General Instructions:
i)   Attempt all the questions.
ii)   This question paper consists of 31 questions divided into five sections A, B, C, D and E. Section A comprises of 4 questions of 1 mark each, section B comprises of 6 questions of 2 marks each, section C comprises of 8 questions of 3 marks each, section D comprises of 10 questions of 4 marks each and section E comprises of 2 question of 3 marks each and 1 questions of 4 marks. This section is based on OTBA.

SECTION – A   (1 x 4 = 4 marks)

1.   In the given figure, PQRS is a cyclic quadrilateral.
If $\angle QRS = 110°$, then find $\angle SPQ$.

2.   In parallelogram ABCD, AC is the diagonal. Find the area of ΔABC, if area of parallelogram ABCD = 56cm^2.

3.   A coin is tossed. If the probability of getting a tail is $\frac{3}{8}$.
Find the probability of getting a head.

4.   The radius of a sphere is 3r. Find its volume in terms of π.
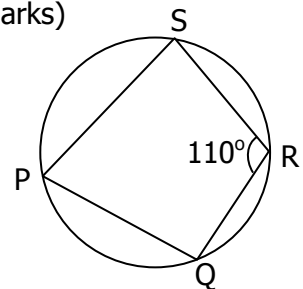
SECTION – B   (2 x 6 = 12 marks)

5.   Find the amount of water displaced by a solid spherical ball of radius 21mm if it is fully immersed in water.

6.   Find mean of the following data: 22, 25, 20, 32, 36, 28,40, 45, 38, 35.

7.   Prove that if chords of congruent circles subtend equal angles at their centres, then the chords are equal.

8.   Write the equations of two lines passing through the point (-2, 5).

9.   The area of a parallelogram is 288 cm^2. If its altitude is twice the corresponding base, determine the base and altitude.

10. The hollow sphere in which the motorcyclist performs his stunts has diameter 7m. Find the area available to the motorcyclist for riding.

SECTION – C   (3 x 8 = 24 marks)

11. It is required to make a closed cylindrical tank of height 1m and base diameter 140 cm from a metal sheet. How many square meter of the sheet is required for the same?

12. If two equal chords of a circle intersect within the circle, prove that the line joining the point of intersection to the centre makes equal angles with the chords.

13. Frame linear equation in two variables for the given situations:
    i)   The difference between two numbers is 8. Take greater number as x and smaller as y.

    ii)   In a class, the number of boys and girls are in the ratio 3:2. Take total number of students as x and number of boys and girls in terms of y.

14. A conical tent is 10 m high and radius of its base is 24m. Find
    i)   Slant height of the tent.
    ii)   Cost of the canvas required to make the tent, if the cost of 1 m^2 canvas is Rs. 90.

15. Construct ΔPQR in which QR = 7 cm, $\angle$PQR = 45° and PQ – PR = 2 cm.

16. Draw the graph of the equation x +2y – 4 = 0. Find the coordinates of the point where the graph cuts x-axis.

17. How many spherical bullets of diameter 4 cm can be made from a solid cube of lead whose edge measures 44cm?

18. The percentage of marks obtained by a student in monthly unit tests are given as:

Test	I	II	III	IV	V	VI
Marks percentage	52	60	65	75	80	72

Find the probability that if a test is selected at random, the student gets:
    i)   More than 70% marks
    ii)   Less than 70% marks
    iii)   At least 60% marks

SECTION – D   (4 x 10 = 40 marks)

19. If diagonals of a cyclic quadrilateral are diameters of the circle through the vertices of the quadrilateral, then prove that it is a rectangle.

20. Construct triangle ABC in which sum of three sides is 13.5 cm and $\angle$B = 75° and $\angle$C = 90°.

21. Draw histogram for the following distribution:

Marks obtained	0 – 20	20 – 30	30 – 50	50 – 60	60 – 90	90 –100
No. of students	8	10	6	12	6	4

If a child gets more marks in exams using unfair means, what value is lacking in him?

22.   Draw the graph of the equations $x + y = 6$ and $2x + 3y = 16$ on the same graph.
Find the coordinates of the point where the two lines intersect each other.

23.   Show that the diagonals of a parallelogram divide it into four triangles of equal areas.

24.   A hemispherical dome of a building needs to be painted. If the circumference of the base of the dome is 17.6 m, find the cost incurred if the rate of painting is Rs.19 per m^2.

