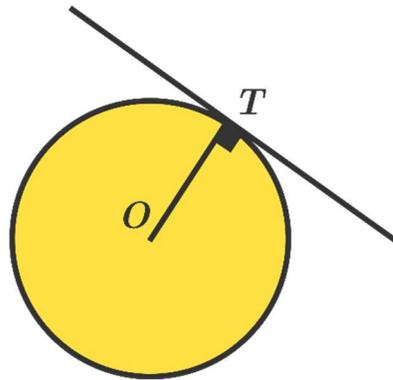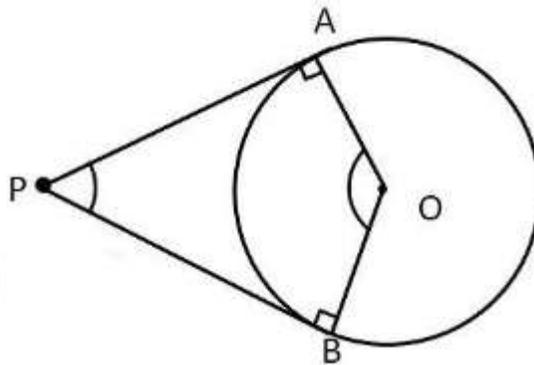# CLASSROOM PROGRAMME

Class 10 Short Note

Tangents

✓ The tangent at a point on a circle is perpendicular to the diameter through the point

✓ In a circle, the angles between the radii through two points and the angle between the tangents at these points are supplementary
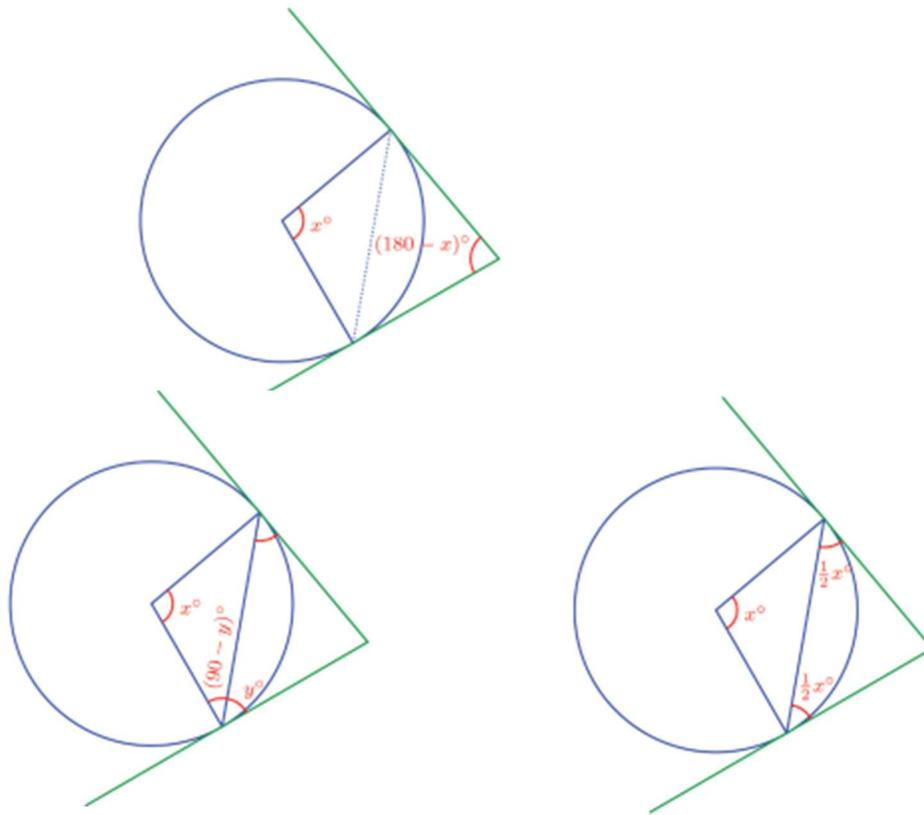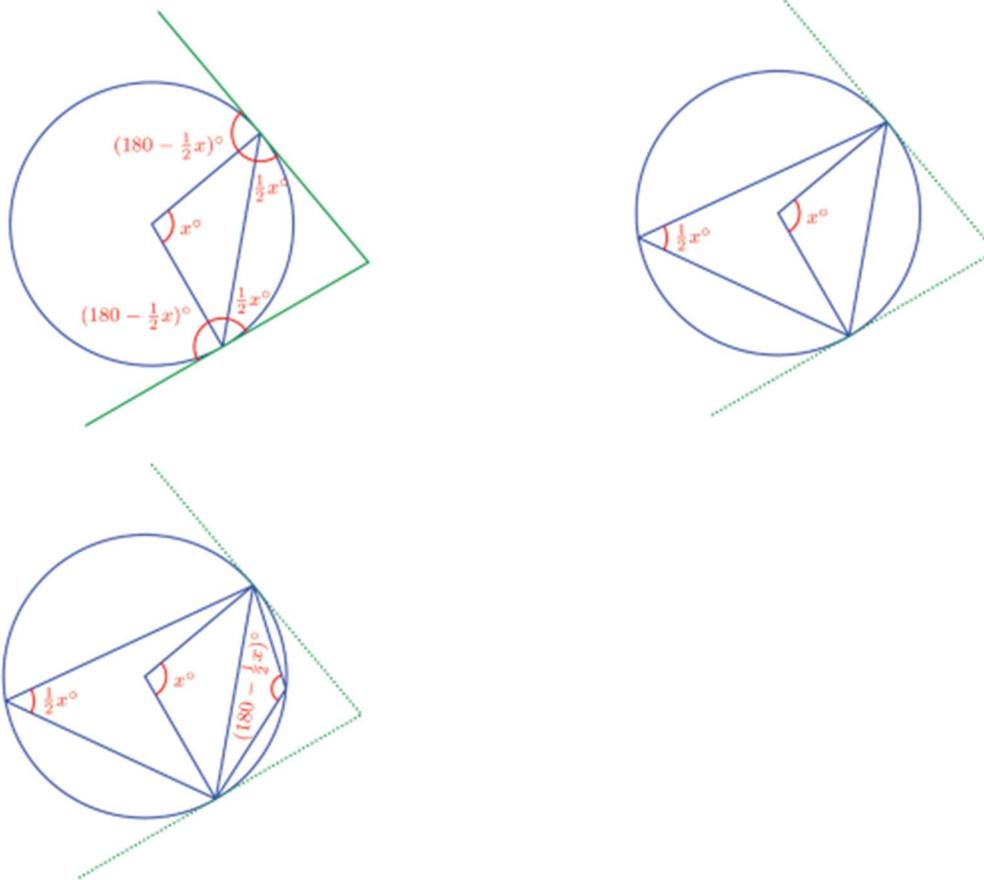
✓ In a circle, the angle between a chord and tangent at either end is half the central angle of the chord

