6 CHAPTER 6 : CONSTRUCTIONS AND TILINGS

SUMMARY OF CONCEPTS

1. STATISTICAL QUESTIONS & STATEMENTS

- A statistical statement is a claim/summary about some phenomenon, expressed in numbers (values, proportions, probabilities, or predictions).
- A statistical question is a question whose answer can be found by collecting data.

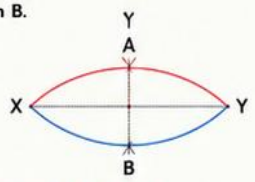
Examples

Statistical Statements	Statistical Questions
• Jemimah's batting has been consistent.	• How tall are Grade 7 students in our school?
• I take about 15 minutes to cycle home.	• Are onions costlier in Yahapur or Wahapur?
• The population of their village has reduced by about 100 in a decade.	• What fraction of students like walking up a hill?
• I eat fruits & vegetables more frequently, so I can run 2 km more each day.	• What was the rainfall pattern in Barmer last year?
• David spends about 7 hours daily in school.	

2. GEOMETRIC CONSTRUCTIONS

(A) Eyes Construction (Grade 6 Recall)

- Draw a line XY (supporting line).
- From X and Y, draw arcs (same radius) above and below XY.
- Points of intersection of arcs give centres A (above) and B (below).
- Draw upper arc from A and lower arc from B.



(B) Perpendicular Bisector

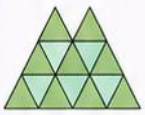
- Set of all points equidistant from X and Y lies on the perpendicular bisector of XY.
- Steps to construct:
  1. From X and Y, draw arcs above XY.
  2. From X and Y, draw arcs below XY (with same radius).
  3. Join the two intersection points (A and B). AB is the perpendicular bisector of XY.

3. TILINGS

- A tiling (or tessellation) is a pattern that covers a plane completely without any gaps or overlaps.
- Regular tilings use one kind of regular polygon.
- Semi-regular (Archimedean) tilings use two or more kinds of regular polygons.

Examples

Regular Tilings

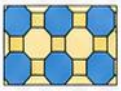


Equilateral Triangles (3.6.3.6)

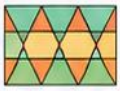
Squares (4.4.4.4)

Regular Hexagons (6.6.6)

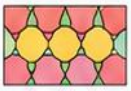
Semi-regular Tilings



(4.8.4.8)



(3.6.3.6)



(3.4.6.4)

(a.b.c.d) shows polygons around a vertex.

4. MULTIPLICATION OF DECIMALS

- Multiply as whole numbers.
- In the product, place the decimal point so that the number of decimal places = sum of decimal places in multiplier and multiplicand.

Example:

2.35 × 4.6

2.35 → 2 decimal places

× 4.6 → 1 decimal place

$$\begin{array}{r} 235 \\ \times\ 46 \\ \hline 1410 \\ 940 \\ \hline 10810 \end{array}$$

2 + 1 = 3 decimal places

10.810 → 10.81

Product Comparison

- Both > 1 → Product > both
- Both between 0 and 1 → Product < both
- One > 1 and other between 0 and 1 → Product is between the two

5. DIVISION BY 10, 100, 1000, ...

- Move the decimal point to the LEFT as many places as there are zeroes in the divisor.

÷ 10	÷ 100	÷ 1000
18.7	1.87	0.187
21.1	0.211	0.0211
2.146	0.02146	0.002146
0.306	0.0306	0.000306

6. DIVISION USING PLACE VALUE (LONG DIVISION)

- Same method as for whole numbers.
- After Ones, regroup to Tenths, Hundredths, Thousandths, ...
- Place the decimal point in the quotient when we start dividing the Tenths.
- Continue till remainder is 0 or desired accuracy.

1325 ÷ 4 = 331.25

$$\begin{array}{r|l} 4 & 1325 \\ -12 & \\ \hline -12 & \\ \hline -12 & \\ \hline 05 & \\ -4 & \\ \hline 10 & \\ -8 & \\ \hline 20 & \\ -20 & \\ \hline 0 & \end{array}$$

→ Hundreds
→ Tens
→ Ones
→ Tenths
→ Hundredths

7. DIVISION WITH DECIMAL DIVISOR

- Make divisor a whole number by multiplying dividend and divisor by the same power of 10.
- Then divide using long division.

Example: 4.68 ÷ 0.13

$$= 4.68 \div 0.13 \times \frac{100}{100} = \frac{468}{13}$$

$$\begin{array}{r|l} 13 & 468 \\ -39 & \\ \hline 78 & \\ -78 & \\ \hline 0 & \end{array}$$ (36

Rule

Multiply both dividend and divisor by the same power of 10 so that the divisor becomes a whole number.

