ANGLES, HISTOGRAMS & PYRAMIDS

Complete SSC CGL Geometry & Statistics Notes

Comprehensive Guide with Formulas & Examples • Created by GovtExamPrep

1. ANGLES SUBTENDED BY CHORDS OF A CIRCLE

Basic Circle Terminology

Chord: A line segment whose endpoints lie on the circle.
Arc: A portion of the circumference of a circle.
Central Angle: Angle subtended at the center by an arc.
Inscribed Angle: Angle subtended at the circumference by an arc.

[Diagram: Circle showing chord, arc, central angle, and inscribed angle]

Element	Definition	Symbol/Notation
Chord	Line joining two points on circle	AB, CD, etc.
Arc	Part of circumference	Arc AB, Minor arc, Major arc
Central Angle	Angle at center subtended by arc	∠AOB
Inscribed Angle	Angle on circumference subtended by arc	∠ACB

Important Theorems

Theorem 1: The angle subtended by an arc at the center is double the angle subtended by it at any point on the remaining part of the circle.
Formula: Central Angle = 2 × Inscribed Angle

Theorem 2: Angles in the same segment of a circle are equal.

Theorem 3: The angle in a semicircle is a right angle (90°).

Example: In a circle, chord AB subtends 60° at center O. Find angle subtended by the same chord at point C on the circumference.

Solution:

- Central angle ∠AOB = 60°
- Using theorem: Central Angle = 2 × Inscribed Angle
- 60° = 2 × ∠ACB
- ∠ACB = 60°/2 = **30°**

2. HISTOGRAMS - DATA REPRESENTATION

Understanding Histograms

Histogram: A graphical representation of data using rectangles of different heights, where the area of each rectangle represents the frequency of data in that class interval.

Key Features of Histogram:
• Used for continuous data
• No gaps between bars (unlike bar graph)
• Area of bar ∝ Frequency
• Class intervals on x-axis, frequency on y-axis

Graph Type	Data Type	Spacing between bars	What height represents
Histogram	Continuous	No gaps	Frequency density
Bar Graph	Discrete	Equal gaps	Frequency

Histogram Construction

Sample Data:
Class Interval: 0-10, 10-20, 20-30, 30-40, 40-50
Frequency: 5, 8, 12, 7, 3

Frequency Density Formula:
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Frequency Density = Frequency / Class Width
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For equal class intervals:
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Height of bar ∝ Frequency
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Example: Draw histogram for data with unequal class intervals

Given Data:

- 0-10: Frequency 5
- 10-30: Frequency 12
- 30-40: Frequency 8

- 40-60: Frequency 10

Solution:

- Calculate class width and frequency density:
- 0-10: Width=10, FD=5/10=0.5
- 10-30: Width=20, FD=12/20=0.6
- 30-40: Width=10, FD=8/10=0.8
- 40-60: Width=20, FD=10/20=0.5
- Draw bars with heights proportional to frequency density

3. REGULAR RIGHT PYRAMIDS

Pyramid Basics

Regular Right Pyramid: A pyramid whose base is a regular polygon and whose apex is directly above the center of the base, with lateral faces as congruent isosceles triangles.

[Diagram: Square pyramid and triangular pyramid showing height, slant height, base]

Element	Definition	Notation
Base	Regular polygon at bottom	Triangle, Square, etc.
Apex	Top vertex point	O, V, etc.
Height	Perpendicular distance from apex to base	h
Slant Height	Height of triangular lateral face	l
Lateral Edge	Edge from apex to base vertex	e

Square Base Pyramid Formulas

For Square Pyramid (side = a, height = h, slant height = l):

Slant Height:
$l = \sqrt{[h^2 + (a/2)^2]}$

Lateral Surface Area:
$LSA = 2 \times a \times l$

Total Surface Area:
$TSA = a^2 + 2 \times a \times l$

Volume:
$V = (1/3) \times a^2 \times h$

Example: Square pyramid with base side 6 cm and height 4 cm. Find volume and total surface area.

