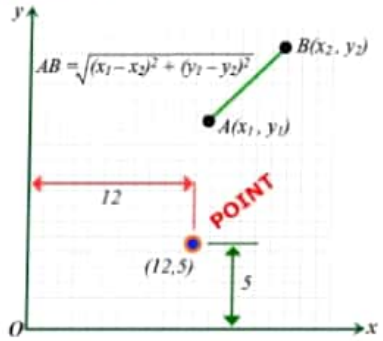
# POINT IN 2D CARTESIAN SYSTEM

## Point Definition

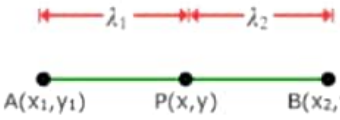
**Point is an exact location. It has no size, only position.**




## Section Formula

### Internally

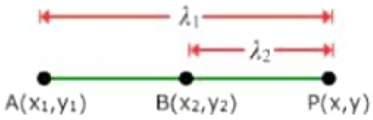
When P divides AB in ratio $\lambda_1 : \lambda_2$




$$P\left(\frac{\lambda_1 x_2 + \lambda_2 x_1}{\lambda_1 + \lambda_2}, \frac{\lambda_1 y_2 + \lambda_2 y_1}{\lambda_1 + \lambda_2}\right)$$

### Externally

When P divides AB in ratio $\lambda_1 : \lambda_2$

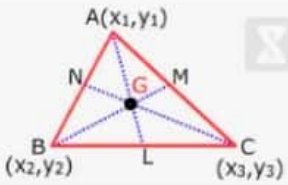



$$P\left(\frac{\lambda_1 x_2 - \lambda_2 x_1}{\lambda_1 - \lambda_2}, \frac{\lambda_1 y_2 - \lambda_2 y_1}{\lambda_1 - \lambda_2}\right)$$

## Special points in a triangle with 2D co-ordinates

### Centroid (G)

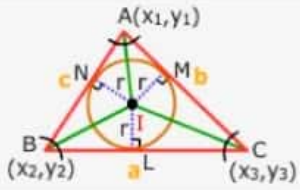
Point of intersection of medians




$$G\left(\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3}\right)$$

### Incentre (I)

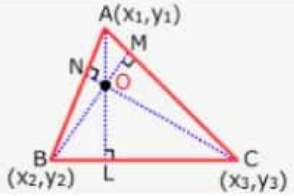
Point of intersection of angle bisectors




$$I\left(\frac{ax_1 + bx_2 + cx_3}{a+b+c}, \frac{ay_1 + by_2 + cy_3}{a+b+c}\right)$$

### Orthocentre (O)

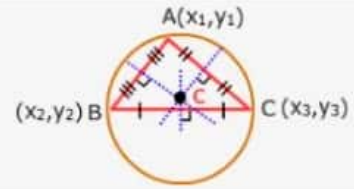
Point of intersection of Altitudes




$$O\left(\frac{x_1 \tan A + x_2 \tan B + x_3 \tan C}{\tan A + \tan B + \tan C}, \frac{y_1 \tan A + y_2 \tan B + y_3 \tan C}{\tan A + \tan B + \tan C}\right)$$

### Circumcentre (C)

Point of intersection of perpendicular bisectors




$$C\left(\frac{x_1 \sin 2A + x_2 \sin 2B + x_3 \sin 2C}{\sin 2A + \sin 2B + \sin 2C}, \frac{y_1 \sin 2A + y_2 \sin 2B + y_3 \sin 2C}{\sin 2A + \sin 2B + \sin 2C}\right)$$