

Trigonometric Ratios Guide Notes

Trigonometric Ratios are ratios of the measure of two sides of a right triangle.
Common trigonometric ratios are: *sine*(*sin*), *cosine*(*cos*), *tangent*(*tan*), *cosecant*(*csc*), *secant*(*sec*) and *cotangent*(*cot*).

$$\sin \angle A = \frac{\text{measure of leg opposite to } \angle A}{\text{measure of hypotenuse}} = \frac{\overline{BC}}{\overline{AB}}$$

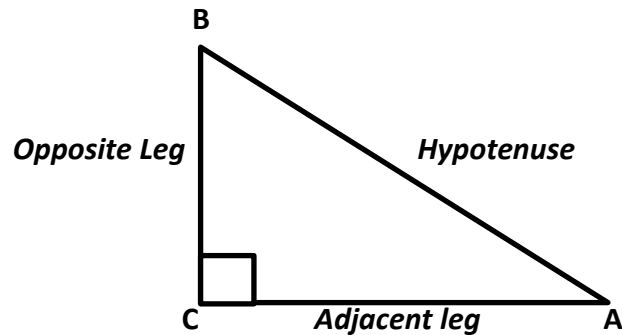
$$\cos \angle A = \frac{\text{measure of leg adjacent to } \angle A}{\text{measure of hypotenuse}} = \frac{\overline{CA}}{\overline{AB}}$$

$$\tan \angle A = \frac{\text{measure of leg opposite to } \angle A}{\text{measure of leg adjacent to } \angle A} = \frac{\overline{BC}}{\overline{CA}}$$

$$\csc \angle A = \frac{1}{\sin \angle A} = \frac{\text{measure of hypotenuse}}{\text{measure of leg opposite to } \angle A} = \frac{\overline{AB}}{\overline{BC}}$$

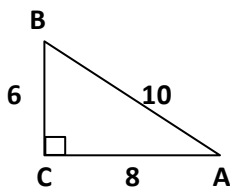
$$\sec \angle A = \frac{1}{\cos \angle A} = \frac{\text{measure of hypotenuse}}{\text{measure of leg adjacent to } \angle A} = \frac{\overline{AB}}{\overline{CA}}$$

$$\cot \angle A = \frac{1}{\tan \angle A} = \frac{\text{measure of leg adjacent to } \angle A}{\text{measure of leg opposite to } \angle A} = \frac{\overline{CA}}{\overline{BC}}$$



Sample Problem 1: Find *sin*, *cos*, *tan*, *csc*, *sec* and *cot* of each acute angle of the right triangle *ABC*.

a.



$$\sin \angle A = \frac{\overline{BC}}{\overline{AB}} = \frac{6}{10} = 0,6$$

$$\sin \angle B = \frac{\overline{CA}}{\overline{AB}} = \frac{8}{10} = 0,8$$

$$\cos \angle A = \frac{\overline{CA}}{\overline{AB}} = \frac{8}{10} = 0,8$$

$$\cos \angle B = \frac{\overline{BC}}{\overline{AB}} = \frac{6}{10} = 0,6$$

$$\tan \angle A = \frac{\overline{BC}}{\overline{CA}} = \frac{6}{8} = 0,75$$

$$\tan \angle B = \frac{\overline{CA}}{\overline{BC}} = \frac{8}{6} = 1,33$$

$$\csc \angle A = \frac{1}{\sin \angle A} = \frac{1}{0,6} = 1,66$$

$$\csc \angle B = \frac{1}{\sin \angle B} = \frac{1}{0,8} = 1,25$$

$$\sec \angle A = \frac{1}{\cos \angle A} = \frac{1}{0,8} = 1,25$$

$$\sec \angle B = \frac{1}{\cos \angle B} = \frac{1}{0,6} = 1,66$$

$$\cot \angle A = \frac{1}{\tan \angle A} = \frac{1}{0,75} = 1,33$$

$$\cot \angle B = \frac{1}{\tan \angle B} = \frac{1}{1,33} = 0,75$$

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Sample Problem 2: Use your calculator to calculate the following (correct to 2 decimal places).

