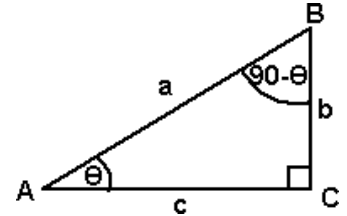


TRIGONOMETRIC RATIOS OF COMPLEMENTARY ANGLES

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Introduction to Complementary Angles



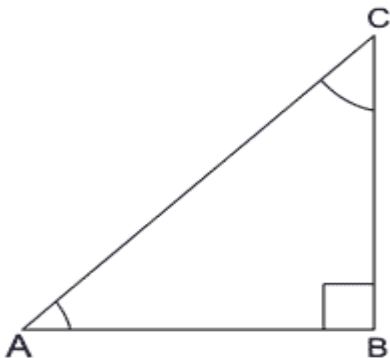
What are [Complementary Angles](#)?

A pair of angles is complementary if the sum of their measures is 90 degrees.

In the adjoining $\triangle ABC$, $\angle A$ and $\angle C$ are pair of complementary angles. Following this we have, $\angle A + \angle C = 90^\circ$.

Also, $\angle C = 90^\circ - \angle A \dots(i)$

We already are aware of [trigonometric ratios](#), now we will define all six trigonometric ratios with respect to $\angle A$ and $\angle C$.



Trigonometric ratios with respect to $\angle A$

$$\begin{aligned} \sin A &= BC / AC \\ \cos A &= AB / AC \\ \tan A &= BC / AB \quad (I) \\ \operatorname{cosec} A &= AC / BC \\ \sec A &= AC / AB \\ \cot A &= AB / BC \end{aligned}$$

Trigonometric ratios with respect to $\angle C$

$$\begin{aligned} \sin C &= AB / AC \\ \cos C &= BC / AC \\ \tan C &= AB / BC \quad (II) \end{aligned}$$

$$\operatorname{Cosec} C = AC / AB$$

$$\operatorname{Sec} C = AC / BC$$

$$\operatorname{Cot} C = BC / AB$$

Substituting $C = 90^\circ - A$ (from (i))

$$\sin (90^\circ - A) = AB / AC$$

$$\cos (90^\circ - A) = BC / AC$$

$$\tan (90^\circ - A) = AB / BC \quad (\text{III})$$

$$\operatorname{Cosec} (90^\circ - A) = AC / AB$$

$$\operatorname{Sec} (90^\circ - A) = AC / BC$$

$$\operatorname{Cot} (90^\circ - A) = BC / AB$$

Now, compare the ratios in (I) and (III)

$$\sin (90^\circ - A) = AB / AC = \cos A$$

$$\cos (90^\circ - A) = BC / AC = \sin A$$

$$\tan (90^\circ - A) = AB / BC = \cot A$$

$$\operatorname{Cosec} (90^\circ - A) = AC / AB = \sec A$$

$$\operatorname{Sec} (90^\circ - A) = AC / BC = \operatorname{cosec} A$$

$$\operatorname{Cot} (90^\circ - A) = BC / AB = \tan A$$

So,

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

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

$$\tan (90^\circ - A) = \cot A$$

$$\operatorname{Cosec} (90^\circ - A) = \sec A$$

$$\operatorname{Sec} (90^\circ - A) = \operatorname{cosec} A$$

$$\operatorname{Cot} (90^\circ - A) = \tan A$$

For all values of angle A lying between 0° and 90° .

Now, we will check whether this holds for $A = 0^\circ$ or $A = 90^\circ$

$$\tan 0^\circ = 0 = \cot 90^\circ$$

$$\sec 0^\circ = 1 = \operatorname{cosec} 90^\circ$$

$\sec 90^\circ$, $\operatorname{cosec} 90^\circ$, $\tan 90^\circ$ and $\cot 90^\circ$ are not defined.

On the basis of above discussion, we will solve the following problem:

Evaluate: $\tan 65^\circ$

$$\cot 25^\circ$$

We know: $\cot A = \tan (90^\circ - A)$

$$\cot 25^\circ = \tan (90^\circ - 25^\circ) = \tan 65^\circ$$

That is, $\tan 65^\circ = \tan 65^\circ = 1$

$$\cot 65^\circ = \tan 65^\circ$$

Now try it yourself! Should you still need any help, [click here](#) to schedule live online session with e Tutor!

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Reference Links:

- http://en.wikipedia.org/wiki/Complementary_angles
- <http://www.purplemath.com/modules/basirati.htm>

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