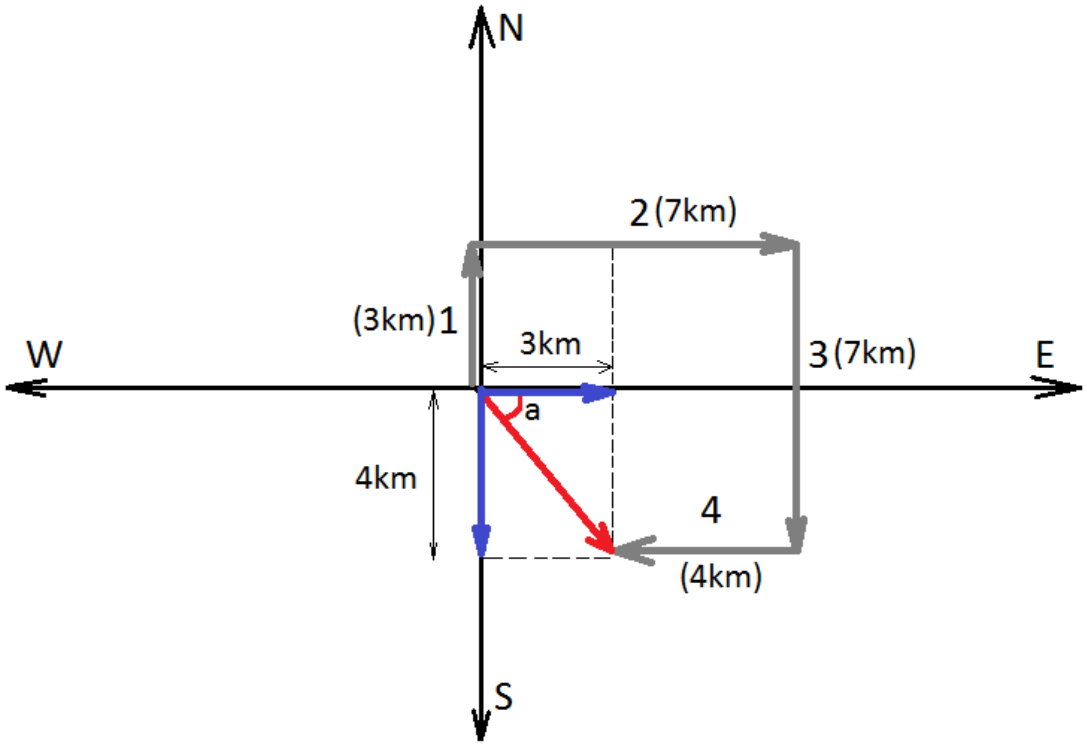
A man is lost in the woods. He wanders 3.0km N, then 7.0km E, then 7km S, then 4km W. What is the magnitude and direction of his resultant displacement?

Solution:



Consider separately vertical movement (north and south) and horizontal movement (east and west):

Vertical: man wandered 3 km north and 7 km south, therefore he wandered:

$$7km - 3km = 4\ km\ south$$

Horizontal: man wandered 7 km east and 4 km west, therefore he wandered 7 - 4 = 3 km east.

$$7km - 4\ km = 3\ km\ east$$

So man wandered 4 km south and 3 km east.

By the Pythagorean theorem we find the magnitude of resultant displacement:

$$S = \sqrt{3km^2 + 4km^2} = 5\ km$$

Direction of resultant displacement: of rectangular triangle we can find the arc tangent of the angle a:

$$\mathrm{a} = \tan^{-1}(\frac{4}{3})$$

Answer: magnitude of resultant displacement: $S = 5\ km$

Direction of resultant displacement: $\tan^{-1}(\frac{4}{3})$ degrees from east towards south.