✓ From any point outside a circle, we can draw two tangents, and the lengths of These tangents are equal.
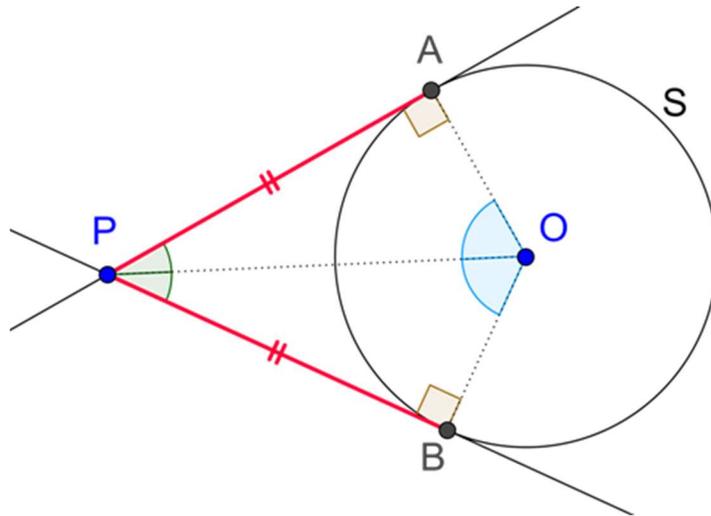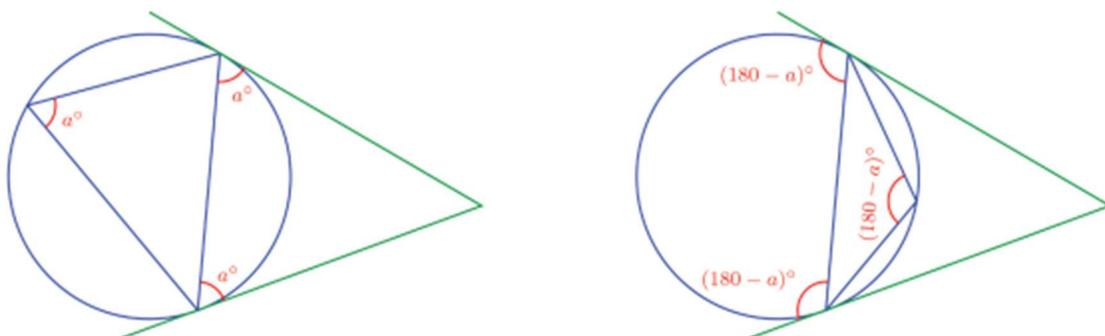
Chord and tangent