8. RECURRING (NEVER ENDING) DECIMALS

- Some divisions never end.
- The remainders repeat in a cycle.
- The decimal digits also repeat in the same cycle.

10 ÷ 3 = 3.3333 ... (3 repeats)

$\frac{1}{7}$ ÷ 7 = 0.142857142857 ... (block 142857 repeats)

1 → 3 → 2 → 6 → 4 → 5 →
5 ← 4 ← 6 ← 2 ← 3 ← 1

9. LEAP YEAR (GREGORIAN CALENDAR)

- Earth takes 365.2422 days to go around the Sun.
- To keep the calendar in sync, we add extra days.

Year is:	Type of Year	Days
Divisible by 400	Leap year	366
Divisible by 100 but not by 400	Common year	365
Divisible by 4 but not by 100	Leap year	366
Otherwise	Common year	365

FEB 29

✓ This keeps our calendar in close sync with Earth's revolution.

10. KEY TAKEAWAYS

- ✓ Decimals extend our place value system.
- ✓ Multiplication & division of decimals follow simple rules based on place value.
- ✓ Division by 10, 100, 1000, ... → move decimal left.
- ✓ Long division works for decimals with regrouping.
- ✓ Some decimal divisions never end (recurring).
- ✓ Geometric constructions create accurate figures using compass & ruler.
- ✓ Tilings cover a plane without gaps or overlaps.
- ✓ Statistics helps us make sense of data around us.

REMEMBER! Understand the idea → Practice regularly → Observe patterns → Apply in real life → Excel in Maths!

CONSTRUCTION AND TILLING

WORKSHEET-1

Section A: MCQs(Part-1) (10 × 1 = 10 marks)

1.What is a perpendicular bisector?

A) A line parallel to a segment B) A line that bisects a segment and is perpendicular to it

C) A line joining two midpoints D) Any line through the midpoint

2.If AX = AY = BX = BY, then the line AB is:

A) Parallel to XY B) Perpendicular bisector of XY

C) Angle bisector of ∠XAY D) Median of triangle XAB

3.To construct a perpendicular bisector, arcs from X and Y are drawn with:

A) Different radii always B) Radius less than XY/2

C) The same fixed radius D) Radius equal to XY

4.In the 'Eyes' construction, for symmetry which condition must hold?

A) AX = BY only B) AX = AY = BX = BY C) AX = BX only D) AX > BX

5.A division of any geometrical object into two equal parts is called:

A) Trisection B) Rotation C) Bisection D) Translation

6.Any point equidistant from endpoints X and Y of a segment lies on:

A) The segment XY B) A line parallel to XY

C) The perpendicular bisector of XY D) The angle bisector

7.To construct 90° at O, which step is essential?

A) Find midpoint of OX first

B) Mark X and Y equidistant from O then construct perpendicular bisector of XY

C) Draw two parallel lines through O

D) Bisect a 60° angle

8.In the Śulba-Sūtras, what replaced the compass?

A) Set square B) Protractor C) Rope D) Marked ruler

9.A 45° angle can be constructed by:

A) Trisecting a 90° angle B) Bisecting a 60° angle

C) Bisecting a 90° angle D) Copying a 30° angle

10.In angle bisection, ΔOBC ≅ ΔOAC is shown by:

A) ASA B) AAS C) SAS D) SSS

MCQs(Part-2) (10 × 1 = 10 marks)

11. The line that bisects a given line segment and is perpendicular to it is called:
(A) Angle bisector (B) Perpendicular bisector (C) Parallel line (D) Transversal

12. In the figure below, XY is a line segment and A, B are points such that AX = AY = BX = BY. Which of the following is correct?

A

X --------O-------- Y

B

(A) AB is parallel to XY (B) AB is the perpendicular bisector of XY
(C) O is any point on XY (D) AB bisects only the angle at O

13. A 60° angle can be constructed using a ruler and compass by:

(A) Bisecting a 30° angle (B) Constructing an equilateral triangle

(C) Drawing a perpendicular bisector (D) Copying a 90° angle

14. Which of the following regular polygons CANNOT tile the plane by itself?

(A) Equilateral Triangle (B) Square (C) Regular Hexagon (D) Regular Pentagon

15. A 5 × 7 grid cannot be tiled with 2 × 1 tiles because:

(A) The tiles are too large

(B) The grid has an odd number of unit squares (35), not divisible by 2

(C) The rows are not equal to the columns

(D) Only square tiles can be use16.