25.   In the given figure, $\angle PQR = 110°$, where P,Q and R are points on a circle with centre O. Find $\angle OPR$
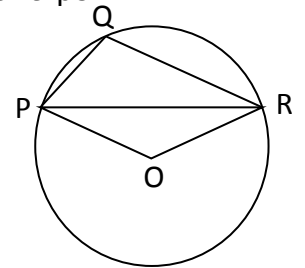
26.   Convert the given distribution into a continuous grouped frequency distribution and hence draw a frequency polygon for the same

Class Interval	150 – 153	154 – 157	158 - 161	162- 165	166 -169	170 - 173
Frequency	7	7	10	15	5	6

27.   The following table gives the weights of 45 students of a class:

Weight (in Kg)	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70
No. of students	8	6	16	9	3	1	0	2

Find the probability that the weight of a student in the class, selected at random:
i)   Lies in the interval 50 – 60 kg.
ii)   Is less than 50 kg
iii)   Is more than 60 kg
iv)   Lies between 40 kg to 60 kg.

28.   If a point (2, -6) lies on the graph of the equation $2y = ax – 10$, find the value of a. Write the equation in the standard form and also find two solutions of the obtained equation in two variables.

SECTION – E (OTBA)

Theme 2: 'Quadrilaterals in Architecture, WAH TAJ!
Abstract

Knowledge of Euclidean Geometry and specially the properties of various types of quadrilaterals plays very special role in work of architects as it helps them to design any building by making effective utilization of space. This case study will help you to appreciate and understand the complex structure of famous monuments like TajMahal in simplified way with the knowledge gained by you in class IX about quadrilaterals.

This text is created to show the practical applications of the concepts learnt in geometry about quadrilaterals.

Note: Taj is specially chosen for this case study as it is embodiment of perfect symmetry. The simplest way to appreciate this symmetrical construction is to divide its geometrical or structural drawing into rectangular grids.

Quadrilaterals are second most popular shape used in architectural designs. With four corners and four edges it is possible to get many types of quadrilaterals such as trapezium, parallelogram, rectangle, square, rhombus and kite etc. by bringing variations in their angles and sides. This dynamic character of four sided polygon gives lots of possibilities and freedom to architects to create beautiful buildings. Quadrilaterals are preferred in constructing buildings over other polygons as they can make maximum utilization of space. Observe the following images of some buildings:

You can observe the prominent use of parallelograms, rectangles, squares, rhombus and trapezium etc. in designs of buildings. Architectural style of most of buildings can be understood using quadrilaterals. Right from foundation of the building to the vertical pillar and horizontal cross beams

to the top roof one or the other type of quadrilateral is used. Very often it can be observed at construction sites that rectangular frame with a diagonal is used. It is done to provide strength to building as the diagonals provide rigidity in rectangular frame.

Before starting construction lay out plan of any land or construction site is worked out. Generally the layout of land is planned using quadrilaterals. For example when we talk about the Taj Mahal, first picture comes to our mind is of main Tomb with onion dome. But Taj is considered seventh wonder of the world due to perfect symmetry, harmony and order in its entire complex Pictures (i), (ii), (iii) of Taj complex demonstrates very clearly that the total land area of 42 acres on which Taj complex is built is divided into 5 main parts of rectangular shape.

(i)

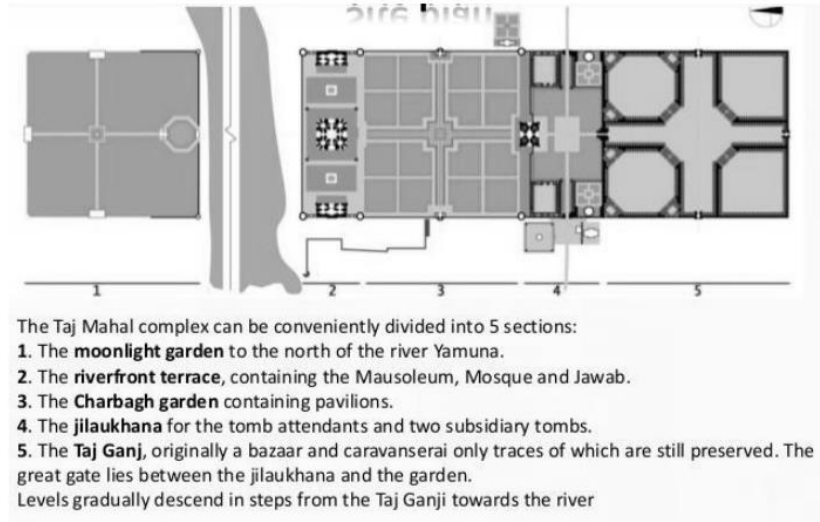See the aerial view and Layout of land use for Taj complex