Solution:

- Base side a = 6 cm, Height h = 4 cm
- Slant height l = $\sqrt{[h^2 + (a/2)^2]} = \sqrt{[16 + 9]} = \sqrt{25} = 5$ cm
- Volume = $(1/3) \times a^2 \times h = (1/3) \times 36 \times 4 = 48$ cm^3
- TSA = $a^2 + 2 \times a \times l = 36 + 2 \times 6 \times 5 = 36 + 60 = 96$ cm^2

Triangular Base Pyramid Formulas

For Triangular Pyramid (Equilateral triangle base side = a, height = h):

Base Area:

$$\text{Base Area} = (\sqrt{3}/4) \times a^2$$

Slant Height:

$$l = \sqrt{[h^2 + (a/(2\sqrt{3}))^2]}$$

Lateral Surface Area:

$$\text{LSA} = (3/2) \times a \times l$$

Total Surface Area:

$$\text{TSA} = (\sqrt{3}/4) \times a^2 + (3/2) \times a \times l$$

Volume:

$$V = (1/3) \times \text{Base Area} \times h = (1/3) \times (\sqrt{3}/4) \times a^2 \times h$$

4. PRACTICAL APPLICATIONS & PROBLEM TYPES

Circle Theorem Applications

Common Problem Types:
- Finding unknown angles using circle theorems
- Proving geometrical relationships
- Cyclic quadrilateral properties
- Tangent and chord properties

Example: In circle with center O, chord AB = chord AC. If ∠OAB = 40°, find ∠BAC.

Solution:

- Since AB = AC, triangle ABC is isosceles
- ∠OAB = 40° ⇒ ∠OBA = 40° (isosceles triangle)
- ∠AOB = 180° - 40° - 40° = 100°
- ∠ACB = ½ × ∠AOB = 50° (angle at circumference)
- In ΔABC: ∠ABC = ∠ACB = 50°
- ∠BAC = 180° - 50° - 50° = **80°**

Histogram Analysis

Histogram Analysis Tasks:
- Finding mode from histogram
- Calculating mean from grouped data
- Determining median class
- Comparing distributions

Example: From histogram, modal class is 20-30 with frequency 25. Previous class 10-20 frequency 15, next class 30-40 frequency 20. Find mode.

Solution:

- Modal class: 20-30, $f_1 = 25$
- $f_0 = 15$ (previous class), $f_2 = 20$ (next class)
- Class width h = 10, Lower limit L = 20

- Mode = L + $[(f_1 - f_0)/(2f_1 - f_0 - f_2)] \times h$
- = 20 + [(25-15)/(50-15-20)] × 10
- = 20 + [10/15] × 10 = 20 + 6.67 = **26.67**

5. SSC CGL PRACTICE PROBLEMS

Previous Year Question Types

Problem 1: In a circle, chord AB subtends 130° at center. Find angle between tangents at A and B.

Solution:

- Angle between radius and tangent = 90°
- In quadrilateral OATB (O=center, A,B=tangent points, T=intersection)
- ∠OAT = ∠OBT = 90°
- ∠AOB = 130° (given)
- ∠ATB = 360° - 90° - 90° - 130° = **50°**

Problem 2: Square pyramid has base area 64 cm^2 and volume 256 cm^3. Find its height.

Solution:

- Base area = 64 cm^2 ⇒ side = √64 = 8 cm
- Volume = (1/3) × base area × height
- 256 = (1/3) × 64 × h
- h = (256 × 3)/64 = 768/64 = **12 cm**

Problem 3: Histogram shows classes 0-10, 10-20, 20-40, 40-60 with frequencies 5, 8, 12, 10. Find total frequency.

Solution:

- Total frequency = 5 + 8 + 12 + 10 = **35**
- Note: Class widths are different but we sum actual frequencies

6. QUICK FORMULAS & SHORTCUTS

Memory Tips

Circle Theorems:
• "Center angle = 2 × circumference angle"
• "Angles in same segment = Equal"
• "Angle in semicircle = 90°"

Histogram Rules:
• Area ∝ Frequency
• For equal classes: Height ∝ Frequency
• For unequal classes: Use frequency density

Pyramid Formulas:
• Volume = (1/3) × Base Area × Height
• Slant height^2 = Height^2 + (Base/2)^2
• TSA = Base Area + Lateral Area

Important Values

Central Angle	Inscribed Angle	Application
60°	30°	Equilateral triangle in circle
90°	45°	Right angle properties
120°	60°	Hexagon in circle
180°	90°	Semicircle theorem

7. SSC CGL PREPARATION STRATEGY

Expected Marks Distribution

Topic	Frequency	Difficulty	Marks Weightage
Circle Geometry	High	Medium	2-3 marks
Histograms	Medium	Easy-Medium	1-2 marks
Pyramids	Low-Medium	Medium	1-2 marks
Mixed Problems	High	Medium-Hard	2-3 marks

25-Day Study Plan

Week 1-2: Foundation Building
- Days 1-5: Circle theorems and properties
- Days 6-10: Histograms and data interpretation
- Days 11-15: Pyramid concepts and formulas

Week 3-4: Advanced Practice
- Days 16-20: Mixed problem solving
- Days 21-25: Previous year papers and mock tests

Daily Practice: 5 circle problems, 3 histogram questions, 2 pyramid problems, revise all formulas.