16. A student constructs a line segment PQ = 8 cm and draws its perpendicular bisector. Which statement is always true?
(A) Every point on the bisector is 8 cm from P.
(B) Every point on the bisector is equidistant from P and Q.
(C) The bisector is parallel to PQ.
(D) The bisector divides PQ into three equal parts.

17. Which of the following angles can be constructed by first constructing a **60° angle** and then bisecting it?
(A) 45° (B) 30° (C) 75° (D) 120°

18. A floor is to be covered completely using **only one type of regular polygon** without leaving any gaps or overlaps. Which polygon can be used?
(A) Regular Pentagon (B) Regular Heptagon (C) Regular Hexagon (D) Regular Nonagon

19. A regular octagon has been constructed using a ruler and compass. What is the measure of each **central angle** of the octagon?
(A) 30° (B) 45° (C) 60° (D) 90°

20. A **10 × 8** rectangular grid is completely covered using **2 × 2 square tiles** without cutting any tile. What is the minimum number of tiles required?
(A) 10 (B) 16 (C) 20 (D) 40

WORKSHEET-2

Section B: Short Answer (10 × 2 = 20 marks)

1.Explain how to construct a 90° angle at any point O on a line using only ruler and compass

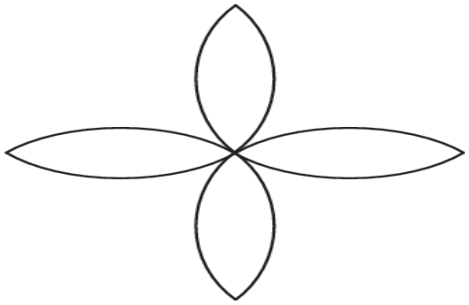
2. State the congruence condition used to prove AB is the perpendicular bisector of XY.

3. State the two steps to construct a 60° angle.

4. How many equilateral triangles form a regular hexagon? What is each interior angle?

5. Construct a 30° angle from a 60° angle. Write the steps in brief.

6. Recreate this design using only a ruler and compass —



7. Draw a perpendicular bisector of line 5 cm.

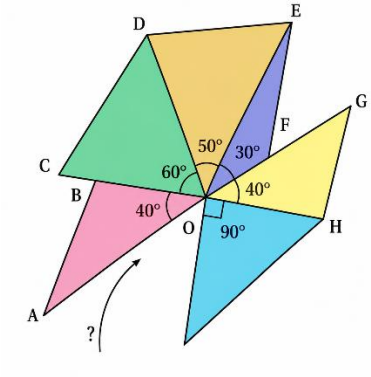
Section C: Short Answer (6 × 3 = 18 marks)

11. Draw an angle. Create a copy of this angle using only a ruler and compass.

12. Draw two parallel lines using compass and ruler only.

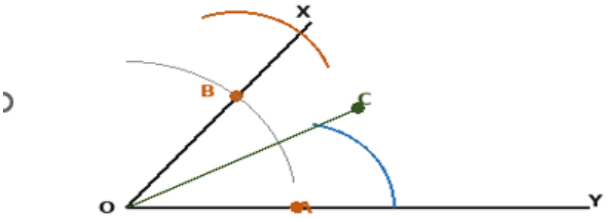
13. Construct an angle of 75^0 using compass and ruler.

