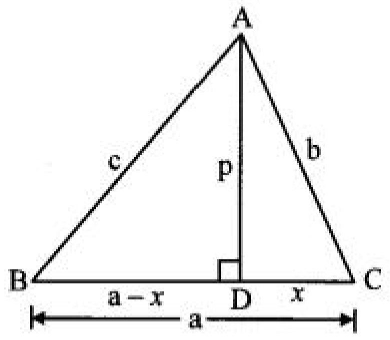


In ΔPTS, ∠PST is an acute angle
and seg AT ⊥ side PS [From (iii)]
$\therefore TP^2 = PS^2 + TS^2 – 2\ PS.AS$ (v) [Application of Pythagoras theorem]
In ΔTQR., ∠TRQ is an acute angle
and seg BT ⊥ side QR [From (iii)]
$\therefore TQ^2 = RQ^2 + TR^2 – 2\ RQ.BR$ (vi) [Application of pythagoras theorem]



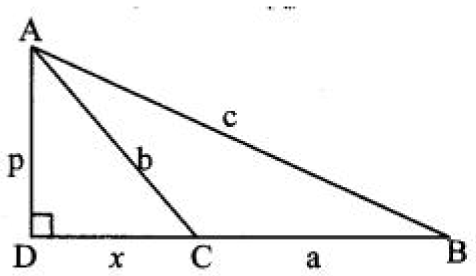
$TP^2 – TQ^2 = PS^2 + TS^2 – 2PS.AS$
$-RQ^2 – TR^2 + 2RQ.BR$ [Subtracting (vi) from (v)]
$\therefore TP^2 – TQ^2 = TS^2 – TR^2 + PS^2$
$– RQ^2 -2\ PS.AS +2\ RQ.BR$
$\therefore TP^2 – TQ^2 = TS^2 – TR^2 + PS^2$
$– PS^2 – 2\ PS.BR + 2PS.BR$ [From (i) and (iv)]
$\therefore TP^2 – TQ^2 = TS^2 – TR^2$
$\therefore TS^2 + TQ^2 = TP^2 + TR^2$

Question 1.
In ΔABC, ∠C is an acute angle, seg AD Iseg BC. Prove that: $AB^2 = BC^2 + A^2 – 2\ BC \times DC$. (Textbook pg. no. 44)
Given: ∠C is an acute angle, seg AD ⊥ seg BC.
To prove: $AB^2 = BC^2 + AC^2 – 2BC \times DC$
Solution:
Proof:
∴ LetAB = c, AC = b, AD = p,



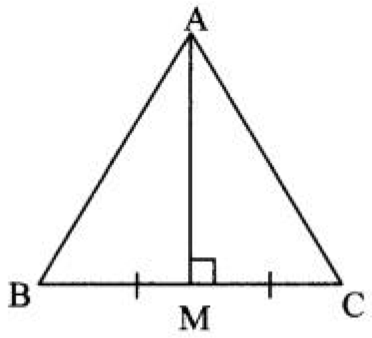
∴ BC = a, DC = x
BD + DC = BC [B – D – C]
∴ BD = BC – DC
∴ BD = a – x
In ΔABD, ∠D = 90° [Given]
$AB^2 = BD^2 + AD^2$ [Pythagoras theorem]
$\therefore c^2 = (a – x)^2 + [P^2]$ (i)
$\therefore c^2 = a^2 – 2ax + x^2 + [P^2]$
In ΔADC, ∠D = 90° [Given]
$AC^2 = AD^2 + CD^2$ [Pythagoras theorem]
$\therefore b^2 = p^2 + [X^2]$
$\therefore p^2 = b^2 – [X^2]$ (ii)
$\therefore c^2 = a^2 – 2ax + x^2 + b^2 – x^2$ [Substituting (ii) in (i)]
$\therefore c^2 = a^2 + b^2 – 2ax$
$\therefore AB^2 = BC^2 + AC^2 – 2\ BC \times DC$

Question 2.
In ΔABC, ∠ACB is an obtuse angle, seg AD ⊥ seg BC. Prove that: $AB^2 = BC^2 + AC^2 + 2\ BC \times CD$. (Textbook pg. no. 40 and 4.1)
Given: ∠ACB is an obtuse angle, seg AD ⊥ seg BC.
To prove: $AB^2 = BC^2 + AC^2 + 2BC \times CD$
Solution:
Proof:



Let AD = p, AC = b, AB = c,
BC = a, DC = x
BD = BC + DC [B – C – D]
∴ BD = a + x
In ΔADB, ∠D = 90° [Given]
$AB^2 = BD^2 + AD^2$ [Pythagoras theorem]
∴ $c^2 = (a + x)^2 + p^2$ (i)
∴ $c^2 = a^2 + 2ax + x^2 + p^2$
Also, in ΔADC, ∠D = 90° [Given]
$AC^2 = CD^2 + AD^2$ [Pythagoras theorem]
∴ $b^2 = x^2 + p^2$
∴ $p^2 = b^2 – x^2$ (ii)
∴ $c^2 = a^2 + 2ax + x^2 + b^2 – x^2$ [Substituting (ii) in (i)]
∴ $c^2 = a^2 + b^2 + 2ax$
∴ $AB^2 = BC^2 + AC^2 + 2\ BC \times CD$

