PARALLELOGRAM LAW OF VECTORS

AIM:

To find the weight of the given body using parallelogram law of vectors.

MATERIALS REQUIRED:

Gravesand's apparatus, Given body, Thread, Drawing pins, White drawing sheets, Meter scale, Mirror strips, Spring balance, Slotted weights.

THEORY:

If two vectors acting simultaneously on a particle are represented in magnitude and direction by the two adjacent sides of a parallelogram drawn from a point, then their resultant is completely represented in magnitude and direction by the diagonal of that parallelogram drawn from that point.

Let two vectors P and Q act simultaneously on a particle O at an angle . They are represented in magnitude and direction by the adjacent sides OA and OB of a parallelogram OACB drawn from a point O.Then the diagonal OC passing through O, will represent the resultant R in magnitude and direction.

P and Q are suspended from the two hangers then,

$$\vec{R} = \vec{P} + \vec{Q}$$

$$R=\sqrt{P^2 + Q^2 + 2PQCos\theta} \quad \text{.....(1)}$$

The unknown weight can be calculated from the equation (1)

PROCEDURE:

1. Set the board of Gravesand's apparatus in a vertical position by using a plumb-line. Ensure that the pulleys are moving smoothly.
2. Fix a sheet of white paper on the wooden board with drawing pins.
3. Add weights in the hangers such that the junction of the threads is in equilibrium in the lower half of the paper. Make sure that neither the weights nor the threads touch the board or the table.
4. Bring the knot of the three threads to the position of no-friction.
5. To mark the direction of the force acting along a string, place a mirror strip below the string on the paper . Adjust the position of the eye such that there is no parallax between the string and its image. Mark the two points A1 and A2 at the edges of the mirror where the image of the string leaves the mirror.Similarly, mark the directions of the other two forces by points B1 and B2 and by points X1 and X2 along the strings OB and OX respectively.
6. Remove the hangers and note the weight of each hanger and slotted weights on Them.
7. Place the board flat on the table with paper on it. Join the three pairs of points marked on the paper and extend these lines to meet at O. These three lines represent the directions of the three forces.
8. Choose a suitable scale, say 0.5 N (50 g wt) = 1cm and cut off length OA and OB to represent forces P and Q respectively acting at point O. With OA and OB as adjacent sides, complete the parallelogram OACB. Ensure that the scale chosen is such that the parallelogram covers the maximum area of the sheet.
9. Join points O and C. The length of OC will measure the weight of the given body. See whether OC is along the straight line XO. If not, let it meet BC at some point C′ . Measure the angle COC′ .

10. Repeat the steps 2 to 9 by suspending two different sets of weights and calculate the mean value of the unknown weight.

RESULT:

The weight of the given body=.....g

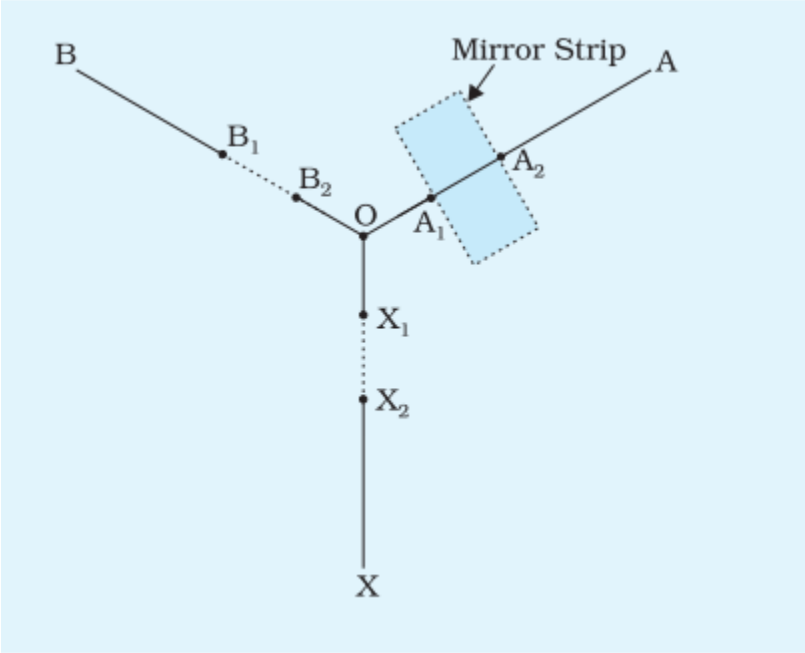
PRECAUTIONS:

1. Mark the points only when weights are rest
2. Ensure that the pulleys are frictionless.
3. Board should be in a perfectly vertical position and it should be stable.

SOURCES OF ERROR:

1. Pulley may not be frictionless.
2. Inaccuracy while marking on the paper.
3. The knot may not be in the middle.

DIAGRAM:



OBSERVATIONS:

NO	FORCES(g.wt)		SIDES(cm)			RESULTANT FORCE (g.wt)	UNKNOWN WEIGHT,W (g.wt)	WEIGHT BY SPRING BALANCE, W' (g.wt)	ERROR $E=(\frac{W'-W}{W}) * 100$ %
	P	Q	OA	OB	OC				
1									
2									
3									

CALCULATIONS:

Weight by spring balance,W'=.....g.wt

P=Q=.....G.WT

OA=OB=.....cm

OC=.....cm

Unknown weight,W=.....