✓ The angle between the tangents at the ends of a chord in a circle is the central angle of the chord subtracted from 180^0

The angles which the tangents to a circle at the ends of a chord make on one side of the chord are both equal to the angle in the alternate segment
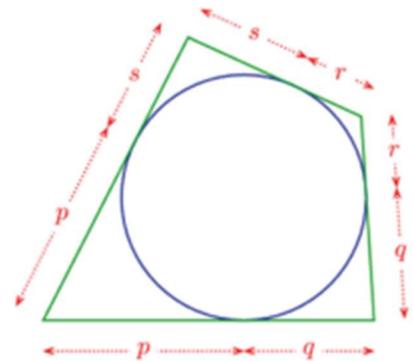
Tangent from outside

✓ From a point outside a circle, two tangents can be drawn to the circle
✓ The two tangents from a point outside a circle have the same length

$a = p + q$

$b = q + r$

$c = r + s$

$d = s + p$

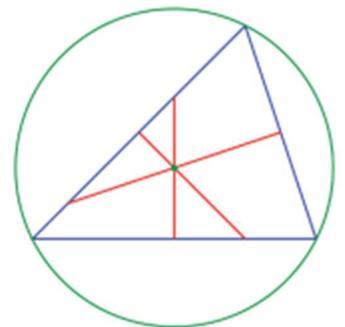In a quadrilateral formed by the tangents at four points on a circle, the sum of the lengths of opposite sides is equal

Circle touching a line

✓ In any triangle, the bisectors of all three angles intersect at a single point

✓ The radius of the incircle of a triangle is equal to its area divided by half the   perimeter

$$r = \sqrt{\frac{(s-a)\,(s-b)\,(s-c)}{s}}$$

Construction of tangents to a circle from a point outside it

Consider a circle with centre O and let P be the exterior point from which the Tangents to be drawn.

Step 1 : join the PO and bisect it. Let M be the midpoint of PO.

Step 2 : taking M as the centre and MO or MP as the radius, draw a circle. Let it

intersect the given circle at the points Q and R.

Step 3 : join PQ and PR

PQ and PR are the required tangents to the circle.

Exercise

- ✓ Draw tangents from outside point of a circle.
- ✓ Draw a circle with given radius. Draw triangle with given angles and sides are tangent to the circle
- ✓ Draw a triangle with given side and draw incircle to the triangle.

Polynomials And Equations

✓ The product of the first degree polynomials $x + a$ and $x + b$ is the second degree polynomial $x^2 + (a + b)x + ab$

✓ $(x + y)(u - v) = xu - xv + yu - yv$

✓ $(x - y)(u - v) = xu - xv - yu + yv$

✓ $(x + a)(x - b) = x2 + (a - b)x - ab$

✓ $(x - a)(x - b) = x2 - (a + b)x + ab$

✓ $P(x)$ is any polynomial and $(x - a)$ is a first degree polynomial

    1. If $P(a) = 0$ then $(x - a)$ is a factor of $P(x)$

    2. If $P(a) \neq 0$ then $(x - a)$ is not a factor of $P(x)$

    3. If $P(a) = b$ then b is reminder

✓ $(x - a)$ and $(x - b)$ are two first degree polynomials

    1. $(x - a)(x - b) = x^2 - (a+b)x + ab$ (a 2nd degree polynomial as the product of Two first degree polynomials)