Question 3.
In ΔABC, if M is the midpoint of side BC and seg AM ⊥seg BC, then prove that
$AB^2 + AC^2 = 2\ AM^2 + 2\ BM^2$. (Textbook pg, no. 41)
Given: In ΔABC, M is the midpoint of side BC and seg AM ⊥ seg BC.
To prove: $AB^2 + AC^2 = 2\ AM^2 + 2\ BM^2$
Solution:
Proof:



In ΔAMB, ∠M = 90° [segAM ⊥ segBC]
∴ $AB2 = AM2 + BM2$ (i) [Pythagoras theorem]
Also, in ΔAMC, ∠M = 90° [seg AM ⊥ seg BC]
∴ $AC2 = AM2 + MC2$ (ii) [Pythagoras theorem]
∴ $AB^2 + AC^2 = AM^2 + BM^2 + AM^2 + MC^2$ [Adding (i) and (ii)]
∴ $AB^2 + AC^2 = 2\ AM^2 + BM^2 + BM^2$ [∵ BM = MC (M is the midpoint of BC)]
∴ $AB^2 + AC^2 = 2\ AM^2 + 2\ BM^2$

Problem Set 2 Geometry 10th Std Maths Part 2 Answers Chapter 2 Pythagoras Theorem

Question 1.
Some questions and their alternative answers are given. Select the correct alternative. [1 Mark each]

i. 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)
Answer: (B)
Hint: Refer Practice set 2.1 Q.1 (i)

ii. In a right angled triangle, if sum of the squares of the sides making right angle is 169, then what is the length of the hypotenuse?
(A) 15
(B) 13

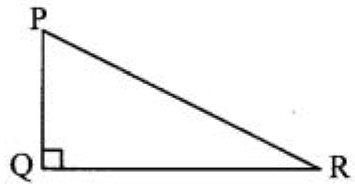
(C) 5
(D) 12
Answer: (B)
Hint:

ii. In ΔPQR, $\angle Q = 90^\circ$

$\therefore \quad PR^2 = PQ^2 + QR^2$ ...[Pythagoras theorem]

$\therefore \quad PR^2 = 169$

$\therefore \quad PR = \sqrt{169} = 13$



iii. Out of the dates given below which date constitutes a Pythagorean triplet?
(A) 15/08/17
(B) 16/08/16
(C) 3/5/17
(D) 4/9/15
Answer: (A)
Hint:

Consider Option A.
Here, $15^2 + 8^2 = 225 + 64 = 289$, and $17^2 = 289$

$\therefore \quad 15^2 + 8^2 = 17^2$

iv. If a, b, c are sides of a triangle and $a^2 + b^2 = c^2$, name the type of the triangle.
(A) Obtuse angled triangle
(B) Acute angled triangle
(C) Right angled triangle
(D) Equilateral triangle
Answer: (C)

v. Find perimeter of a square if its diagonal is $10\sqrt{2}$ cm.
(A) 10 cm
(B) $40\sqrt{2}$ cm
(C) 20 cm
(D) 40 cm
Answer: (D)
Hint:

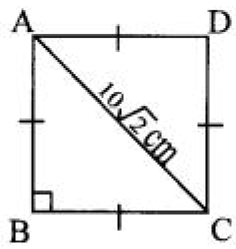
In ΔABC, $\angle B = 90^\circ$, and $\angle BAC = \angle BCA = 45^\circ$

$\therefore \quad AB = \frac{1}{\sqrt{2}} AC$ ...[Theorem of $45^\circ - 45^\circ - 90^\circ$ triangle]

$= \frac{1}{\sqrt{2}} \times 10\sqrt{2}$

$\therefore \quad AB = 10$ cm

$\therefore$ Perimeter of square $= 4\,(AB) = 4 \times 10 = 40$ cm

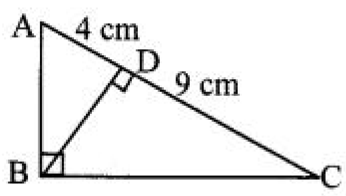


vi. Altitude on the hypotenuse of a right angled triangle divides it in two parts of lengths 4 cm and 9 cm. Find the length of the altitude.
(A) 9 cm
(B) 4 cm
(C) 6 cm
(D) $2\sqrt{6}$
Answer: (C)
Hint:

In ΔABC,
$BD^2 = AD \times DC$ ...[Theorem of geometric mean]

$\therefore \quad BD^2 = 4 \times 9$

$\therefore \quad BD = \sqrt{36} = 6$ cm



vii. Height and base of a right angled triangle are 24 cm and 18 cm find the length of its hypotenuse.
(A) 24 cm
(B) 30 cm
(C) 15 cm
(D) 18 cm
Answer: (B)

Hint:

In ΔPQR, $\angle Q = 90°$

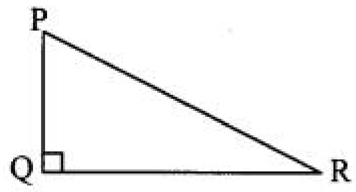
$\therefore \quad PR^2 = PQ^2 + QR^2$ …[Pythagoras theorem]

$= 24^2 + 18^2$

$= 576 + 324$

$= 900$

$\therefore \quad PR = \sqrt{900} = 30$ cm

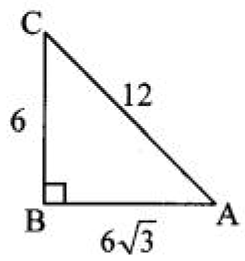


viii. In ΔABC, AB = $6\sqrt{3}$ cm, AC = 12 cm, BC = 6 cm. Find measure of ∠A.
(A) 30°
(B) 60°
(C) 90°
(D) 45°
Answer: (A)
Hint:

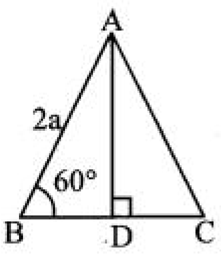
We know that, $6 = \frac{1}{2}(12)$ and $6\sqrt{3} = \frac{\sqrt{3}}{2}(12)$

$\therefore \quad BC = \frac{1}{2}$ AC and $AB = \frac{\sqrt{3}}{2}$ AC

$\therefore \quad \angle A = 30°$ …[Converse of 30° – 60° – 90° theorem]



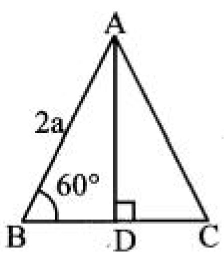
Question 2.
Solve the following examples.
i. Find the height of an equilateral triangle having side 2a.
ii. Do sides 7 cm, 24 cm, 25 cm form a right angled triangle? Give reason.
iii. Find the length of a diagonal of a rectangle having sides 11 cm and 60 cm.
iv. Find the length of the hypotenuse of a right angled triangle if remaining sides are 9 cm and 12 cm.
v. A side of an isosceles right angled triangle is x. Find its hypotenuse.
vi. In ΔPQR, PQ = $\sqrt{8}$, QR = $\sqrt{5}$, PR = $\sqrt{3}$. Is ΔPQR a right angled triangle? If yes, which angle is of 90°?
Solution:
i. Let ΔABC be the given equilateral triangle.



∴ ∠B = 60° [Angle of an equilateral triangle]
Let AD ⊥ BC, B – D – C.
In ΔABD, ∠B = 60°, ∠ADB = 90°
∴ ∠BAD = 30° [Remaining angle of a triangle]
∴ ΔABD is a 30° – 60° – 90° triangle.
∴ AD = $\frac{\sqrt{3}}{2}$ AB [Side opposite to 60°]
= $\frac{\sqrt{3}}{2}$ × 2a
= a$\sqrt{3}$ units
The height of the equilateral triangle is a$\sqrt{3}$ units.

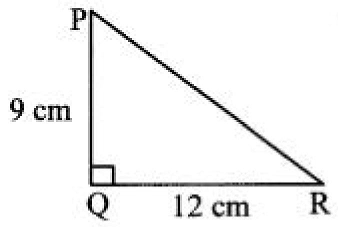
ii. The sides of the triangle are 7 cm, 24 cm and 25 cm.
The longest side of the triangle is 25 cm.
∴ $(25)^2$ = 625
Now, sum of the squares of the remaining sides is,
$(7)^2 + (24)^2 = 49 + 576$
= 625
∴ $(25)^2 = (7)^2 + (24)^2$
∴ Square of the longest side is equal to the sum of the squares of the remaining two sides.
∴ The given sides will form a right angled triangle. [Converse of Pythagoras theorem]

iii. Let □ ABCD be the given rectangle.
AB = 11 cm, BC = 60 cm



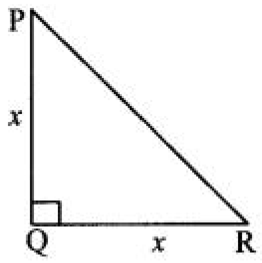
In ΔABC, $\angle B = 90°$ [Angle of a rectangle]
$\therefore AC^2 = AB^2 + BC^2$ [Pythagoras theorem]
$= 11^2 + 60^2$
$= 121 + 3600$
$= 3721$
$\therefore AC = \sqrt{3721}$ [Taking square root of both sides]
$= 61$ cm
The length of the diagonal of the rectangle is 61 cm.
$\therefore$ The length of the diagonal of the rectangle is 61 cm.

iv. Let ΔPQR be the given right angled triangle.
In ΔPQR, $\angle Q = 90°$



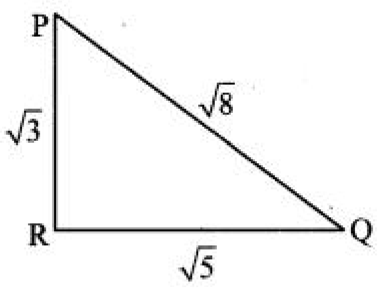
$\therefore PR^2 = PQ^2 + QR^2$ [Pythagoras theorem]
$= 9^2 + 12^2$
$= 81 + 144$
$= 225$
$\therefore PR = \sqrt{225}$ [Taking square root of both sides]
$= 15$ cm
$\therefore$ The length of the hypotenuse of the right angled triangle is 15 cm.

v. Let ΔPQR be the given right angled isosceles triangle.
$PQ = QR = x$.



In ΔPQR, $\angle Q = 90°$ [Pythagoras theorem]
$\therefore PR^2 = PQ^2 + QR^2$
$= x^2 + x^2$
$= 2x^2$
$\therefore PR = \sqrt{2x^2}$ [Taking square root of both sides]
$= x\sqrt{2}$ units
$\therefore$ The hypotenuse of the right angled isosceles triangle is $x\sqrt{2}$ units.
$\therefore$ The hypotenuse of the right angled isosceles triangle is $x\sqrt{2}$ units.