14. Consider this figure. Will the 50° angle fit into the gap? What is the gap angle ∠AOI?

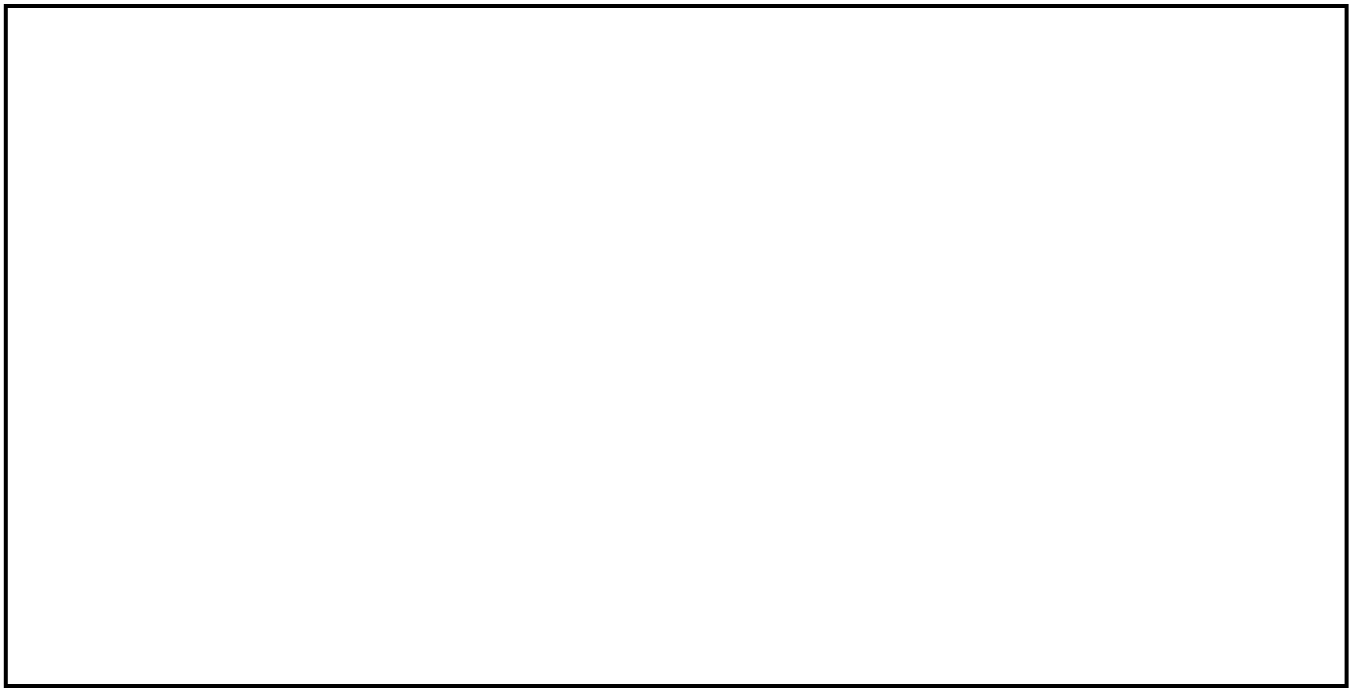


15. How many equilateral triangles form a regular hexagon? What is each interior angle?

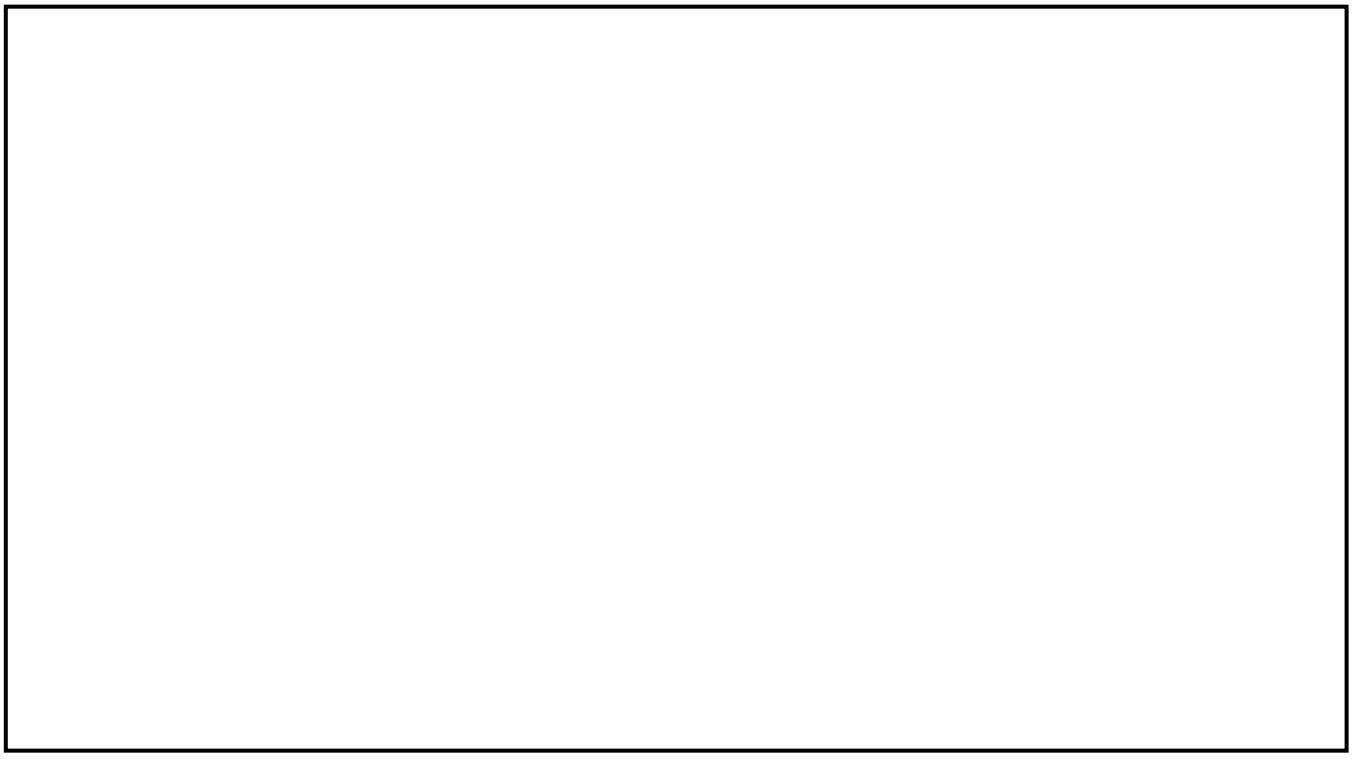
16. In the figure, ∠XOY is drawn with OA = OB. Equal arcs from A and B meet at C, and ray OC is drawn. What does OC do to ∠XOY?