    2. The solutions of the equation $p(x) = 0$ are x=a and x=b

✓ $P(x) = (x - a)q(x) + b$

    $q(x)$ is quotient

    b is reminder

✓ $(x - a)$ is not a factor of $p(x)$. that is $p(a) = b$

    The polynomial with factor $(x - a)$ is $p(x) + (-b)$

✓ If $x^2 - a^2$ is factor of $p(x)$ then $(x + a)$ and $(x - a)$ are factors of $p(x)$

The solutions of the equation

$$ax^2 + bx + c = 0$$

are given by

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Exercises

➤ Find the value of k if $(x-2)$ is a factor of the polynomial $p(x) =$ $2x^2-3x+k$?

➤ Write the second-degree polynomial $P(x) = 2x^2-5x+2$ as the product of first-degree polynomials?

➤ $P(x) = x^2-6x+9$

    a) Prove that $(x-3)$ is a factor of $p(x)$?

    b) Prove that for any number x, $p(x)$ is always non negative?

    c) Find the number a and b such that $p(a) = p(b)$?

➤ If $P(x) = x^3+7x^2+7x-15$. Check whether $(2x-2), (3x-3), (5x-5)$ are the factors of it?

➤ Find remainder and quotient obtained by dividing x^3-4x^2+8x+8 by $(x-2)$?
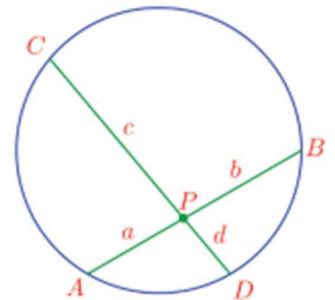
Circles And Lines

Chords

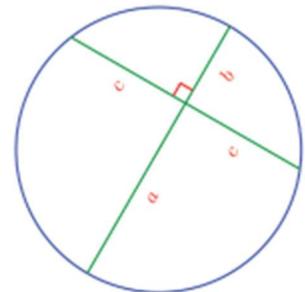A chord of a circle is a line segment that connects any two points on the circle's circumference
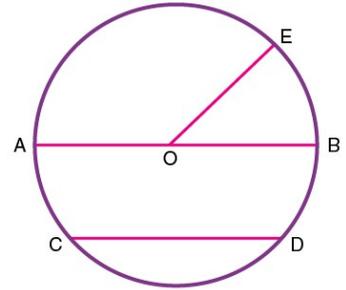
When two chords of a circle intersect within the circle, the product of the parts of one chord is equal to the product of the p
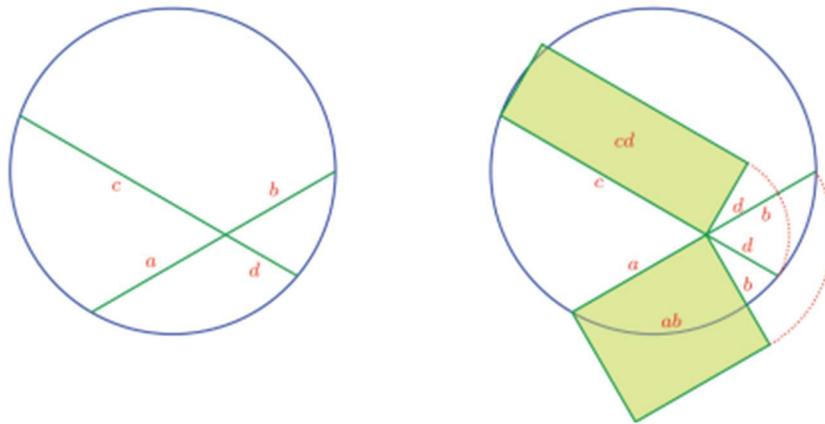
$$AP \times PB = CP \times PD$$

The product of the parts into which a diameter of a circle is cut by a perpendicular chord, is the square of half the chord
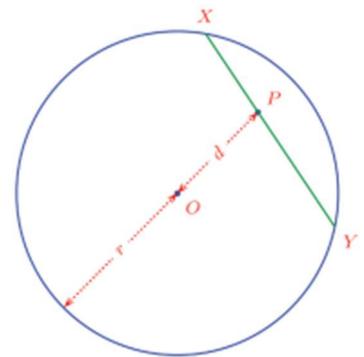
$$ab = c^2$$