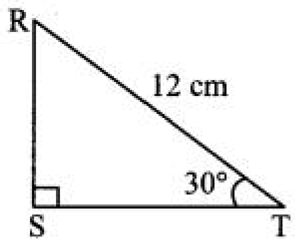
vi. Longest side of $\Delta PQR = PQ = \sqrt{8}$
$\therefore PQ^2 = (\sqrt{8})^2 = 8$
Now, sum of the squares of the remaining sides is,



$QR^2 + PR^2 = (\sqrt{5})^2 + (\sqrt{3})^2$
$= 5 + 3$
$= 8$
$\therefore PQ^2 = QR^2 + PR^2$
$\therefore$ Square of the longest side is equal to the sum of the squares of the remaining two sides.
$\therefore \Delta PQR$ is a right angled triangle. [Converse of Pythagoras theorem]
Now, PQ is the hypotenuse.
$\therefore \angle PRQ = 90°$ [Angle opposite to hypotenuse]
$\therefore \Delta PQR$ is a right angled triangle in which $\angle PRQ$ is of 90°.

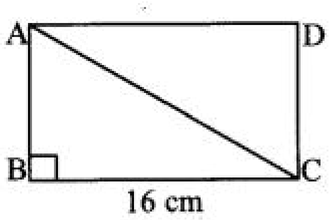
Question 3.
In ΔRST, $\angle S = 90°$, $\angle T = 30°$, $RT = 12$ cm, then find RS and ST.

Solution:
in ΔRST, ∠S = 900, ∠T = 30° [Given]
∴ ∠R = 60° [Remaining angle of a triangle]
∴ ΔRST is a 30° – 60° – 90° triangle.



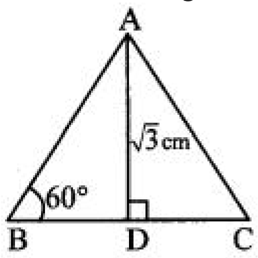
∴ RS = 12 RT [Side opposite to 30°]
= 12 × 12 = 6cm
Also, ST = 3√2 RT [Side opposite to 60°]
= 3√2 × 12 = 6 3–√ cm
∴ RS = 6 cm and ST = 6 3–√ cm

Question 4.
Find the diagonal of a rectangle whose length is 16 cm and area is 192 sq. cm.
Solution:
Let ⌋ ABCD be the given rectangle.
BC = 16cm
Area of rectangle = length × breadth
Area of ⌋ ABCD = BC × AB



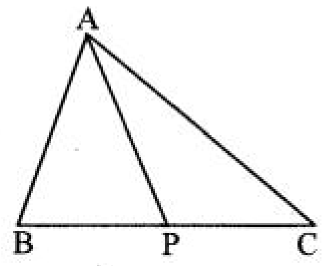
∴ 192 = I6 × AB
∴ AB = 19216
= 12cm
Now, in ΔABC, ∠B = 90° [Angle of a rectangle]
∴ $AC^2 = AB^2 + BC^2$ [Pythagoras theorem]
= 122 + 162
= 144 + 256
=400
∴ AC = 400−−−√ [Taking square root of both sides]
= 20cm
∴ The diagonal of the rectangle is 20 cm.

Question 5.
Find the length of the side and perimeter of an equilateral triangle whose height is 3–√ cm.
Solution:
Let ΔABC be the given equilateral triangle.
∴ ∠B = 60° [Angle of an equilateral triangle]



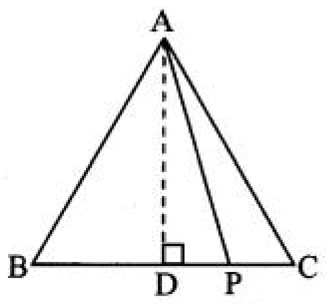
AD ⊥ BC, B – D – C.
In ΔABD, ∠B =60°, ∠ADB = 90°
∴ ∠BAD = 30° [Remaining angle of a triangle]
∴ ΔABD is a 30° – 60° – 90° triangle.
∴ AD = 3√2AB [Side opposite to 600]
∴ 3–√ = 3√2AB
∴ AB = 23√3√
∴ AB = 2cm
∴ Side of equilateral triangle = 2cm
Perimeter of ΔABC = 3 × side
= 3 × AB
= 3 × 2
= 6cm
∴ The length of the side and perimeter of the equilateral triangle are 2 cm and 6 cm respectively.

Question 6.
In ΔABC, seg AP is a median. If BC = 18, $AB^2 + AC^2 = 260$, find AP.
Solution:
PC = $\frac{1}{2}$ BC [P is the midpoint of side BC]
= $\frac{1}{2} \times 18$ = 9cm



in ΔABC, seg AP is the median,
Now, $AB^2 + AC^2 = 2 A^2 + 2 PC^2$ [Apollonius theorem]
∴ $260 = 2 AP^2 + 2 (9)^2$
∴ $130 = AP^2 + 81$ [Dividing both sides by 2]
∴ $AP^2 = 130 – 81$
∴ $AP^2 = 49$
∴ AP = $\sqrt{49}$ [Taking square root of both sides]
∴ AP = 7 units

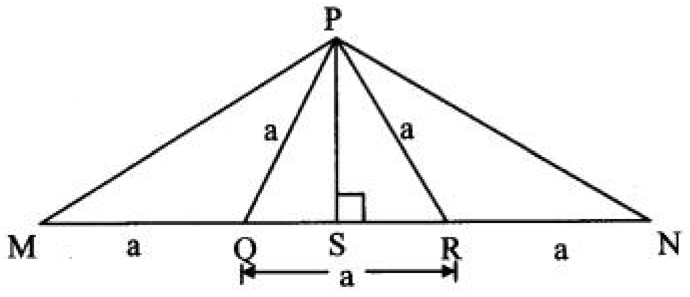
Question 7.
ΔABC is an equilateral triangle. Point P is on base BC such that PC = $\frac{1}{3}$ BC, if AB = 6 cm find AP.



