Question.

The resultant of two forces at right angles is 5N. when the angle between them is 120°; the resultant is √13N then magnitudes of those two forces are

Given:

$F_1 = 5\ N$

$\alpha_1 = 90°$

$F_2 = \sqrt{13}\ N$

$\alpha_2 = 120°$

Find:

$f_1 = ?$

$f_2 = ?$

Solution.

We have two pictures (figures, situations).
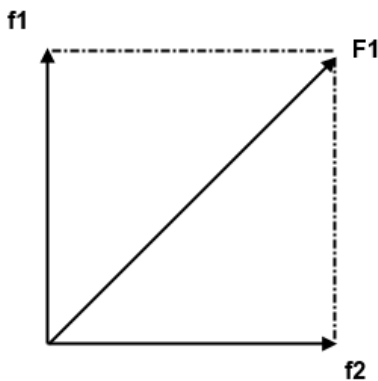
Consider the first situation:

Fig.1. First situation(right angle).

In this case:

$$F_1^2 = f_1^2 + f_2^2$$
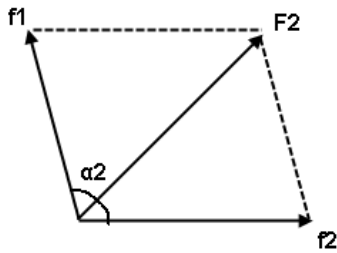
Consider the second situation:

Fig.2.1. Second situation (angle α_2).
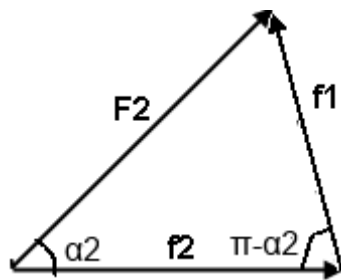
Or it can be represented by the triangle rule:

Fig.2.2. Second situation (angle α_2). Triangle rule.

Use the law of cosines:

$$F_2^2 = f_1^2 + f_2^2 - 2f_1f_2 \cos(\pi - \alpha_2)$$

Thus, we obtained the system of equations for f_1 and f_2:

$$\begin{cases} f_1^2 + f_2^2 = F_1^2 \\ f_1^2 + f_2^2 - 2f_1f_2 \cos(\pi - \alpha_2) = F_2^2 \end{cases}$$

Substitute F_1, F_2, α_2:

$$\begin{cases} f_1^2 + f_2^2 = 25 \\ f_1^2 + f_2^2 - f_1f_2 = 13 \end{cases}$$

Solution of this system of equations is:

$f_1 = 3$; $f_2 = 4$ or $f_1 = 4$; $f_2 = 3$

Answer.

$f_1 = 3\ N$

$f_2 = 4\ N$