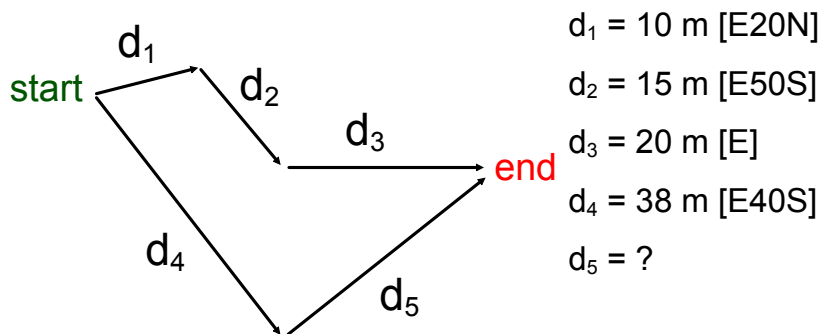


Subtracting all the vectors from the resultant to determine the missing one works in all cases, but sometimes the resultant may not be given (but there is enough information to calculate it).

Take the example below:

Two people walk separate paths but want to arrive at the same place a while later. Refer to the diagram and calculate what vector the second person must take to reach their desired location.



No resultant is given! You could calculate it by adding all the vectors in the top path, then subtract  $d_4$  to get  $d_5$ . That will work but requires more calculations than necessary and that increases the chance of mistakes :(

Since both paths end at the same place each have the same resultant:

$$R_{\text{path1}} = R_{\text{path2}}$$

therefore,

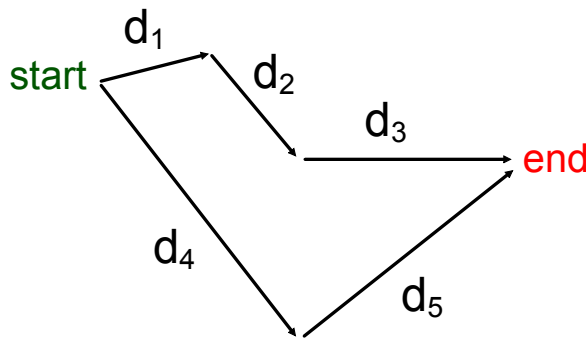
$$d_1 + d_2 + d_3 = d_4 + d_5$$

solve for  $d_5$ ,

$$d_5 = d_1 + d_2 + d_3 - d_4$$

$d_1 + d_2 + d_3$ 
  
 resultant

You folks go ahead and take it from here



$$d_1 = 10 \text{ m [E}20\text{N]}$$

$$d_2 = 15 \text{ m [E}50\text{S]}$$

$$d_3 = 20 \text{ m [E]}$$

$$d_4 = 38 \text{ m [E}40\text{S]}$$

$$d_5 = ?$$

$$\mathbf{d_5 = d_1 + d_2 + d_3 - d_4}$$

$$d_{1E} = 10 \cos 20 = \underline{9.4} \quad d_{1N} = 10 \sin 20 = \underline{3.4}$$

$$d_{2E} = 15 \cos 50 = \underline{9.6} \quad d_{2N} = -15 \sin 50 = \underline{-11.5}$$

$$d_{3E} = \underline{20} \quad d_{3N} = \underline{0}$$

$$d_{4E} = 38 \cos 40 = \underline{29.1} \quad d_{4N} = -38 \sin 40 = \underline{-24.4}$$

$$d_{5E} = d_{1E} + d_{2E} + d_{3E} - d_{4E} \quad \left| \quad d_{5N} = d_{1N} + d_{2N} + d_{3N} - d_{4N} \right.$$

$$d_{5E} = 9.4 + 9.6 + 20 - 29.1$$

$$= \underline{9.9 \text{ m}}$$

$$d_{5N} = 3.4 + (-11.5) + 0 - (-24.4)$$

$$= \underline{16.3 \text{ m}}$$

$$|\vec{d}_5| = \sqrt{(d_{5E})^2 + (d_{5N})^2}$$

$$= \sqrt{(9.9)^2 + (16.3)^2}$$

$$= 19.1 \text{ m}$$

$$\theta = \tan^{-1} \left| \frac{d_{5N}}{d_{5E}} \right| = \tan^{-1} \left( \frac{16.3}{9.9} \right)$$

$$\theta = 59^\circ$$

$$\boxed{\vec{d}_5 = 19.1 \text{ m [E}59^\circ\text{N]}}$$