COMPLEMENTARY ANGLES

Complete SSC CGL Master Notes

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1. ANGLE PAIR DEFINITIONS

Complementary Angles

Complementary Angles: Two angles whose sum is 90°.
Example: 30° and 60° are complementary because 30° + 60° = 90°

Angle Pair Types:
• **Complementary**: Sum = 90°
• **Supplementary**: Sum = 180°
• **Adjacent**: Share common vertex and side
• **Linear Pair**: Adjacent and supplementary

Supplementary Angles

Supplementary Angles: Two angles whose sum is 180°.
Example: 120° and 60° are supplementary because 120° + 60° = 180°

2. TRIGONOMETRIC RATIOS OF COMPLEMENTARY ANGLES

Fundamental Relationships

For complementary angles (θ and 90°-θ):

```
sin(90° - θ) = cos θ
cos(90° - θ) = sin θ
tan(90° - θ) = cot θ
cot(90° - θ) = tan θ
sec(90° - θ) = cosec θ
cosec(90° - θ) = sec θ
```

Memory Technique

Easy to Remember:
• Sine and Cosine are co-functions
• Tangent and Cotangent are co-functions
• Secant and Cosecant are co-functions
• "Co" means complementary
• For (90° - θ), change trigonometric ratio to its co-function

3. APPLICATIONS & PROBLEMS

Finding Angle Measures

Example 1: If angle A and angle B are complementary and A = 35°, find B.

Solution:

- $A + B = 90°$
- $35° + B = 90°$
- $B = 90° - 35° =$ **55°**

Example 2: Two complementary angles are in ratio 2:3. Find the angles.

Solution:

- Let angles be $2x$ and $3x$
- $2x + 3x = 90°$
- $5x = 90° \Rightarrow x = 18°$
- Angles: $2\times18 =$ **36°** and $3\times18 =$ **54°**

4. TRIGONOMETRIC PROBLEMS

Using Complementary Relationships

Example: Evaluate sin 35°/cos 55°

Solution:

- Note: 55° = 90° - 35°
- cos 55° = cos(90° - 35°) = sin 35°
- Therefore, sin 35°/cos 55° = sin 35°/sin 35° = **1**

Example: If sin 3A = cos(A - 26°) and 3A is acute, find A.

Solution:

- sin 3A = cos(A - 26°)
- sin 3A = sin[90° - (A - 26°)]
- sin 3A = sin(116° - A)
- 3A = 116° - A
- 4A = 116° ⇒ A = **29°**

5. GEOMETRIC APPLICATIONS

Right Triangle Properties

In a right-angled triangle:
• The two acute angles are always complementary
• Their sum is always 90°
• This is because total angles in triangle = 180° and right angle = 90°
• So remaining two angles sum to 90°

Parallel Lines & Transversals

In parallel lines cut by transversal:
• Corresponding angles are equal
• Alternate interior angles are equal
• Co-interior angles are supplementary
• Vertically opposite angles are equal

6. QUADRILATERAL ANGLE PROPERTIES

Cyclic Quadrilateral

In cyclic quadrilateral:
• Sum of opposite angles = 180°
• $\angle A + \angle C = 180°$
• $\angle B + \angle D = 180°$

Other Quadrilaterals

Angle Properties:
• Parallelogram: Opposite angles equal, adjacent angles supplementary
• Rectangle: All angles 90°
• Square: All angles 90°
• Rhombus: Opposite angles equal, adjacent angles supplementary
• Trapezium: Angles on same side of leg are supplementary

7. POLYGON ANGLE PROPERTIES

Regular Polygons

For regular polygon of n sides:

```
• Each interior angle = [(n-2)×180°]/n
• Each exterior angle = 360°/n
• Sum of interior angles = (n-2)×180°
• Sum of exterior angles = 360°
```

Interior-Exterior Relationship

For any polygon:

```
Interior angle + Exterior angle = 180°
They form a linear pair at each vertex
```

8. SSC CGL PRACTICE PROBLEMS

Problem Set with Solutions

Problem 1: If tan 2A = cot(A - 18°), find A.

Solution:

- tan 2A = cot(A - 18°)
- tan 2A = tan[90° - (A - 18°)]
- tan 2A = tan(108° - A)
- 2A = 108° - A
- 3A = 108° ⇒ A = **36°**

Problem 2: Evaluate: sin 25° cos 65° + cos 25° sin 65°

Solution:

- cos 65° = cos(90° - 25°) = sin 25°
- sin 65° = sin(90° - 25°) = cos 25°
- Expression becomes: sin 25° × sin 25° + cos 25° × cos 25°
- = $\sin^2 25° + \cos^2 25°$ = **1**

Problem 3: Two complementary angles differ by 20°. Find the angles.

Solution:

- Let angles be x and x + 20
- x + (x + 20) = 90°
- 2x + 20 = 90°
- 2x = 70° ⇒ x = 35°
- Angles: **35°** and **55°**

9. IMPORTANT FORMULAS & IDENTITIES

Trigonometric Identities

Identity	Formula
Pythagorean Identity	$\sin^2\theta + \cos^2\theta = 1$
Tangent Identity	$\tan \theta = \sin \theta / \cos \theta$
Cotangent Identity	$\cot \theta = \cos \theta / \sin \theta$
Secant Identity	$\sec \theta = 1 / \cos \theta$
Cosecant Identity	$\text{cosec}\ \theta = 1 / \sin \theta$

Angle Sum Formulas

```
sin(A + B) = sin A cos B + cos A sin B
cos(A + B) = cos A cos B - sin A sin B
tan(A + B) = (tan A + tan B) / (1 - tan A tan B)
```

10. EXAM TIPS & STRATEGIES

Problem Solving Approach

Key Strategies:
• Always check if angles are complementary (sum to 90°)
• Use trigonometric identities to simplify expressions
• Remember that complementary angles have special relationships
• For geometry problems, look for right triangles
• Practice mental calculation for common angle pairs

Common Mistakes to Avoid

Avoid These Errors:
• Confusing complementary (90°) with supplementary (180°)
• Forgetting to convert between degrees and radians
• Misapplying trigonometric identities
• Not checking if angles are acute when using complementary relationships
• Overlooking the fact that only acute angles can be complementary