Area

When two chords intersect within a circle, the rectangles with sides as the parts of each chord have equal areas
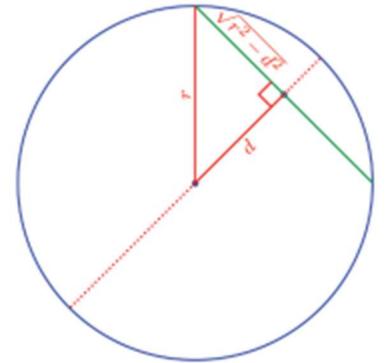

Line and point

For any chord XY of a circle of radius r, passing through a point P within the circle at a distance d from the centre,
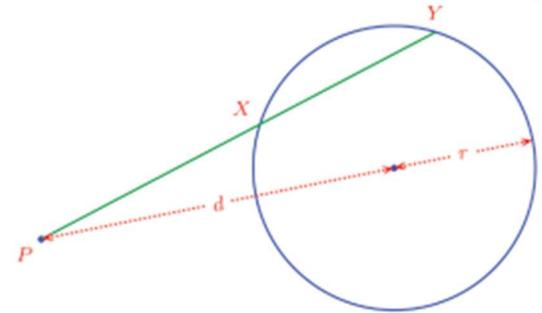
$$PX \times PY = r^2 - d^2$$

Geometrically, $r^2 - d^2$ is equal to the square of half the chord through P, perpendicular to the diameter through P

If a line from a point P outside a circle of radius r at a distance d from the centre cuts the circle at X and Y, then

$$PX \times PY = d^2 - r^2$$

If X and Y are the points of intersection of a circle of radius r with a line through a point P inside or outside the circle, at a distance d from the centre, then

$$PX \times PY = |r^2 - d^2|$$

Exercise

1) Draw a rectangle of width 5 centimetres and height 4 centimetres.
    a. Draw a rectangle of the same area with width 6 centimetres.
    b. Draw a square of the same area.
2) Draw a square of area 15 square centimetres.

3) In the picture, a line from the centre of a circle cuts a chord into two parts:
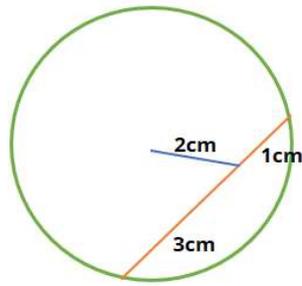
What is the radius of the circle?

Geometry And Algebra

✓ The distance between any two points (x_1, y_1) and (x_2, y_2) is

$$D = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

✓ Slope of a line

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

✓ P (x, y) is the midpoint of the line joining A (x_1, y_1), B (x_2, y_2) then

$$x = \frac{x_1 + x_2}{2}, \quad y = \frac{y_1 + y_2}{2}$$

✓ If P (x, y) divides the line joining A (x_1, y_1), B (x_2, y_2) in the ratio m : n

Then,

$$X = \frac{mx_2 + nx_1}{m+n}, \quad y = \frac{my_2 + ny_1}{m+n}$$

✓ Equation of a line, which passes through a point (x_1, y_1) is

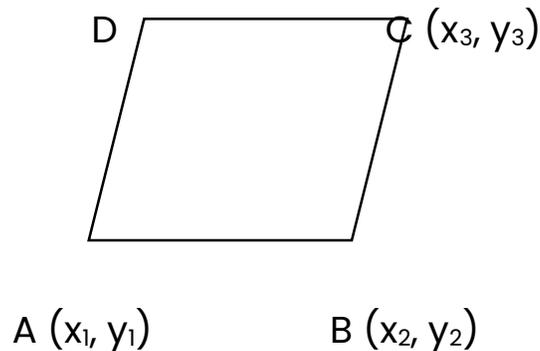$$\frac{y - y_1}{x - x_1} = \frac{y_2 - y_1}{x_2 - x_1}$$

✓ For any two points on a line not parallel to either axis, the change in *y*-coordinates divided by the change in *x* coordinates g

