Section formulae

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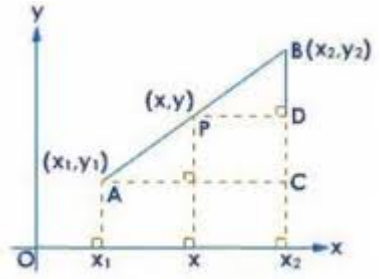
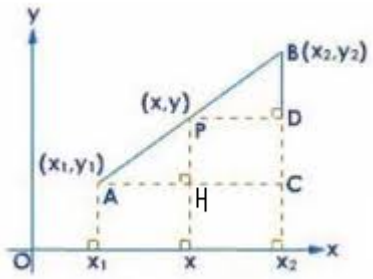
Internal Division



Let A and B be two points and P be a point on the segment joining A and B such that AP: BP = m: n. Then, the point P divides segment AB internally in the ratio m: n.

Coordinates of the point which divides the line segment joining the points (x1, y1) and (x2, y2) internally in the ratio m: n are given by

x = mx2 + nx1 , y = my2 + ny1
m + n m + n



Proof: Let O be the origin and let OX and OY be the x - axis and y – axis respectively. Let A(x1, y1) and B(x2, y2) be the given points. Let (x, y) be the coordinates of point P which divides AB internally in the ratio m: n.

Draw AX1 perpendicular to OX, BX2 perpendicular to OX, PX perpendicular to OX. Also draw AH and PD perpendiculars from A and P on PX and BX2 respectively. Then, OX1 = x1, OX = x, OX2 = x2, AX1 = y1, PX = y and BX2 = y2.

AH = X1X = OX – OX1 = x = x1, PH = PX – HX = PX – AX1 = y – y1
PD = XX2 = OX2 – OX = x2 – x
and, BD = BX2 – DX2 = BX2 – PX = y2 – y.
Now, ?AHP and ?PDB are similar.
= =
= =
Now, =
mx2 – mx = nx – nx1
mx + nx = mx2 + nx1
x = mx2 + nx1
m + n
and, =

my2 – my = ny – ny1
my + ny = my2 + ny1
y = = my2 + ny1
m + n
Thus, the coordinates of P are mx2 + nx1 , my2 + ny1
m + n m + n

External Division

Let A and B be two points and P be a point on AB produced such that AP: BP = m: n. Then, the point P divides segment AB externally in the ratio m: n.

Important Note

If P is the midpoint of AB, then it divides AB in the ratio 1: 1, so its coordinates are 1. x1 + 1x2 , 1. y1 + 1. y2 = x1 + x2 , y1 + y2
1 + 1 1 + 1 2 2

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Reference Links :

- http://en.wikipedia.org/wiki/Cartesian_coordinate_system
- http://en.wikipedia.org/wiki/Perpendicular
- http://en.wikipedia.org/wiki/Midpoint

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