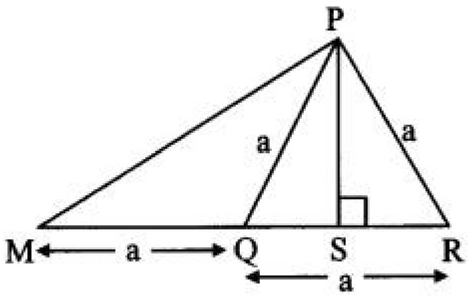
Given: ΔABC is an equilateral triangle.
PC = $\frac{1}{3}$ BC, AB = 6cm.
To find: AP
Consttuction: Draw seg AD ± seg BC, B – D – C.
Solution:
ΔABC is an equilateral triangle.
∴ AB = BC = AC = 6cm [Sides of an equilateral triangle]
pc = $\frac{1}{3}$ BC [Given]
= $\frac{1}{3}$ (6)
∴ PC = 2cm
In ΔADC,
∠D = 90° [Construction]
∠C = 60° [Angle of an equilateral triangle]
∠DAC = 30° [Remaining angle of a triangle]
∴ Δ ADC is a 30° – 60° – 90° triangle.
∴ AD = $\frac{\sqrt{3}}{2}$ AC [Side opposite to 60°]
∴ AD = $\frac{\sqrt{3}}{2}$ (6)
∴ AD = $3\sqrt{3}$cm
CD = $\frac{1}{2}$ AC [Side opposite to 30°]
∴ CD = $\frac{1}{2}$ (6)
∴ CD = 3cm
Now DP + PC = CD [D – P – C]
∴ DP + 2 = 3
∴ DP = 1cm
In ΔADP,
∠ADP = 900
$AP^2 = AD^2 + DP^2$ [Pythagoras theorem]
∴ $AP^2 = (3\sqrt{3})^2 + (1)^2$
∴ $AP^2 = 9 \times 3 + 1 = 27 + 1$
∴ $AP^2 = 28$
∴ AP = $\sqrt{28}$
∴ AP = $\sqrt{4 \times 7}$
∴ AP = $2\sqrt{7}$cm

Question 8.
From the information given in the adjoining figure, prove that

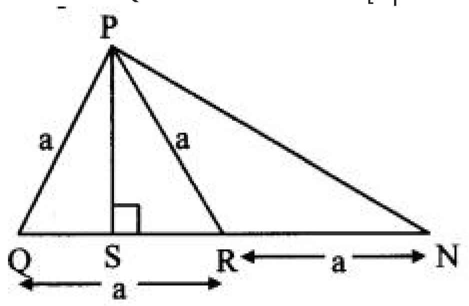
PM = PN = $\sqrt{3}$ × a



Solution:
Proof:
In ∆PMR,
QM = QR = a [Given]
∴ Q is the midpoint of side MR.
∴ seg PQ is the median.
∴ $PM^2 + PR^2 = 2PQ^2 + 2QM^2$ [Apollonius theorem]

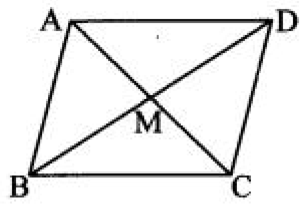


∴ $PM^2 + a^2 = 2a^2 + 2a^2$
∴ $PM^2 + a^2 = 4a^2$
∴ $PM^2 = 3a^2$
∴ PM,= $\sqrt{3}$a (i) [Taking square root of both sides]
Simlarly, in ∆PNQ,
R is the midpoint of side QN.
∴ seg PR is the median.
∴ $PN^2 + PQ^2 = 2\ PR^2 + 2\ RN^2$ [Apollonius theorem]



∴ $PN^2 + a^2 = 2a^2 + 2a^2$
∴ $PN^2 + a^2 = 4a^2$
∴ $PN^2 = 3a^2$
∴ PN = $\sqrt{3}$a (ii) [Taking square root of both sides]
∴ PM = PN = $\sqrt{3}$ a [From (i) and (ii)]

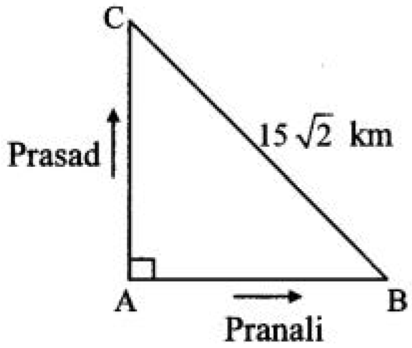
Question 9.
Prove that the sum of the squares of the diagonals of a parallelogram ¡s equal to the sum of the squares of its sides.



