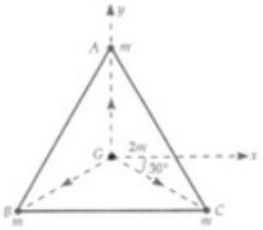
QUES 06:-

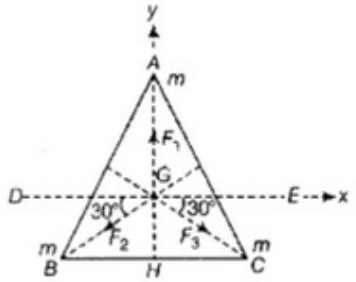
Three equal masses of m kg each are fixed at the vertices of an equilateral triangle ABC (in the figure)



i. What is the force acting on a mass 2 m placed at the centroid G of the triangle?

ii. What is the force, if the mass at vertex A is doubled? (Take, AG = BG = CG = 1 m)

i. In the given figure, △ ABC



Mass of each body A, B and C = m

$F_1 = \frac{G \times m \times 2m}{(1)^2} = 2Gm^2$ along GA

$F_2 = \frac{G \times m \times 2m}{(1)^2} = 2Gm^2$ along GB

$F_3 = \frac{G \times m \times 2m}{(1)^2} = 2Gm^2$ along GC

Then, $\angle EGC = \angle DGB = 30^o$

Resolving F_2 and F_3 into x and y-axes components. $F_2 cos30^\circ$ along GD and $F_2 sin30^\circ$ along GH and $F_3 cos30^\circ$ along GE and F_3 sin 30° along GH Resultant force on the mass 2m at G. Force at G is $F_1 - (F_2 sin30^\circ + F_3 sin30^\circ)$

$F = 2Gm^2 - \left(2Gm^2 \times \frac{1}{2} + 2Gm^2 \times \frac{1}{2}\right) = 0$

ii. When mass at A is 2m, then gravitational force on mass 2m at G due to mass 2m at A is

Net force, F_1 is G $\frac{2m \times 2m}{1^2} = 4Gm^2$ along GA

Net force getting at G due to masses A, B and C is given by:

$= F_1 - (F_2 sin30^o + F_3 sin30^o)$

$= 4Gm^2 - \left(2Gm^2 \times \frac{1}{2} + 2Gm^2 \times \frac{1}{2}\right)$

$= 2Gm^2$ along GA.