RD Sharma Solutions Class 11 Maths Chapter 23 Ex 23.17

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Straight lines Ex 23.17 Q1

Let $ABCD$ be a parallelogram the equation of whose sides AB, BC, CD and DA are a_1x_1, b_1y_1, $c_1 = 0$, $a_2x + b_2y + c_2 = 0$, $a_1x + b_1y + d_1 = 0$ and $a_2x + b_2y + d_2 = 0$.

Let p, and p_2 be the distance between the pairs of parallel side of $ABCD$.

$$\sin\theta \frac{p_1}{AD} = \frac{p_2}{AB}$$

$$\therefore \quad AD = \frac{p_1}{\sin\theta} \text{ and } AB = \frac{p_2}{\sin\theta}$$

$$\text{Area of } ABCD = AB \times p_1 = \frac{p_1p_2}{\sin\theta}$$

$$\text{or} \quad \Rightarrow AD \times p_2 = \frac{p_1p_2}{\sin\theta}.$$

Now,

$$m_1 = \text{slope of } AB = \frac{a_1}{b_1}$$

$$m_2 = \text{slope of } AD = \frac{-a_2}{b_1}$$

Since θ is angle between AB and AC.

$$\tan\theta = \frac{m_1 - m_2}{1 + m_1m_2}$$

$$= \frac{\frac{-a_2}{b_2} + \frac{a_1}{b_1}}{1 - \frac{a_1a_2}{b_1b_2}}$$

$$\tan\theta = \frac{a_2b_1 - a_1b_2}{a_1a_2 + b_1b_2} \Rightarrow \sin\theta = \frac{a_2b_1 - a_1b_2}{\sqrt{\left(a_1^2 + b_1^2\right)\left(a_2^2 + b_2^2\right)}}$$

P_1 = Distance between AB and AD.

$$= \left|\frac{c_1 - d_1}{\sqrt{a_1^2 + b_1^2}}\right|$$

P_2 = Distance between AD and BC.

$$= \left|\frac{c_2 - d_2}{\sqrt{a_2^2 + b_2^2}}\right|$$

$\therefore$ Area of parallelogram is

$$\frac{|c_1 - d_1||c_2 - d_2|}{|a_2b_1 - a_1b_2|} \qquad \text{Hence, proved.}$$

(ii) Rhombus is a paralleogram with all side equal.

$$\therefore \quad P_1 = P_2$$

$\therefore$ Modifing the formula of area of parallelogram devided above.
The area of rhombus

$$= \frac{P_1P_2}{\sin\theta}$$

$$2p_1 \qquad 2p_2$$

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$= \frac{[illegible]}{\sin\theta} = \frac{[illegible]}{\sin\theta}$

$$= 2\left|\frac{(c_1 - d_1)}{a_2b_1 - a_1b_2}\right| \text{ or } 2\left|\frac{(c_2 - d_2)}{a_2b_1 - b_2a_1}\right|$$

Straight lines Ex 23.17 Q2

The area of a parallelogram is

$$= \frac{|c_1 - d_1||c_2 - d_2|}{|a_2b_1 - b_2a_1|}$$

$$= \frac{|-a + 2a||3a - a|}{|3(-3) - 4(-4)|}$$

$$= \frac{a \times 2a}{7}$$

$$= \frac{2}{7}a^2$$

Hence, proved.

Straight lines Ex 23.17 Q3

Let $ABCD$ be a parallelogram as shown in the following figure.

We observe that the following parallelogram is a rhombus, as distance between opposite sides $(AB$ and $CD)$ and $(AD$ and $BC)$ is equal $= (n - n')$.

And in a Rhombus, diagnals are perpendicular to eah other.

$\therefore$ Angle between the two diagnals is 17/2.

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