Trigonometry Concepts Summary

Concise summaries and targeted practice questions per concept

HSS MA.1.01 - MA.1.11

1. Unit Circle

A circle centered at the origin $(0, 0)$ with a radius of $r = 1$. Its standard equation is $x^2 + y^2 = 1$. For any point (x, y) on the unit circle corresponding to angle θ, $x = \cos(\theta)$ and $y = \sin(\theta)$.

Practice Questions:

1. If point $(3/5, y)$ lies on the unit circle in Quadrant I, find the value of y.
2. Find the coordinates of the point (x, y) on the unit circle corresponding to $\theta = 180°$.

2. Six Trigonometric Functions (without graph)

Consists of the three primary functions: sine $\sin(\theta)$, cosine $\cos(\theta)$, and tangent $\tan(\theta) = \sin/\cos$; along with their reciprocals: cosecant $\csc(\theta) = 1/\sin$, secant $\sec(\theta) = 1/\cos$, and cotangent $\cot(\theta) = 1/\tan$.

Practice Questions:

1. Given $\sin(\theta) = 3/5$ in Quadrant I, calculate the values of $\tan(\theta)$ and $\sec(\theta)$.
2. If $\cos(\theta) = -5/13$ and θ is in Quadrant II, find $\csc(\theta)$.

3. Related & Reference Angles

Used to evaluate trigonometric functions of any angle by relating it to an acute reference angle θ' in Quadrant I. The sign of the function is determined by the quadrant rules (ASTC rule).

Practice Questions:

1. Find the reference angle θ' for $\theta = 210°$.
2. Find the exact value of $\sin(300°)$ using its reference angle.

4. Law of Sines and Law of Cosines

Law of Sines: $a / \sin(A) = b / \sin(B) = c / \sin(C)$ (used for AAS, ASA, or SSA).

Law of Cosines: $a^2 = b^2 + c^2 - 2bc \cdot \cos(A)$ (used for SAS or SSS).

Practice Questions:

1. In triangle ABC, if $A = 30°$, $B = 45°$, and side $a = 10$ cm, calculate side b.
2. A triangle has side lengths of 7 cm, 8 cm, and 9 cm. Find the measure of the largest angle using the Law of Cosines.

5. Angle of Elevation and Angle of Depression

Angle of Elevation: The angle measured upward from the horizontal line of sight to an object above.
Angle of Depression: The angle measured downward from the horizontal line of sight to an object below.

Practice Questions:

1. Standing $20\ \text{m}$ away from the base of a tower, a observer measures the angle of elevation to the top as 60°. Find the height of the tower.
2. From the top of a cliff $50\ \text{m}$ high, the angle of depression to a boat is 30°. How far is the boat from the base of the cliff?

6. Directed Angle

An ordered pair of rays starting from a common vertex (initial side and terminal side). The angle is **positive** if rotated counterclockwise and **negative** if rotated clockwise.

Practice Questions:

1. Determine the quadrant in which the terminal side of a directed angle measuring -120° lies in standard position.
2. In which quadrant does the terminal side of a directed angle measuring 580° land?

7. Positive, Negative, and Co-terminal Angles

Co-terminal angles share the same terminal side in standard position. They are generated by adding or subtracting full rotations: $\theta + k \cdot 360^\circ$ where $k \in \mathbb{Z}$.

Practice Questions:

1. Find two co-terminal angles (one positive and one negative) for 70°.
2. Show whether the angles 1100° and -340° are co-terminal.