welcome student today we are going to start straight lines before we start straight line we must have some idea about rectangular coordinates

so here we have two perpendicular line x x dash and y y dash this horizontal x x dice is called x axis called x axis x x dash called x axis and vertical line y y dash is called y axis suppose you have to locate any point on this plane we know that in this plane we have infinitely many points and every points have its unique position unique location say this point p now this point p is at three distance on x axis and also 3 distance on y axis

so coordinate of this point is 3 3 means this is three and this is three

so distance on x axis is three and distance one y axis is also three in this way we can locate any point on this plane say any point on the x axis this point at distance from origin 5 and on y axis a distance is zero

so coordinate of this point is what five zero similarly we can locate point on y axis in the left of x axis in the left of y in the down of y axis now this two mutually perpendicular line divide this plane into four quadrant and the numbering of this quadrant in anticlockwise direction this is first this is second this is third quadrant and this is fourth quadrant sign of first quadrant is plus plus y plus plus because the right of x right of x axis is plus and upward of y axis is also plus

so any point in this quadrant has sine plus plus similarly in second quadrant the sign of second quadrant is minus plus sign of third quadrant is minus minus and sine of fourth quadrant is plus minus

so this is something about rectangular coordinate that you must have to know now how can you find distance of any two points in a plane here we have two point p x one y one and q x two y two now the distance between these two point say this is d then how can you find the the distance between these two point that is d now for this we just draw two perpendicular the perpendicular drawn from p on x axis that is p m and perpendicular drawn from q on x axis is say p q m now again draw a perpendicular p r on q n now we have right angle triangle p q r

so in this right angle triangle these is hypotenuse

so by pythagoras theorem in right angle triangle p q r p q s square is equal to what p q square is equal to p r square plus q r s square this implies d square is equal to p r means x two minus x one y x two minus x one because the coordinate of p is x one y one and coordinate of p is q x two i two

so this distance is what this m n is x two minus x one this o when is x two and this om is x one

so this o n m n is x two minus x one

so this p r is also x two minus x one

so x two minus x one whole square plus similarly this q r is y two minus y one

so y two minus y one whole square and we know that distance is absolute quantity it is never negative

so we take d as a square root of x two minus x one whole square plus y two minus y one whole square now we have some problem let us discuss one problem on distance formula we have two points p one three and q minus two one

so this is x axis and this is y axis this is always in

so p 1 3 1 2 3 and this is 1 2 and this is minus 1 minus 2

so p one three p one three means this point is p one three and q minus two one this point is q minus 2 1

so join this point p q we have to find the distance of this p q

so by distance formula p q is equal to square root of x two minus x one whole square plus y two minus y one whole square

so now put the value of x 2 x 1 y 2 y 1

so either you take this as a first quadrant coordinate coordinate and this has

second or this as a first is a second no problem
so x two one plus two one plus two whole square plus three minus one whole square
so this is what this is nine and this is four
so root thirteen unit in this way we can use this formula for different purpose like another example
so that the point minus three one two four and zero minus four are vertices of a right-wing triangle
so again we take first of all locate these three points this is x this is y
so 1 2 3 4 minus 1 minus 2 minus 3 1 2 3 then minus one minus two minus three minus three one
so this point is say a minus three one two four this point is b two four zero minus four this is zero zero minus four
so this point is zero minus four say this point is zero minus four now join these three points now we have to prove that this triangle a b c is a right angle triangle
so if this triangle is right angle triangle then square of one side must be equal to the sum of square of other two side
so let us find what is the value of a b s square
so a b by using distance formula we can find a b square is equal to two plus three whole square plus four minus one whole square it means twenty five plus nine equal to thirty four again b c square b c square is equal to two minus zero whole square plus 4 minus 4 4 plus 4 whole square
so this is 4 and this is 64.

so this is sixty eight now ac square is equal to zero plus three plus minus 4 plus 1 whole square
so this is 9 minus minus minus one minus minus one whole square
so this is nine and this is again twenty five equal to thirty four
so we can see here the sum of square of a b square plus a c square equal to b c square means a b square plus a c square is equal to thirty four plus 34 equal to 68 equal to bc square
so by pythagoras theorem we can say this triangle abc is a right angle triangle now you can try these three problem that is find the distance between a b and a plus c b plus d you just use distance formula and you can get the value of distance between these two points similarly we have three point four points is given a one zero b minus two three c two minus 1 and d 5 2 are vertices of parallelogram we have to use here the distance formula as well as the properties of parallelogram and third one is the point x y is on the x axis and six unit away from the point one four find x y
so point on the x axis is what its y coordinate is zero it means obviously y is zero
so we have to find the distance between x 0 and 1 4 the distance between these two point is already given 6 you simplify it and get the value of x and y now very important segment of line
so segment of line means we have a line segment given that is p q join of p q and the coordinate of this p q is given as p x 1 y 1 and q x 2 y 2 and r is a point in between p and q which divide this p q in the ratio m and n m is to n
so and we have to find the coordinate of this point r x y when this ratio is given and another situation when r is given then we have to find the ratio m and is to n
so first of all we have to find the coordinate of this r x y
so we just complete this diagram by drawing perpendicular from p q r that is p l r m and q n all this perpendicular on x axis on x axis this is y axis and this

