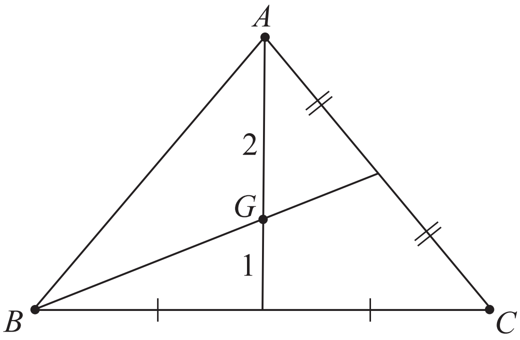
LC 2017: Paper 2

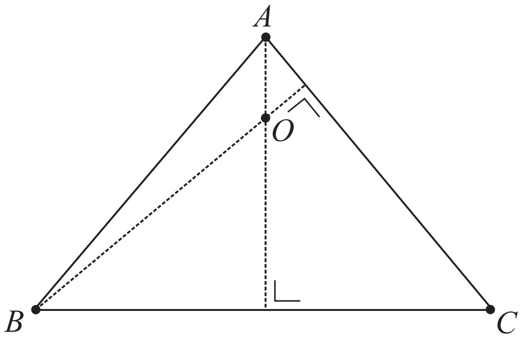
Question 3 (25 marks)

Centroid of a triangle

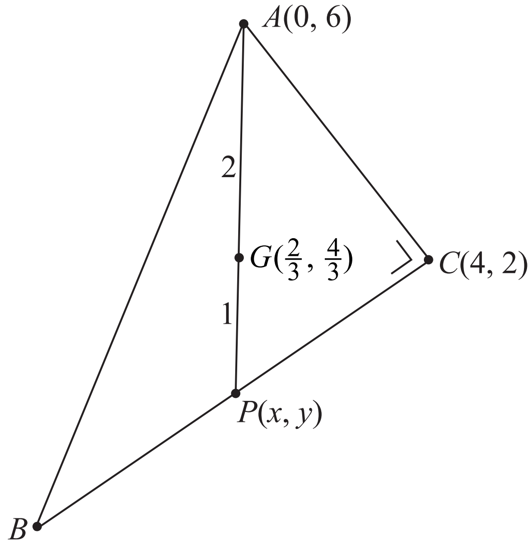


A median is a line from a vertex to the midpoint of the opposite side. The **centroid** G is the intersection of the medians. G divides the median in the ratio 2:1.

Orthocentre of a triangle



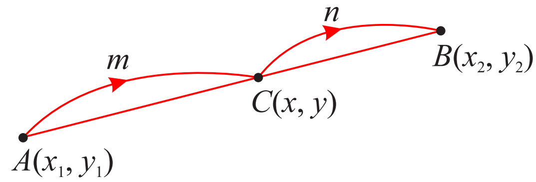
An altitude is a line from a vertex perpendicular to the opposite side. The **orthocentre** O is the intersection of the altitudes.



Internal division of a line

The point between $A(x_1, y_1)$ and $B(x_2, y_2)$ that divides $[AB]$ in the ratio $m:n$ is given by $C(x, y)$, where:

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



Question 3 (a)

2	1
$A(0, 6)$	$P(x, y)$

Centroid $G(\frac{2}{3}, \frac{4}{3})$

$\frac{2}{3} = \frac{2x+0}{2+1} = \frac{2x}{3} \Rightarrow x = 1$

$\frac{4}{3} = \frac{2y+6}{2+1} = \frac{2y+6}{3} \Rightarrow 4 = 2y + 6 \Rightarrow y = -1$

$\therefore P(1, -1)$

Question 3 (b)

P is the midpoint of BC.

$C(4, 2) \to P(1, -1) \to B(-2, -4)$

Question 3 (c)

In order for C to be the orthocentre of the triangle ABC: The altitudes from vertices A and B are the sides AC and BC which will be perpendicular to each other at C.

$A(0, 6), B(-2, -4), C(4, 2)$

Slope of AC: $m_1 = \frac{2-6}{4-0} = \frac{-4}{4} = -1$

Slope of BC: $m_2 = \frac{2+4}{4+2} = \frac{6}{6} = 1$

$m_1 \times m_2 = -1 \times 1 = -1 \Rightarrow AC \perp BC$

$\therefore C$ is the orthocentre of ΔABC.