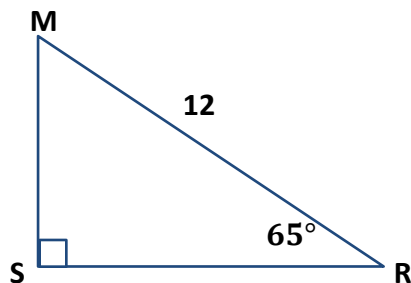
- | | | |
|----|-------------------|------------------------|
| a. | $\sin 45^\circ =$ | $\sin 45^\circ = 0,71$ |
| b. | $\cos 60^\circ =$ | $\cos 60^\circ = 0,50$ |
| c. | $\tan 30^\circ =$ | $\tan 30^\circ = 0,57$ |
| d. | $\sin 75^\circ =$ | $\sin 75^\circ = 0,96$ |

Sample Problem 3: Use your calculator to calculate the following.

- | | | |
|----|-------------------------|-----------------------|
| a. | $\sin \angle B = 0,886$ | $\angle B = 60^\circ$ |
| b. | $\cos \angle A = 0,309$ | $\angle A = 72^\circ$ |
| c. | $\tan \angle B = 1,000$ | $\angle B = 45^\circ$ |
| d. | $\sin \angle A = 0,707$ | $\angle A = 45^\circ$ |

Sample Problem 4: Use trigonometric ratios and Pythagorean Theorem to find the values of missing sides and angles.

a.



$$\begin{array}{ll} \overline{MR} = 12 & \angle R = 65^\circ \\ \overline{MS} = ? & \angle M = ? \\ \overline{SR} = ? & \end{array}$$

$$\sin \angle R = \frac{\overline{MS}}{\overline{MR}}$$

$$\sin 65^\circ = \frac{\overline{MS}}{12}$$

$$\overline{MS} = 12 * \sin 65^\circ$$

$$\overline{MS} = 12 * 0,90$$

$$\overline{MS} = 10,87$$

$$\overline{MR}^2 = \overline{MS}^2 + \overline{SR}^2$$

$$\overline{SR}^2 = \overline{MR}^2 - \overline{MS}^2$$

$$\overline{SR}^2 = 12^2 - 10,87^2$$

$$\overline{SR}^2 = 144 - 118,28$$

$$\overline{SR} = \sqrt{25,71}$$

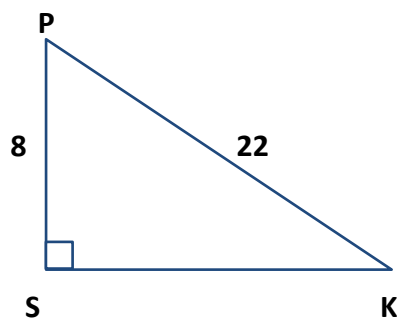
$$\overline{SR} = 5,08$$

$$\angle M = 90^\circ - 65^\circ$$

$$\angle M = 25^\circ$$

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b.



$$\overline{PS} = 8 \quad \angle P = ?$$

$$\overline{PK} = 22 \quad \angle K = ?$$

$$\overline{SK} = ?$$

$$\cos \angle P = \frac{\overline{PS}}{\overline{PK}}$$

$$\cos \angle P = \frac{8}{22}$$

$$\cos \angle P = 0,363$$

$$\angle P = 68,67^\circ$$

$$\angle K = 90^\circ - 68,67^\circ$$

$$\angle K = 21,33^\circ$$

$$\overline{PK}^2 = \overline{PS}^2 + \overline{SK}^2$$

$$\overline{SK}^2 = \overline{PK}^2 - \overline{PS}^2$$

$$\overline{SK}^2 = 22^2 - 8^2$$

$$\overline{SK}^2 = 484 - 64$$

$$\overline{SK} = \sqrt{420}$$

$$\overline{SK} = 20,49$$

If $\angle A$ and $\angle B$ are the acute angles of a right triangle, then $\sin \angle A = \cos \angle B$

Since the measures of these acute angles of a right triangle add to 90° , we know these acute angles are complementary.

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

$$\sin \angle B = \cos(90^\circ - \angle B)$$

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

$$\cos \angle B = \sin(90^\circ - \angle B)$$

Sample Problem 5: Find the value of θ that makes each statement true.

a. $\sin \theta = \cos(\theta + 46^\circ)$

$$\sin \theta = \cos(\theta + 46^\circ)$$

$$\cos(90^\circ - \theta) = \cos(\theta + 46^\circ)$$

$$90^\circ - \theta = \theta + 46^\circ$$

$$2\theta = 44^\circ$$

$$\theta = 22^\circ$$

b. $\cos \theta = \sin(\theta - 30^\circ)$

$$\cos \theta = \sin(\theta - 30^\circ)$$

$$\sin(90^\circ - \theta) = \sin(\theta - 30^\circ)$$

$$90^\circ - \theta = \theta - 30^\circ$$

$$2\theta = 120^\circ$$

$$\theta = 60^\circ$$