(ii)

Site Plan

The Taj Mahal complex can be conveniently divided into 5 sections:
1. The **moonlight garden** to the north of the river Yamuna.
2. The **riverfront terrace**, containing the Mausoleum, Mosque and Jawab.
3. The **Charbagh garden** containing pavilions.
4. The **jilaukhana** for the tomb attendants and two subsidiary tombs.
5. The **Taj Ganj**, originally a bazaar and caravanserai only traces of which are still preserved. The great gate lies between the jilaukhana and the garden.
Levels gradually descend in steps from the Taj Ganji towards the river

(iii)

In this article we will be focusing more on part 2 comprising of Tomb, Mosque and Jawab and part 3 i.e. Charbagh gardens. Part 1 is the area lying behind the Tomb. Part 2 of the site plan is divided into three parts- a square in the middle surrounded by two identical rectangles. The main tomb of Taj Mahal stands on this square platform. Dimension of square platform is 186 feet x 186 feet and its height is 22 feet. This platform raised 50 meter above the river bank and was leveled with dirt in order to reduce seepage from the river. On four corners of the square platform four minarets each of height 137 feet are standing. The height of the tomb standing on square platform is equal to the height of spherical dome over it. It is 35 metre high. The dome is placed on a truncated drum to retain volume, and it locates the exact centre of the building. Because of its shape, the dome is often called an onion dome. The dome is topped by a gilded finial, whose tip rises to a height of 240 Feet above the ground.

Part 3 covers the total area of 580 meter by 300 meter, the garden alone covers 300 meter by 300 meter. The immaculate symmetry is maintained in the designing of this garden. The path grid consists of two sets of parallel paths that intersect at equal distances and create square rectangular fields of space. The four main sections are separated by two water channels which bisect at right angles. Each of these sections are further divided into quarters by sandstone paths.
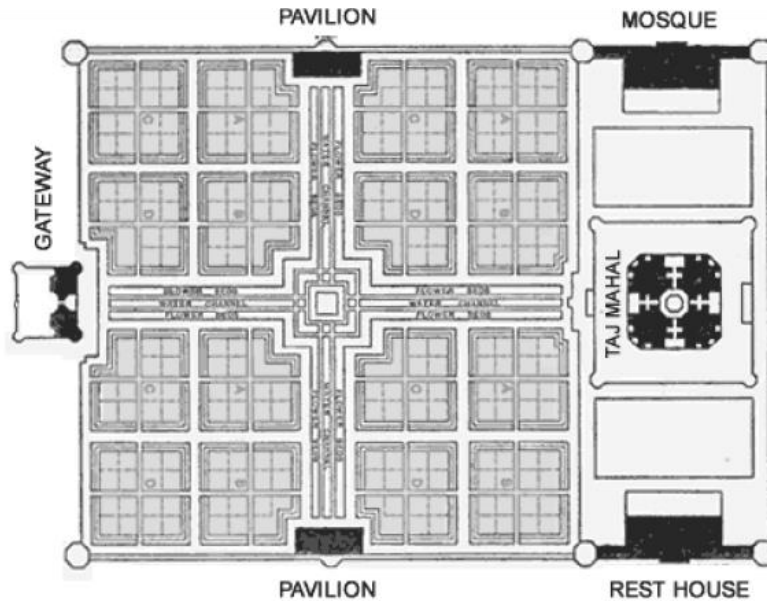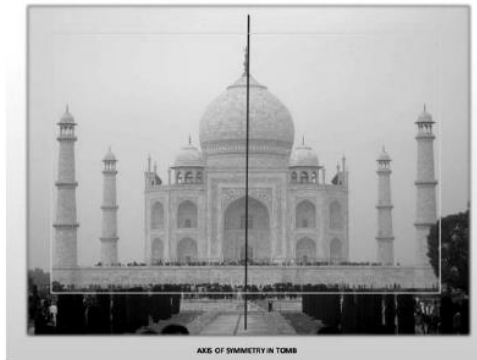
(iv)

The ground plans of the main chamber at the center in octagonal. To maintain symmetry, the base of the four minarets uses an octagonal template also.