Given: ▱ ABCD is a parallelogram, diagonals AC and BD intersect at point M.
To prove: $AC^2 + BD^2 = AB^2 + BC^2 + CD^2 + AD^2$
Solution:
Proof:
▱ ABCD is a parallelogram.
∴ AB = CD and BC = AD (i) [Opposite sides of a parallelogram]
AM = $\frac{1}{2}$ AC and BM = $\frac{1}{2}$ BD (ii) [Diagonals of a parallelogram bisect each other]
∴ M is the midpoint of diagonals AC and BD. (iii)
In ∆ABC.
seg BM is the median. [From (iii)]
$AB^2 + BC^2 = 2AM^2 + 2BM^2$ (iv) [Apollonius theorem]
∴ $AB^2 + BC^2 = 2(\frac{1}{2}AC)^2 + 2(\frac{1}{2}BD)^2$ [From (ii) and (iv)]
∴ $AB^2 + BC^2 = 2 \times \frac{BD^2}{4} + 2 \times \frac{AC^2}{4}$
∴ $AB^2 + BC^2 = \frac{BD^2}{2} + \frac{AC^2}{2}$
∴ $2AB^2 + 2BC^2 = BD^2 + AC^2$ [Multiplying both sides by 2]
∴ $AB^2 + AB^2 + BC^2 + BC^2 = BD^2 + AC^2$

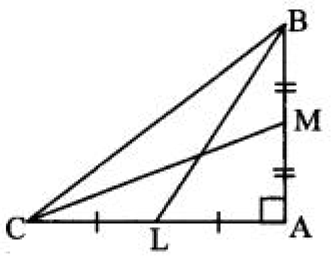
∴ $AB^2 + CD^2 + BC^2 + AD^2 = BD^2 + AC^2$ [From(i)]
i.e. $AC^2 + BD^2 = AB^2 + BC^2 + CD^2 + AD^2$

Question 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 $15\sqrt{2}$ km. Find their speed per hour.
Solution:
Suppose Pranali and Prasad started walking from point A, and reached points B and C respectively after 2 hours.
Distance between them = BC = $15\sqrt{2}$ km



Since, their speed is same, both travel the same distance in the given time.
∴ AB = AC
Let AB = AC = x km (i)
Now, in Δ ABC, ∠A = 90°
∴ $BC^2 = AB^2 + AC^2$ [Pythagoras theorem]
∴ $(15\sqrt{2})^2 = x^2 + x^2$ [From (i)]
∴ $225 \times 2 = 2x^2$
∴ $x^2 = 225$
∴ $x = \sqrt{225}$ [Taking square root of both sides]
∴ x = 15 km
∴ AB = AC = 15km
Now, speed $= \frac{\text{distance}}{\text{time}} = \frac{15}{2}$
= 7.5 km/hr
∴ The speed of Pranali and Prasad is 7.5 km/hour.

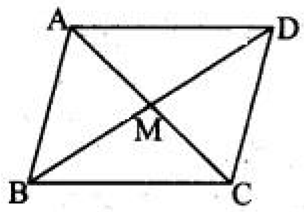
Question 11.
In ΔABC, ∠BAC = 90°, seg BL and seg CM are medians of ΔABC. Then prove that $4(BL^2 + CM^2) = 5BC^2$.



Given : ∠BAC = 90°
seg BL and seg CM are the medians.
To prove: $4(BL^2 + CM^2) = 5BC^2$
Solution:
Proof:
In ΔBAL, ∠BAL 90° [Given]
∴ $BL^2 = AB^2 + AL^2$ (i) [Pythagoras theorem]
In ΔCAM, ∠CAM = 90° [Given]
∴ $CM^2 = AC^2 + AM^2$ (ii) [Pythagoras theorem]
∴ $BL^2 + CM^2 = AB^2 + AC^2 + AL^2 + AM^2$ (iii) [Adding (i) and (ii)]
Now, $AL = \frac{1}{2}AC$ and $AM = \frac{1}{2}AB$ (iv) [seg BL and seg CM are the medians]
∴ $BL^2 + CM^2$
$= AB^2 + AC^2 + (\frac{1}{2}AC)^2 + (\frac{1}{2}AB)^2$ [From (iii) and (iv)]
$= AB^2 + AC^2 + \frac{AC^2}{4} + \frac{AB^2}{4}$
$= AB^2 + \frac{AB^2}{4} + AC^2 + \frac{AC^2}{4}$
$= \frac{5AB^2}{4} + \frac{5AC^2}{4}$
∴ $BL^2 + CM^2 = \frac{5}{4}(AB^2 + AC^2)$
∴ $4(BL^2 + CM^2) = 5(AB^2 + AC^2)$ (v)
In ΔBAC, ∠BAC = 90° [Given]
∴ $BC^2 = AB^2 + AC^2$ (vi) [Pythagoras theorem]
∴ $4(BL^2 + CM^2) = 5BC^2$ [From (v) and (vi)]

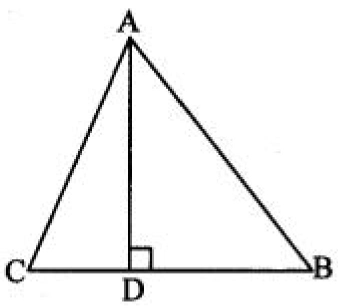
Question 12.
Sum of the squares of adjacent sides of a parallelogram is 130 cm and length of one of its diagonals is 14 cm. Find the length of the other diagonal.
Solution:

Let ⌋ ABCD be the given
parallelogram and its diagonals AC and BD intersect at point M.