17. Draw a regular pentagon of side 4cm. Write steps of construction also.

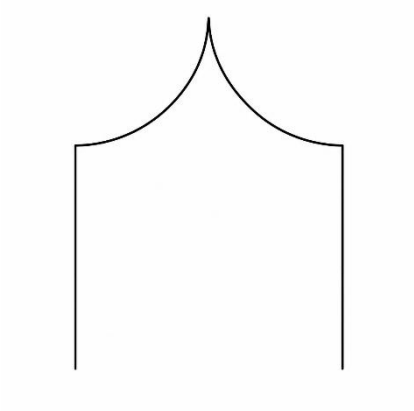


18. Draw a regular Hexagon of side 5 cm. Write steps of construction also.



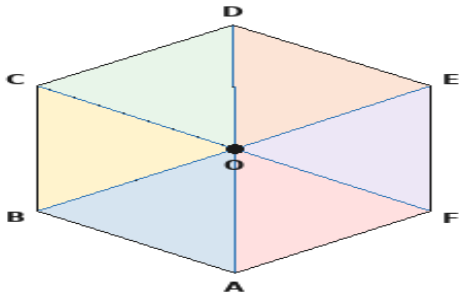
19. Draw an 6 x 6 grid be tiled using 2×1 tiles?

20. construct the given diagram:



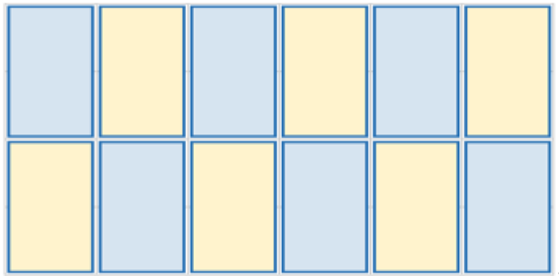
21. Kabir studies a beehive cross-section. The cells are hexagonal and fit together without gaps — a perfect tiling. His math teacher says this relates to regular hexagons.
Kabir tries to construct a regular hexagon of side 4 cm using ruler and compass. His teacher hints: construct a 60° angle and think about equilateral triangles.

Fig: Regular Hexagon = 6 Equilateral Triangles



a.What is the measure of angle ∠ AOF.
b.What is the measure of ∠ DEF.
c.What is the sum of all angles of this regular hexagon .Show your calculations.

22. The school wants to tile an 6 m × 4 m courtyard with 2 m × 1 m tiles placed horizontally or vertically. Student Arjun suggested to tile the courtyard with 2 m × 1 m tiles . Student Priya wonders if the courtyard can still be tiled with 1×1 unit tile.



a.How many tiles be needed if we use Arjuna method ?
b.How many tiles needed by Priya method?
c.If we use 3x1 unit tiles how many tiles will be needed and show it diagramitically.

Self Assessment:

I understood all the concepts: ☐ Yes ☐ No

I need more practice ☐ Yes ☐ No

Name of Concepts having doubts/Not Cleared: _____

Parent's Assessment:

My ward understood all the concepts: ☐ Yes ☐ No

He/She need more practice ☐ Yes ☐ No

Name of Concepts having doubts/Not Cleared: _____

Signature of Parent

Teacher's Assessment:

Answers of Worksheet-1

Q	1	2	3	4	5	6	7	8	9	10
Ans	B	B	C	B	C	C	B	C	C	D
Q	11	12	13	14	15	16	17	18	19	20
Ans	B	B	B	D	B	B	B	C	B	C

Answers of Worksheet-1

Q	4	15	21	22
Ans	120°.	Each interior angle = 120°. Sum of all interior angles = 6 × 120° = 720°.	∠AOF = 60°. ∠DEF = 120° Sum=720°	12 tiles 24 tiles 8 tiles