
DAY 61
MCA CET 2025
MATHS
SOLUTIONS OF
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WHAT IS SOLUTION OF TRIANGLES?

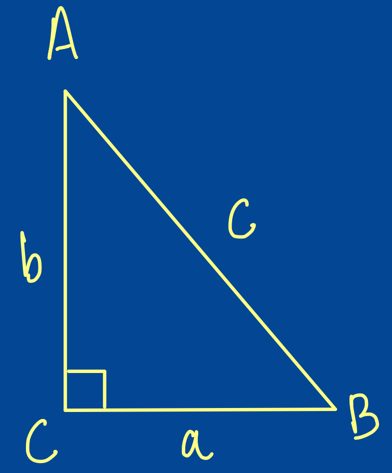
$$\boxed{\begin{array}{l}3 \text{ sides} \\ 3 \text{ angles}\end{array}}$$

If any of 3 element is given

⇓

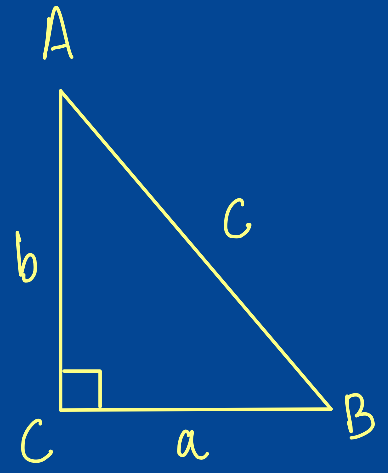
Find the other elements

SOLUTION FOR A RIGHT ANGLED TRIANGLE ($\angle C = 90^\circ$)



TWO SIDES GIVEN	REQUIRED
a, b	$\tan A = \frac{a}{b}$, $B = 90 - A$, $c = \frac{a}{\sin A}$
c, a	$\sin A = \frac{a}{c}$, $b = c\cos A$, $B = 90 - A$

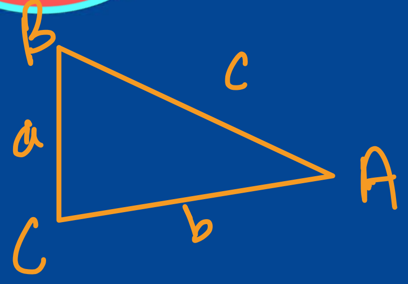
SOLUTION FOR A RIGHT ANGLED TRIANGLE ($\angle C = 90°$)



ONE SIDE & ONE ANGLE GIVEN	REQUIRED
a, A	$B = 90 - A$, $b = a\cot A$, $c = \dfrac{a}{\sin A}$
c, A	$B = 90 - A$, $a = c\sin A$, $b = c \cdot \cos A$

SOLUTION FOR A GENERAL TRIANGLE

WHEN THREE SIDES a, b, c are given.



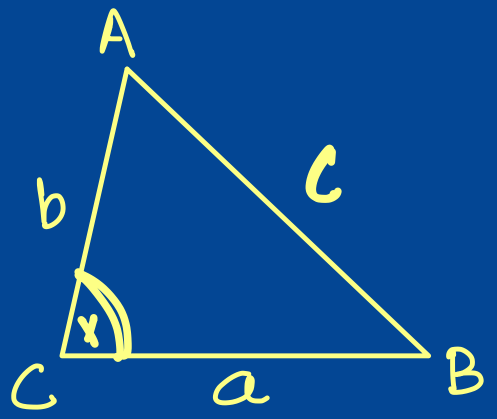
$$\therefore \quad 2s = a+b+c$$

$$\Delta = \sqrt{s(s-a)(s-b)(s-c)}$$

$$\sin A = \frac{2\Delta}{bc} \qquad \sin B = \frac{2\Delta}{ac} \qquad \sin C = \frac{2\Delta}{ab}$$

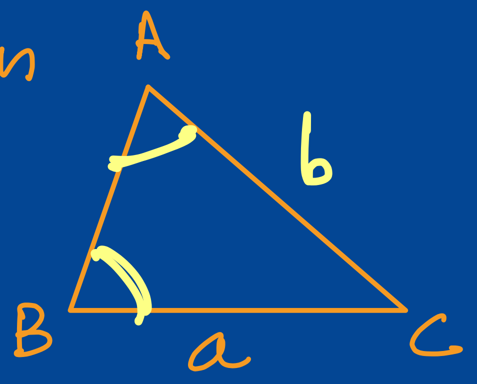
$$\tan \frac{A}{2} = \frac{\Delta}{s(s-a)} \qquad \tan \frac{B}{2} = \frac{\Delta}{s(s-b)} \qquad \tan \frac{C}{2} = \frac{\Delta}{s(s-c)}$$

