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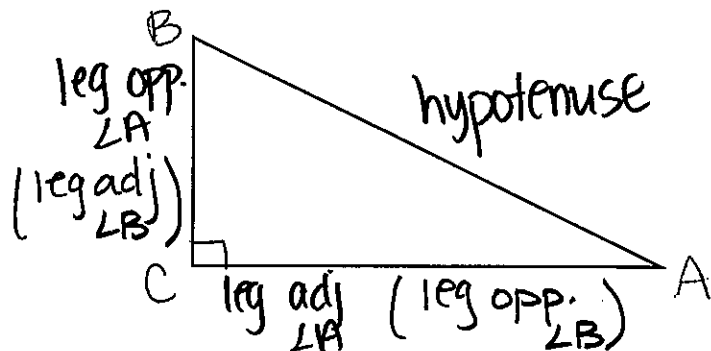
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Period: 2

The Sine and Cosine Ratios

On Objective INBAT use the sine and cosine ratios to find unknown side lengths.

The sine and cosine ratios are trigonometric ratios that acute angles that involve the lengths of a leg and the hypotenuse of a right triangle.



Let $\triangle ABC$ be a right triangle with acute $\angle A$.

"SOH-CAH-TOA"

$\sin = \frac{\text{opp}}{\text{hyp}}$ $\cos = \frac{\text{adj}}{\text{hyp}}$ $\tan = \frac{\text{opp}}{\text{adj}}$

The sine of $\angle A$ (written as $\sin A$) is defined as follows...

$$\sin A = \frac{\text{length of leg opp. } \angle A}{\text{length of hyp}} \rightarrow \sin A = \frac{BC}{BA}$$

$$\sin B = \frac{AC}{AB}$$

The cosine of $\angle A$ (written as $\cos A$) is defined as follows...

$$\cos A = \frac{\text{length of leg adj. } \angle A}{\text{length of hyp}} \rightarrow \cos A = \frac{AC}{AB}$$

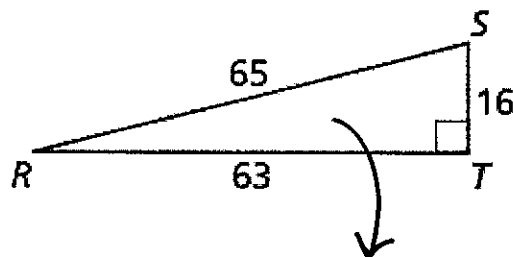
$$\cos B = \frac{BC}{AB}$$

Example:

1. Find $\sin S$, $\sin R$, $\cos S$ and $\cos R$. Write each answer as a fraction and as a decimal rounded to four decimal places.

$$\sin S = \frac{63}{65} \quad \sin R = \frac{16}{65}$$

$$\cos S = \frac{16}{65} \quad \cos R = \frac{63}{65}$$



$\angle R + \angle S = 90^\circ$

The sine of an acute angle is equal to the cosine of its complement.

Similarly, the cosine of an acute angle is equal to the sine of its complement.

Sine and Cosine of Complementary Angles

Let A and B be complementary angles in right $\triangle ABC$.

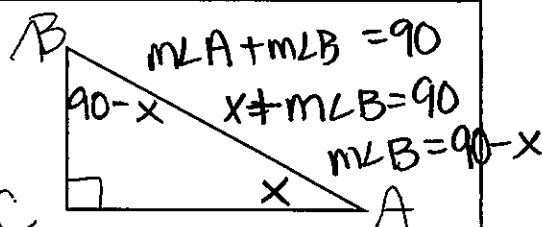
$$\sin A = \cos B$$

and

$$\cos A = \sin B$$

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

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



Examples:

2. Write $\sin(56^\circ)$ in terms of cosine.

$$\sin(56^\circ) = \cos(90 - 56^\circ) = \cos(34^\circ)$$

3. Find the values of x and y using sine and cosine. Give answers in exact form, and also round your answers to the nearest hundredth.

$$\sin(26^\circ) \approx 0.4384$$

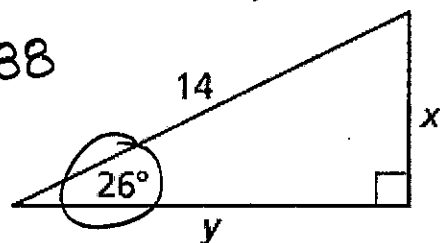
$$0.4384 = \frac{x}{14}$$

$$x \approx 6.14$$

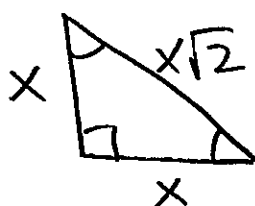
$$\cos(26^\circ) \approx 0.8988$$

$$0.8988 = \frac{y}{14}$$

$$y \approx 12.58$$



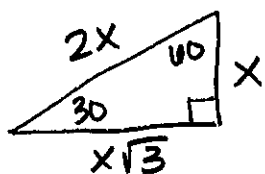
4. Find the sine and cosine of a 45° angle.



$$\sin(45^\circ) = \frac{x}{x\sqrt{2}} = \frac{1}{\sqrt{2}} = \boxed{\frac{\sqrt{2}}{2}}$$

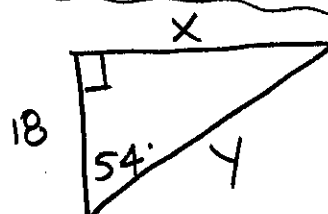
$$\cos(45^\circ) = \frac{x}{x\sqrt{2}} = \boxed{\frac{\sqrt{2}}{2}}$$

5. Find the sine and cosine of a 30° angle.



$$\sin(30^\circ) = \frac{x}{2x} = \boxed{\frac{1}{2}}$$

$$\cos(30^\circ) = \frac{x\sqrt{3}}{2x} = \boxed{\frac{\sqrt{3}}{2}}$$



$$\cos(54^\circ) \approx 0.5878$$

$$0.5878 = \frac{18}{y}$$

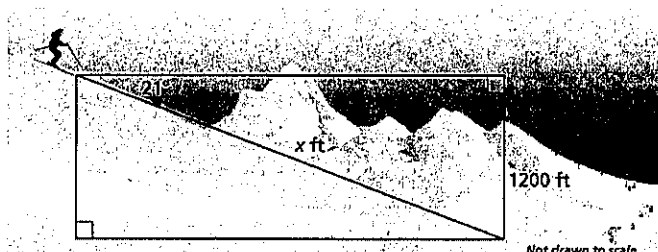
$$y \approx 30.62$$

$$\tan(54^\circ) \approx 1.3764$$

$$1.3764 = \frac{x}{18}$$

$$x \approx 24.77$$

6. You are skiing on a mountain with an altitude of 1200 feet. The angle of depression is 21° . Find the distance x you ski down the mountain to the nearest foot.



$$\sin(21^\circ) \approx 0.3584$$

$$0.3584 = \frac{1200}{x}$$

$$x \approx 3348.51 \text{ ft}$$