is origin now again draw a perpendicular shape p t which is perpendicular on both r m and q m intersect at s n t now we have two triangle that is prs and pqt and these two triangles are similar why by using the properties of similarities of triangle this angle is what this angle is 90 degree this angle is 90 degree okay these two lines are parallel

so these angles equal corresponding angles

so by angle angle property these two triangles are means triangle prs similar to triangle p q t ok now if two triangles are similar then we know that their corresponding sides are proportional then their corresponding sides are proportional

so p s this implies p s by p t is equal to p r by p q now this p s is what this p s is x minus x one

so x minus x one by and this p t is what this p t is x two minus x one x two minus x one and this the ratio of this p r and r n r q is given that is m is to n

so p r m and this p q means p r plus r cube

so this is m plus n

so this implies x minus x one is equal to m x 2 minus x 1 by m plus n this implies x is equal to x 1 plus m x 2 minus x 1 by m plus n and when you simplify it you will get m x 2 plus n x 1 by m plus n

so in this way by using this formula we can get the value of this x because m and x 2 x 1 all these values are known similarly we can find the value of y that is m y 2 plus and y one by m plus n ok

so this is this this is called internal section formula because this r lies between p and q and there may be chance or there may be possibilities this r is outside this p q that is called external section

so when this r intersect this p q externally

so when r intersect when r intersect p q externally then simply just change the sign and will get the formula that is x equal to m x 2 minus n x 1 by m minus n and y is equal to m y 2 minus n y 1 by m minus n or you can write it as n x 1 minus m x 2 by n minus m

so we can also write it as n x 1 minus m x 2 by n minus m are m r and y 1 minus m y 2 by n minus m means this n m n in both denominator and numerator lies similarly suppose this r say this is p x one y one and q x two y two if this r is midpoint of this p q

so here we take this r x y as the midpoint of this p q

so this r divides this p q into two equal parts then its ratio is one is to one

so x is equal to 1 into x 2 plus 1 into x 1 by 1 plus 1 it means x one plus x two by two similarly y is equal to y one plus y two by two

so we can use this formula that is x y r x y is equal to x one plus x two by two y one plus y two by two

so this is midpoint formula find the coordinates of the pointer which divides the segment p one three q minus two one in the ratio one is to three

so just draw this line one three

so this point is p 1 3 this is origin and minus 2 1

so this is minus this is minus two

so minus two one this point is q minus two one

so this q p's

so we take outside q p and r which divides say this is r this is r we take r here this is r and this divide is one is to three one or three just take odd side

so this is q minus two one and this is p 1 3 and say this is a point r which is divide this one is to three we have to find the coordinate of this and that is r x y

so x is equal to what by section formula since this r divides this p q internally
so we can use internal section formula
so x is equal to what x is equal to m x 2 plus n x 1 by m plus n this is what this is m and this is n and this is what this is x1 this is y1 and this is x2 this is y2
so the value of m is 1 1 and x 2 this is x 2 1 into 1 plus 3 into minus 2 by 1 plus three
so this is equal to what this is equal to minus six plus one
so minus five by four minus five by four now the value of y is equal to the value of y is equal to what the value of y is equal to this is y two and this is y one
so um y 2 plus n y 1 by m plus n is equal to 1 into y 2 3 1 into 3 plus 3 into y 1 means 1 by 1 plus 3
so this is what this is 6 by 4 means three by two
so r x y is equal to minus five by four and three by two
so in this way we can use section formula now find the coordinates of the midpoint of segment a four one and b three two
so a four one one two three four this is y and this is x a four one
so four one a four one and b three two and b three two
so this is b three two we have to find the midpoint say this is this is midpoint say this mid point is m we have to find the coordinate of this point m
so midpoint formula says x one plus x two by two and y one plus y two by two m x y equal to x one plus x two by two and comma y one plus y two by two
so the coordinate of this midpoint m x y this m x y is x one plus x two any four plus three by two and one plus two by two means seven by two and three by two it means the coordinate of this m is what seven by two and three by two
so in this way we can find the midpoint of any gain given line segment now find the ratio in which the line joining minus two two and four five is cut by the y axis now we have to find a ratio
so first of all locate this point minus two two
so minus 2 2 this is minus 2 2 this point is p minus 2 2 and 4 5.