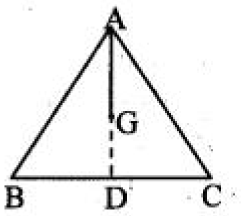
$\therefore AB^2 + AD^2 = 130$cm, BD = 14cm
MD = $\frac{1}{2}$ BD (i) [Diagonals of a parallelogram bisect each other]
= $\frac{1}{2} \times 14 = 7$ cm
In ΔABD, seg AM is the median. [From (i)]
$\therefore AB^2 + = 2AM^2 + 2MD^2$ [Apollonius theorem]
$\therefore 130 = 2\ AM^2 + 2(7)^2$
$\therefore 65 = AM^2 + 49$ [Dividing both sides by 2]
$\therefore AM^2 = 65 - 49$
$\therefore AM^2 = 16$ [Taking square root of both sides]
$\therefore AM = \sqrt{16}$
= 4cm
Now, AC =2 AM [Diagonals of a parallelogram bisect each other]
$2 \times 4 = 8$ cm
∴ The length of the other diagonal of the parallelogram is 8 cm.

Question 13.
In ΔABC, seg AD ⊥ seg BC and DB = 3 CD. Prove that: $2\ AB^2 = 2\ AC^2 + BC^2$.
Given: seg AD ⊥ seg BC
DB = 3CD
To prove: $2AB^2 = 2AC^2 + BC^2$



Solution:
DB = 3CD (i) [Given]
In ΔADB, ∠ADB = 90° [Given]
$\therefore AB^2 = AD^2 + DB^2$ [Pythagoras theorem]
$\therefore AB^2 = AD^2 + (3CD)^2$ [From (i)]
$\therefore AB^2 = AD^2 + 9CD^2$ (ii)
In ΔADC, ∠ADC = 90° [Given]
$\therefore AC^2 = AD^2 + CD^2$ [Pythagoras theorem]
$\therefore AD^2 = AC^2 - CD^2$ (iii)
$AB^2 = AC^2 - CD^2 + 9CD^2$ [From (ii) and(iii)]
$\therefore AB^2 = AC^2 + 8CD^2$ (iv)
CD + DB = BC [C – D – B]
∴ CD + 3CD = BC [From (i)]
∴ 4CD = BC
$\therefore CD = \frac{BC}{4}$ (v)
$AB^2 = AC^2 + 8\left(\frac{BC}{4}\right)^2$ [From (iv) and (v)]
$\therefore AB^2 = AC^2 + 8 \times \frac{BC^2}{16}$
$\therefore AB^2 = AC^2 + \frac{BC^2}{2}$
$\therefore 2AB^2 = 2AC^2 + BC^2$ [Multiplying both sides by 2]

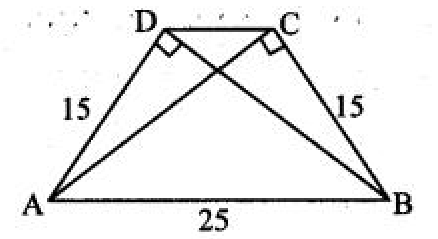
Question 14.
In an isosceles triangle, length of the congruent sides is 13 em and its.base is 10 cm. Find the distance between the vertex opposite to the base and the centroid.
Given: ΔABC is an isosceles triangle.
G is the centroid.
AB = AC = 13 cm, BC = 10 cm.
To find: AG
Construction: Extend AG to intersect side BC at D, B – D – C.



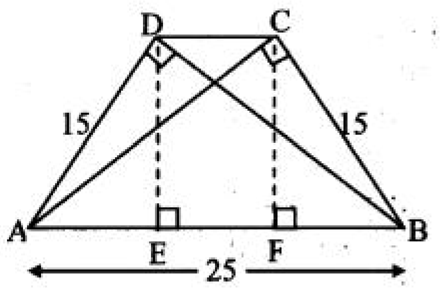
Solution:
Centroid G of ΔABC lies on AD

∴ seg AD is the median. (i)
∴ D is the midpoint of side BC.
∴ DC = 12 BC
= 12 × 10 = 5
In ΔABC, seg AD is the median. [From (i)]
∴ $AB^2 + AC^2 = 2\ AD^2 + 2\ DC^2$ [Apollonius theorem]
∴ $13^2 + 13^2 = 2\ AD^2 + 2\ (5)^2$
∴ $2 \times 13^2 = 2\ AD^2 + 2 \times 25$
∴ $169 = AD^2 + 25$ [Dividing both sides by 2]
∴ $AD^2 = 169 – 25$
∴ $AD^2 = 144$
∴ AD = 144−−−√ [Taking square root of both sides]
= 12 cm
We know that, the centroid divides the median in the ratio 2 : 1.
∴ AGGD = 21
∴ GDAG = 12 [By invertendo]
∴ GD+AGAG = 1+22 [By componendo]
∴ ADAG = 32 [A – G – D]
∴ 12AG = 32
∴ AG = 12×23
= 8cm
∴ The distance between the vertex opposite to the base and the centroid is 8 cm.

Question 15.
In a trapezium ABCD, seg AB || seg DC, seg BD ⊥ seg AD, seg AC ⊥ seg BC. If AD = 15, BC = 15 and AB = 25, find A (□ ABCD).