WHEN TWO SIDES a, b AND INCLUDED ANGLE $\angle C$ IS GIVEN



$\Delta = \frac{1}{2}ab\sin C$	$\tan\frac{A-B}{2} = \frac{a-b}{a+b}\cot\frac{C}{2}$
$\frac{A+B}{2} = 90 - \frac{C}{2}$	$c = \frac{a\sin C}{\sin A}$

WHEN ONE SIDE a AND TWO ANGLES A and B are given

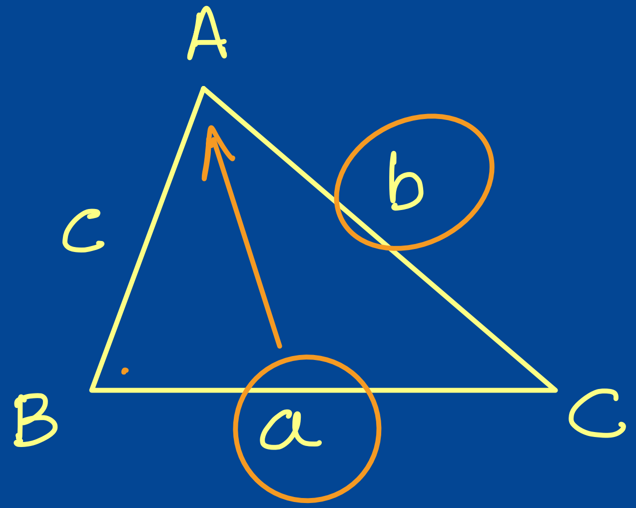


$$C = 180^\circ - A - B$$

$$b = \frac{a \sin B}{\sin A} \qquad c = \frac{a \sin C}{\sin A}$$

$$\Delta = \frac{1}{2} ac \sin B$$

WHEN TWO SIDES a, b
and $\angle A$ OPPOSITE TO ONE SIDE IS GIVEN.



$$\sin B = \frac{b}{a}\sin A$$

$$C = 180^\circ - A - B$$

$$c = \frac{a\sin C}{\sin A}$$

If the sides of a right angled triangle be in AP, then their ratio will be

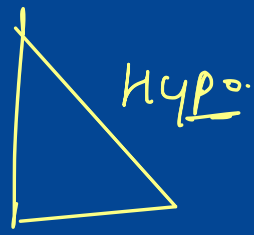
(a) $1^{1} : 2^{4} : 3^{9}$ ⊗

(b) $2^{4} : 3^{9} : 4^{16}$ ⊗ $4 + 9 \neq 16$

(c) $3k : 4k : 5k$ ✓ $9 + 16 = 25$

(d) $4 : 5 : 6$ ⊗ $16 + 25 \neq 36$

TRICK:



$$a-d, \quad a, \quad a+d$$

$$(a+d)^2 = a^2 + (a-d)^2$$

$$\cancel{a^2} + 2ad + \cancel{d^2} = \cancel{a^2} + a^2 - 2ad + \cancel{d^2}$$

$$2ad + 2ad = a^2$$

$$4\cancel{a}d = a^{\cancel{2}}$$

$$d = \frac{a}{4}$$

$$a - \frac{a}{4} = \frac{3a}{4}$$

$$a$$

$$a + \frac{a}{4} = \frac{5a}{4}$$

$$\frac{3a}{4} : a : \frac{5a}{4} = 3\cancel{a} : 4\cancel{a} : 5\cancel{a}$$

$$= 3 : 4 : 5$$

$A : B : C$

If the angles of a triangle are in the ratio 1: 2: 3, then their corresponding sides are in the ratio

$30^\circ \quad 60^\circ \quad 90^\circ$

(a) 1 : 2 : 3 ~~(b)~~ 1: $\sqrt{3}$: 2

(c) $\sqrt{2}$: $\sqrt{3}$: 2 (d) 1: $\sqrt{3}$: 3

$$\sin A : \sin B : \sin C = a : b : c$$

$$\sin 30 : \sin 60 : \sin 90 = \frac{1}{2} : \frac{\sqrt{3}}{2} : 1$$

$$= 1 : \sqrt{3} : 2 = a : b : c$$

If in a ΔABC, $b = \sqrt{3}$, $c = 1$ and $B - C = 90°$, then $\angle A$ is

~~(a)~~ 30° (b) 45° (c) 75° (d) 15°

$$\tan \frac{B-C}{2} = \frac{b-c}{b+c} \cdot \cot \frac{A}{2}$$

tan 45°

$$1 = \frac{\sqrt{3}-1}{\sqrt{3}+1} \cdot \cot \frac{A}{2} \Rightarrow \tan \frac{A}{2} = \frac{\sqrt{3}-1}{\sqrt{3}+1}$$