so this point say this point is four five this is q four five and obviously this p q cut by y axis at this point and we know that the point on y axis is a zero
so say this point is a zero sorry zero zero a zero a the point one y axis is zero a let us suppose that this say this point is r this r divides this p q in k is to one ratio we have to find ratio find the ratio ok
so let r zero a divides p q in k is two one ratio
so zero equal to what zero equal to k into four plus one into minus two by k plus 1 this implies 4 k minus 2 equal to 0 this implies k is equal to one by two
so ratio one is to two now we have to verify this ratio is whether exists for this a or not
so a is means k 1 is to two
so a is equal to one into five plus two into two by one plus two
so nine by three equal to three and we see that this p q intersect this y axis as 3 this p q intersect y axis at 3
so this ratio is correct now area of triangle
so area of triangle for this we use the concept of determinant and you have to learn the concept in class twelve we just use how to explain determinant in simple way
so suppose a1 a2 a3 b1 b2 b3 c1 c2 c3
so we just take sine of plus minus plus

so a 1 now we just take this portion that is b two c three minus b three c two then take sign minus minus a two then b one c three minus b three c one and plus a three b one c two minus b two c one

so you have to just use this concept how to expand this type of determinant

so area of this triangle a b c area of triangle a b c is equal to x one x 2 x 3 y 1 y 2 y 3 and 1 1 1 if the area of this triangle suppose area of this triangle is zero when you calculate this determinant in this way if you find the real equal to zero means area of triangle a b is equal to zero it means this three points a b c are collinear points these three a b c are collinear points

so we can say condition for quality of three points three points x one y one x two y two and x three y three

so just find the area of triangle formed by these three points y one y two y three one one one and say equal to zero this implies points x one y one and x two y two and x three y three are collinear points

so this is very important condition how can you prove that these three points are collinear points now we have an example that is

so that the point two six minus eight one minus two four are collinear

so now what is collinear points what is the meaning of polynomial points three or more than three points lies on same line are called collinear points co co means are the same collinears concurrents coordinates

so co means at the same linear means at the same line

so whenever you have to find the sense of collinear it means these three points lies on same line we have to show it given points are given points say a two six b minus eight one and c minus two four

so find the area of triangle formed by these three points we know that a triangle can be formed by using three points and if area of that triangle is zero it means these three points are collinear points

so means 2 minus 8 minus 2 6 1 4 1 1 1 expand it 2 1 into 1 minus 1 into 4 then plus minus plus minus 6 minus 8 into 1 and minus minus 2 into 1 plus 1 minus 8 into 4 and minus minus two into one is equal to two 1 minus 4 minus 6 minus 8 and minus minus plus

so plus 2 and plus 1 minus 32 minus minus plus plus 2

so this is what this is minus 6 and minus 6 and minus minus this is minus 6

so plus 36 plus 36 and this is minus 30

so minus 36 plus 36 equal to 0

so a b and c are collinear points are collinear points

so in this way we can verify any three points are whether collinear are not collinear now very important concept that is slope of a line what do you mean by slope slope means just inclination inclination along x axis

so here this line inclined in positive direction with x axis and the angle of inclination is theta here and say two points p x one y one and q x two y two on the line now we complete a right angle triangle p q r slope we represent slope by symbol m and if any line say any line makes angle theta with the positive direction of x axis then its slope will be tan theta

so tangent of angle of inclination is called slope of a line when two points on a line is given and this theta is not known

so for this we just complete a right angle triangle that is p q r

so in this right angle triangle p q r this p r is x two minus x one and this q r is y two minus y one now in this right angle triangle this is right angle and if this angle is theta then this angle is also theta by corresponding angle because this p r is parallel to x axis

so tan theta in triangle p q r angle r equal to 90 degree

so tan theta is equal to q r by p r perpendicular by base

so this is y two minus y one by x two minus x one now we just try one example

one problem find the slope of the line passing through the points two three and four nine
so we know that these two line passing through two points two three and four nine say we just draw this is x axis this is y this is zero
so two four say this is one two three four five six seven eight nine one two three four five six seven eight nine
so this is two and this is four and this is three and this is nine
so point is two three
so this point is two three and four nine
so this point is four nine
so we have to find the slope of this line what is the slope of this line means we have to find slope of p q p two three q four nine
so slope of p q of p q that is m is equal to y two minus y one by x two minus x one we have already discussed this formula slope of line when passing through two point can we find by using this formula
so here y two is what y two is say nine nine minus three by four minus two
so this is what six by two
so three
so slope of line slope of line p q equal to three
so in this way we can find slope of a line which passing through two points means difference of ordinates by difference of abscissa slope of a line when two point is given or a line passing through two points then slope of that line is the ratio between difference of ordinate by difference of fc now suppose we take if theta equal to zero what does it mean this line is parallel to x axis that this means this line is parallel to means p q parallel to x axis then its slope is slope of p q equal to zero this is first second if this line p q is parallel to axis if this line is parallel to y axis in that situation theta equal to 90 degree this implies or you can say if theta is 90 degree p q is parallel to y axis
so this implies slope of p q is not defined slope of p q is not defined
so these two information is very important formation
so this is about basic about slope of a line now on the basis of slope of a line how can you say two lines are parallel lines or two lines are perpendicular lines
so this is very important concept of slope of a line now we conclude and discuss in next session you