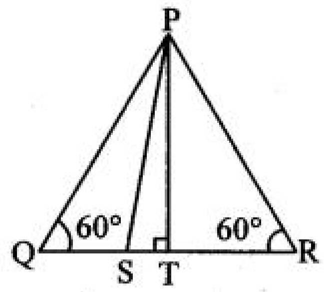
Construction: Draw seg DE ⊥ seg AB, A – E – B
and seg CF ⊥ seg AB, A – F- B.
Solution:
In Δ ACB, ∠ACB = 90° [Given]
∴ AB2 = AC2 + BC2 [Pythagoras theorem]
∴ 252 = AC2 + 152
∴ AC2 = 625 – 225
= 400



∴ AC = 400−−−√ [Taking square root of both sides]
= 20 units
Now, A(ΔABC) = 12 × BC × AC
Also, A(ΔABC) = 12 × AB × CF
∴ 12 × BC × AC = 12 × AB × CF
∴ BC × AC = AB × CF
∴ 15 × 20 = 25 × CF
∴ CF = 15×2025 = 12 units
In ΔCFB, ∠CFB 90° [Construction]
∴ $BC^2 = CF^2 + FB^2$ [Pythagoras theorem]
∴ $15^2 = 12^2 + FB^2$
∴ $FB^2 = 225 – 144$
∴ $FB^2 = 81$
∴ FB = 81−−√ [Taking square root of both sides]
= 9 units
Similarly, we can show that, AE = 9 units
Now, AB = AE + EF + FB [A – E – F, E – F – B]
∴ 25 = 9 + EF + 9
∴ EF = 25 – 18 = 7 units
In □ CDEF,
seg EF || seg DC [Given, A – E – F, E – F – B]
seg ED || seg FC [Perpendiculars to same line are parallel]
∴ □ CDEF is a parallelogram.

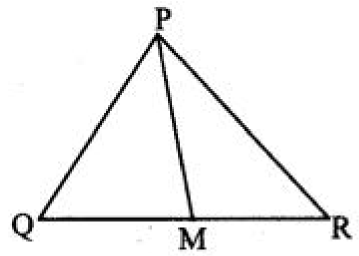
∴ DC = EF 7 units [Opposite sides of a parallelogram]
A(J ABCD) = 12 × CF × (AB + CD)
= 12 × 12 × (25 + 7)
= 12 × 12 × 32
∴ A(J ABCD) = 192 sq. units

Question 16.
In the adjoining figure, ΔPQR is an equilateral triangle. Point S is on seg QR such that QS = 13 QR. Prove that: 9 PS^2 = 7 PQ^2.



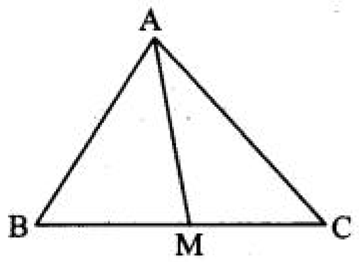
Given: ΔPQR is an equilateral triangle.
QS = 13 QR
To prove: 9PS^2 = 7PQ^2
Solution:
Proof:
ΔPQR is an equilateral triangle [Given]
∴ ∠P = ∠Q = ∠R = 60° (i) [Angles of an equilateral triangle]
PQ = QR = PR (ii) [Sides of an equilateral triangle]
In ΔPTS, ∠PTS = 90° [Given]
PS^2 = PT^2 + ST^2 (iii) [Pythagoras theorem]
In ΔPTQ,
∠PTQ = 90° [Given]
∠PQT = 60° [From (i)]
∴ ∠QPT = 30° [Remaining angle of a triangle]
∴ ΔPTQ is a 30° – 60° – 90° triangle
∴ PT = 3√2 PQ (iv) [Side opposite to 60°]
QT = 12 PQ (v) [Side opposite to 30°]
QS + ST = QT [Q – S – T]
∴ 13 QR + ST = 12 PQ [Given and from (v)]
∴ 13 PQ + ST = 12 PQ [From (ii)]
∴ ST = PQ2 – PQ3
∴ ST = 3PQ–2PQ6
∴ ST = PQ6 (vi)
PS2=(3√2PQ)2+(PQ6)2 [From (iii), (iv) and (vi)]
∴ PS2=3PQ24+PQ236
∴ PS2=27PQ236+PQ236
∴PS2=28PQ236
∴PS^2 = 73 PQ^2
∴ 9PS^2 = 7 PQ^2

Question 17.
Seg PM is a median of APQR. If PQ = 40, PR = 42 and PM = 29, find QR.
Solution:
In ΔPQR, seg PM is the median. [Given]
∴ M is the midpoint of side QR.
∴ PQ^2 + PR^2 = 2 PM^2 + 2 MR^2 [Apollonius theorem]



∴ 40^2 + 42^2 = 2 $(29)^2$ + 2 MR^2
∴ 1600 + 1764 = 2 (841) + 2 MR^2
∴ 3364 = 2 (841) + 2 MR^2
∴ 1682 = 841 +MR^2 [Dividing both sides by 2]
∴ MR^2 = 1682 – 841
∴ MR^2 = 841
∴ MR = 841−−−√ [Taking square root of both sides]
= 29 units
Now, QR = 2 MR [M is the midpoint of QR]
= 2 × 29
∴ QR = 58 units

Question 18.
Seg AM is a median of ΔABC. If AB = 22, AC = 34, BC = 24, find AM.
Solution:
In ΔABC, seg AM is the median. [Given]
∴ M is the midpoint of side BC.



∴ MC = $\frac{1}{2}$ BC
= $\frac{1}{2}$ × 24 = 12 units
Now, $AB^2 + AC^2 = 2\,AM^2 + 2\,MC^2$ [Apollonius theorem]
∴ $22^2 + 34^2 = 2\,AM^2 + 2\,(12)^2$
∴ $484 + 1156 = 2\,AM^2 + 2\,(144)$
∴ $1640 = 2\,AM^2 + 2\,(144)$
∴ $820 = AM^2 + 144$ [Dividing both sides by 2]
∴ $AM^2 = 820 - 144$
∴ $AM^2 = 676$
∴ AM = $\sqrt{676}$ [Taking square root of both sides]
∴ AM = 26 units