$$\tan \frac{A}{2} = \frac{\sqrt{3}-1}{\sqrt{3}+1} \times \frac{\sqrt{3}-1}{\sqrt{3}-1} = \frac{3-2\sqrt{3}+1}{3-1} = \frac{4-2\sqrt{3}}{2} = \frac{\cancel{2}(2-\sqrt{3})}{\cancel{2}}$$

$$\tan \frac{A}{2} = 2-\sqrt{3}$$

$\tan 15° = 2-\sqrt{3}$

$\tan 15° = \tan \frac{A}{2}$

$15° = \frac{A}{2}$

$\therefore A = 30°$

In a ΔABC, $\sin A : \sin B : \sin C = 1:2:3$. If $b = \boxed{4}$ cm, the perimeter of the triangle is

(a) 6 cm (b) 24 cm ~~(c)~~ 12 cm (d) 8 cm

$$\sin A : \sin B : \sin C = a : b : c$$

$$1 : 2 : 3 \quad = a : 4 : c$$

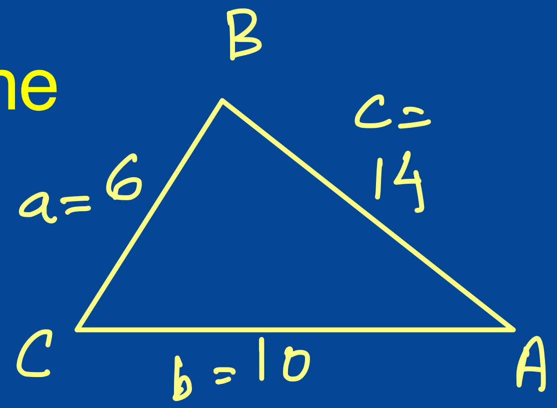
$$\times 2$$

$$2 : 4 : 6 = 12$$

If the sides of triangle be 6, 10 and 14 then the triangle is

(a) obtuse angle (b) acute angle

(c) right angle (d) equilateral



$a < b < c$

$\angle A < \angle B < \angle C$

$$\cos C = \frac{a^2+b^2-c^2}{2ab} = \frac{36+100-196}{120}$$

$$= -\frac{60}{120} = -\frac{1}{2} = \cos C$$

$$\Downarrow$$

$$\cos 120^\circ$$

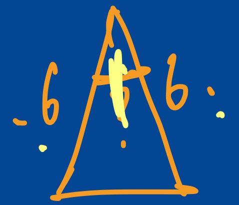
$$\angle C \begin{cases} < 90^\circ & \text{acute} \\ = 90^\circ & \text{R.A.T} \\ > 90^\circ & \text{obtuse} \end{cases}$$

$0 < \text{angle} < 180^\circ$

The area of an isosceles triangle is 9 cm². If the equal sides are 6 cm in length, the angle between them is

(a) 60° (b) 30° (c) 90° (d) 45°

$\Delta = 9 cm^2$



$$\Delta = \frac{1}{2} \cdot 6 \times 6 \times \sin\theta$$

$$9 = 18 \cdot \sin\theta$$

$$\frac{\cancel{9}^{\,1}}{\cancel{18}_{\,2}} = \boxed{\sin\theta = \frac{1}{2}}$$

$\sin 30^\circ$

The perimeter of a ΔABC is 6 times the arithmetic mean of the sines of its angles. If the side $\boxed{a \text{ is } 1}$, then the $\boxed{\angle A}$ is

(a) 30° (b) 60° (c) 90° (d) 180°

$$\boxed{a+b+c} = \frac{\cancel{6}^{2}(\sin A+\sin B+\sin C)}{\cancel{3}_{1}} = 2(\sin A+\sin B+\sin C)$$

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} = K$$

$$\boxed{a+b+c} = K(\sin A+\sin B+\sin C)$$

$$\boxed{a = K\sin A}$$

$$b = K\sin B$$

$$c = K\sin C$$

$$\therefore K = 2$$

$$a = K\sin A$$

$$\frac{1}{2} = \sin A = \sin 30^\circ$$

$$\underline{\underline{30}}$$

If $\cos^2 A + \cos^2 C = \sin^2 B$, then ΔABC is

(a) equilateral triangle ✗ (b) right angled triangle

(c) isosceles triangle (d) None of these

$\cos(90-A) = \sin A$

$\angle B = 90^\circ$

$\angle C = 90^\circ - \angle A$

Not an equi.

LHS $= \frac{1}{4} + \frac{1}{4} = \frac{2}{4} = \frac{1}{2}$

RHS $= \frac{3}{4}$

If right angled Δ,

$\angle B = 90^\circ \Rightarrow \sin^2 B = 1$

$\cos^2 A + \cos^2 C = \cos^2 A + \cos^2(90-A)$

$= \cos^2 A + \sin^2 A = 1$