✓ If equation of a line is ax + by = C then, slope = $-\left(\frac{a}{b}\right)$

✓ The equation of the circle with centre $(0,0)$ and radius r is

$$\sqrt{x^2 + y^2} = r^2$$

✓ The equation of the circle with centre (a, b) and radius r is

$$\sqrt{(x-a)^2 + (y-b)^2} = r^2$$

✓ To find forth vertex of a parallelogram

D ⟋⎯⎯⎯⎯⎯⎯⎯ C (x_3, y_3)

A (x_1, y_1) B (x_2, y_2)

If three vertices are given then,

Coordinates of D = $((x_1 + x_3) - x_2, (y_1 + y_3) - y_2)$

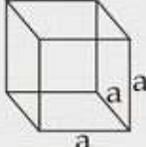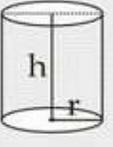✓ For any two points on a line, not parallel to either axis, the change in the y-coordinate is the change in the x coordinate multiplied by a fixed number

Exercises

➢ The equation of circle in a plane is $(x - 3)^2 + (y - 4)^2 = 25$

   a) Write the coordinates of the centre of the circle?

   b) What is its radius?

   c) Is $(6, 8)$ a point on the circle?

➢ Prove that the points $(2, 5)$ $(4, 7)$ $(6, 9)$ are on the same line?

➢ Prove that the line passing through $(2,4)$,$(5,1)$ is perpendicular to the line passing through $(4,3)$, $(-1,-2)$?

➢ In parallelogram ABCD, A(x_1, y_1), B(x_2, y_2), D(x_3, y_3).find the coordinates of C?

➢ Find the midpoint of the line obtained by joining the points (2,6) and (−3, 8)?

➢ A (−2, 1) C (10, 10) are two points in a line. B lies between A and C.

AB: AC = 1:3

      a) Find the length of AB?

      b) Find the coordinates of B?

➢ The points A (5, k) and B (k, 5) are equal distance from P (0, 1). Find k

Solids

Name of the solid	Figure	Volume	Lateral/Curved Surface Area	Total Surface Area
Cuboid		lbh	$2lh + 2bh$ or $2h(l+b)$	$2lh+2bh+2lb$ or $2(lh+bh+lb)$
Cube		a^3	$4a^2$	$4a^2+2a^2$ or $6a^2$
Right circular cylinder		$\pi r^2 h$	$2\pi rh$	$2\pi rh + 2\pi r^2$ or $2\pi r(h+r)$
Right circular cone		$\frac{1}{3}\pi r^2 h$	πrl	$\pi rl + \pi r^2$ or $\pi r(l+r)$
Sphere		$\frac{4}{3}\pi r^3$	$4\pi r^2$	$4\pi r^2$
Hemisphere		$\frac{2}{3}\pi r^3$	$2\pi r^2$	$2\pi r^2+\pi r^2$ or $3\pi r^2$
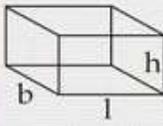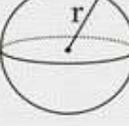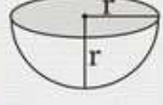
Exercise

➢ The base radius and height of a solid metal cylinder are 20cm and 18 cm respectively. By melting and recasting, how many cones of base radius 6cm and height 5cm can be made?

➢ All the edges of a square pyramid are equal. Total length of all edges is 144. Find the volume of the square pyramid?

➢ A circle is cut into 8 sectors. From there one sector is taken and rolled up to form a cone. What is the ratio of the base radius and slant height of the cone?

Statistics

✓ Mean $= \dfrac{x_1 + x_2 \dots\dots + x_n}{n}$

✓ Median

- o Arrange the given data in ascending or descending order.
- o When the total frequency 'n' is an odd number then the observation of $(\frac{n+1}{2})^{th}$

    Frequency, is the median.

- o If n is an even number, then half of the sum of $(\frac{n}{2})^{th}$ frequency and $(\frac{n}{2} +1)^{th}$ frequency, determines the median.

Exercises

➢ 6,7,8,9,11,15,13

a) Find the mean?

b) Find the median?

➢ Some household in a neighbourhood are sorted according to their monthly income in the table below.

Monthly income	No. of house holds
1000	2
2000	3
3000	2
4000	4
5000	2
6000	5
7000	3

Calculate the median income?

➢ The table below shows number of students in a school and their marks,

marks	No. of students
4	8
6	5
10	3
15	2
20	3

Find mean and median?