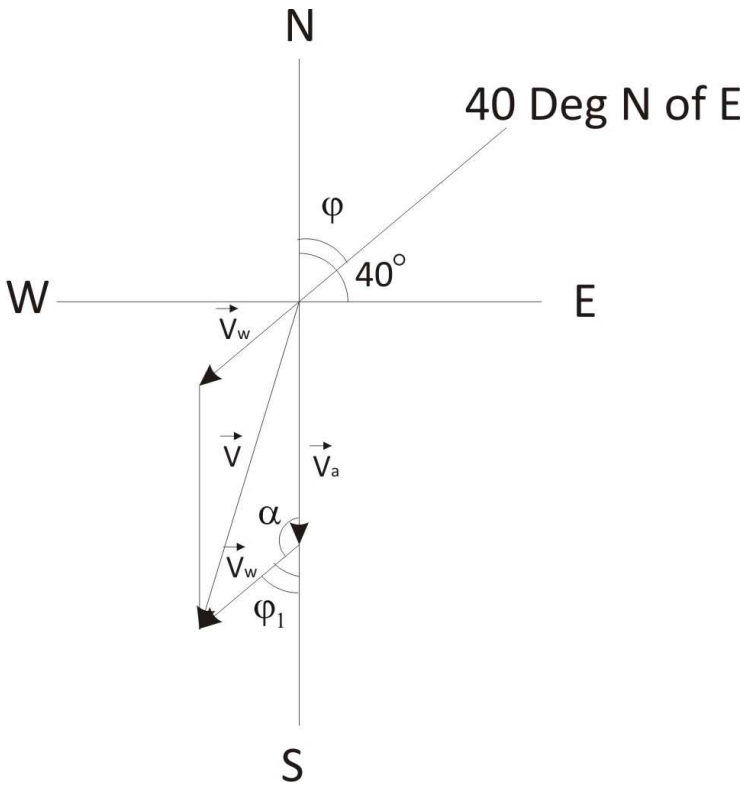
A jet aircraft is aimed south and travelling 851km/h. A wind blows the plane from 40 degrees N of E at 36km/h. What is the plane's resultant velocity?

Solution.

$$v_a = 851\frac{km}{h}, v_w = 36\frac{km}{h};$$

$$v - ?$$



v_a - the velocity of the aircraft.
v_w - the velocity of the wind.
v - the resultant velocity of the aircraft.

A wind blows the plane from 40 degrees N of E as on the diagram.

By the diagram:

An angle $\varphi = 90° - 40° = 50°$.

$\varphi_1 = \varphi = 50°$, as the angles between mutually parallel lines.

An angle $\alpha = 180° - \varphi_1 = 180° - 50° = 130°$.

$$\alpha = 130°.$$

By the diagram there is a triangle with sides: v_a, v_w, v.

By Law of cosines:

$$v^2 = v_a^2 + v_w^2 - 2v_a v_w cos\alpha.$$

The resultant velocity of the aircraft is:

$$v = \sqrt{v_a^2 + v_w^2 - 2v_a v_w cos\alpha}.$$

$$v = \sqrt{\left(851\frac{km}{h}\right)^2 + \left(36\frac{km}{h}\right)^2 - 2 \cdot 851\frac{km}{h} \cdot 36\frac{km}{h} \cdot cos(130°)} = 874.6\frac{km}{h}.$$

Answer: The resultant velocity of the aircraft is $v = 874.6\frac{km}{h}$.