(v)

Good use of geometry is visible in design of Taj. It seems that even 400 years ago lots of geometrical planning to create bilateral symmetry was done by the architect of Taj Mahal. Bilateral symmetry refers to simultaneous pairing of same graphics and patterns.

A geometrical sketch of Taj is divided into rectangular grids. A careful and geometrical analysis of this sketch will help you to appreciate the symmetry in Taj.
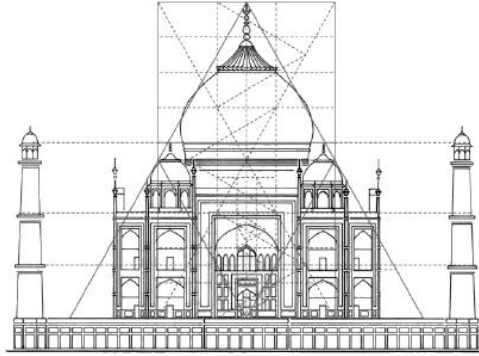
(vi)

The above picture clearly reflects that

- Tomb is comprised of rectangular building with dome over it. Height of the dome is equal to the height of building.
- Three chambers of side minarets are congruent trapezium.
- Simultaneous patterns on both sides of building of Tomb can be observed everywhere be it the wall or the windows or minarets. The concept of golden ratio was used in design of Taj Mahal.
- All rectangles used in the tomb building and its main arch are all Golden rectangle. That means Ratio of length to breadth in all rectangles is equal to 1.618. This ratio is known as Golden ratio and is represented by Φ
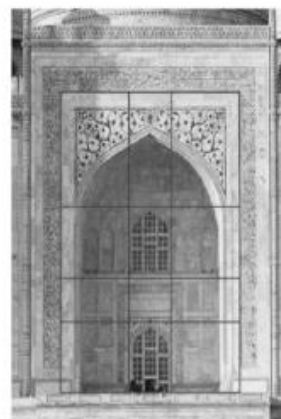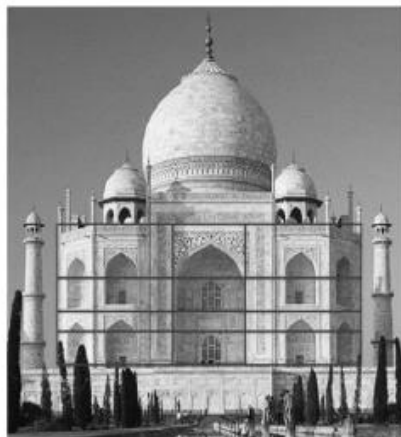
Using properties of quadrilaterals and mid-point theorem one can explore geometrical symmetry of Taj from different perspectives. You can try identifying all problems of quadrilaterals attempted in classroom hidden in picture (vi) and use them to appreciate the symmetry and beauty of Taj.
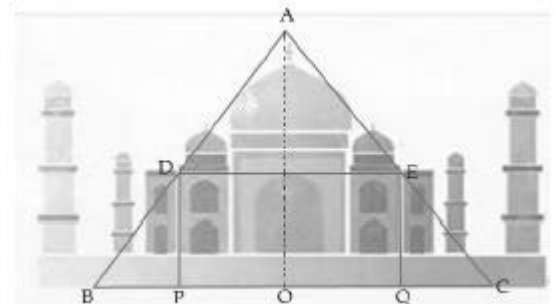
29. Prove that the quadrilateral PQRS formed by joining the mid points of the adjacent sides of a rectangle EFGH is a parallelogram.

    (3)
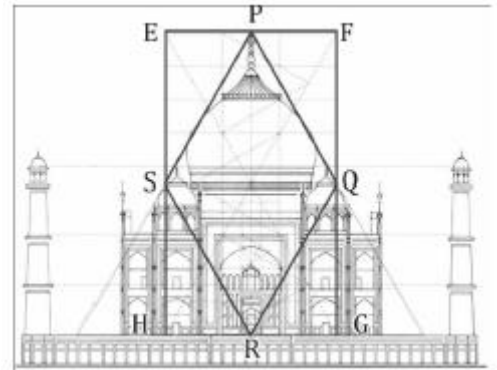
30. Write the relation between the line segment joining the mid points of two sides of the triangle with the third side. State the name of the theorem. Also find the measure of length DE if BC = 84 m.

    (3)

31. Write any four properties of a parallelogram.

    (4)

-x-x-x-x-x-x-