Higher Vectors and Scalars Questions

1. a) What is meant by the term **'Scalar Quantity'**?

b) What is meant by the term **'Vector Quantity'**?

2. Draw a table with the headings **Scalar** and **Vector** then list each of the quantities below into the table.

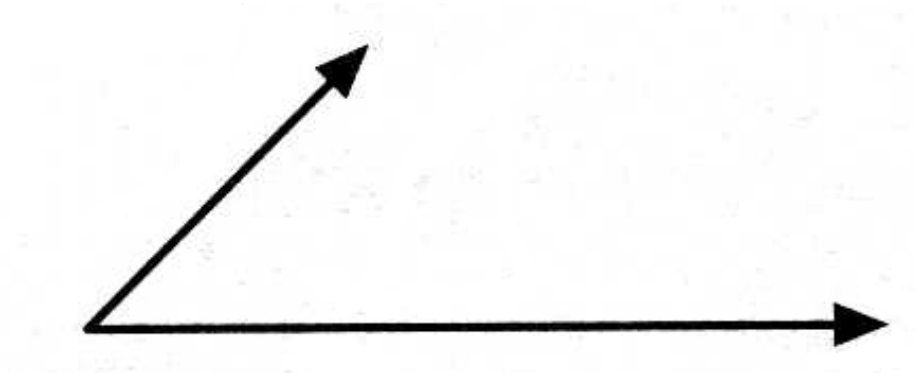
Speed, displacement, momentum, mass, distance, velocity, acceleration, power, time, weight, energy and force.

3. A group of students walked the following course for charity in **8 hours**:

- **7km** due **South** followed by
- **12km** due **West** followed by
- **4km** due **North**.

a) Total distance travelled.
b) **Average Speed** in **kmh^{-1}**.
c) Displacement
d) **Average Velocity** in **kmh^{-1}**.

4. The diagram below shows two vectors added **'tail to tail'**.



Draw the resultant of these two vectors.

5.

During athletics training a runner jogs north along a track for a distance of 40 m. He then turns and jogs east for a distance of 30 m. This takes a total time of 20 s.

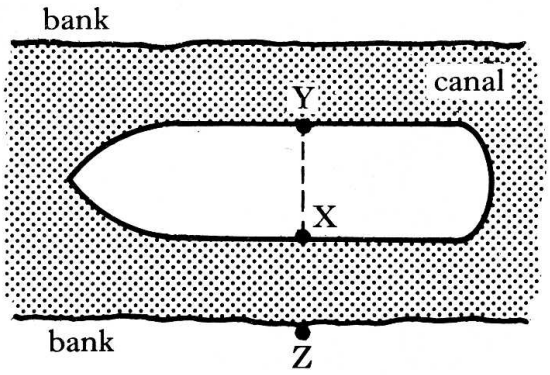
(*a*) (i) What is the size in metres of the displacement of the runner?

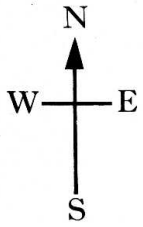
(ii) Find the direction of the resultant displacement.

(*b*) Find his average velocity of the runner during this activity.

6.

A barge is travelling, with a velocity of $2{\cdot}0\,\text{m s}^{-1}$ due west, along a canal. A girl runs, with a speed of $4{\cdot}8\,\text{m s}^{-1}$, from X to Y across the deck of the barge as shown below.



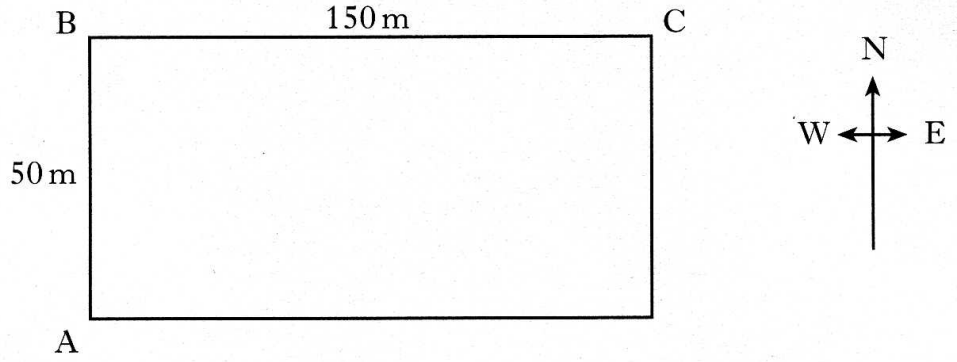


By drawing a scale diagram or otherwise, find the resultant velocity of the girl relative to someone at point Z on the bank of the canal.

7.

A spectator at A walks to C, the opposite corner of a playing field, by walking from A to B and then from B to C as shown in the diagram below.

The distance from A to B is 50 m. The distance from B to C is 150 m.

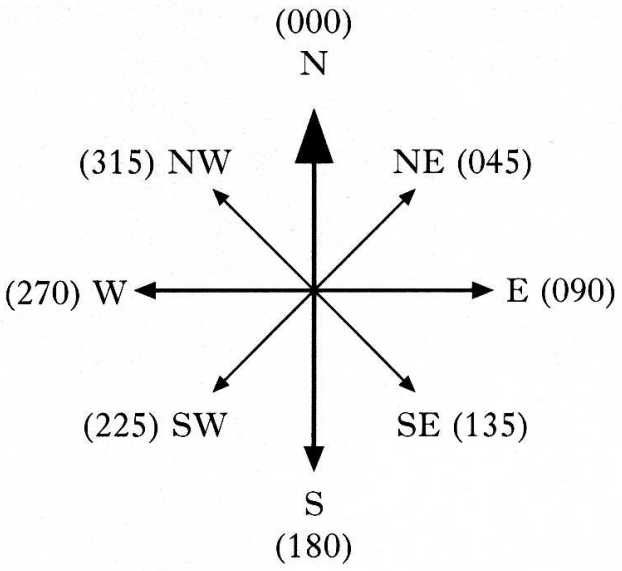


By scale drawing or otherwise, find the resultant displacement. Magnitude and direction are required.

8.

During a flight the aircraft is travelling with a velocity of 36 $m\,s^{-1}$ due north (000).

A wind with a speed of 12 $m\,s^{-1}$ starts to blow **towards** the direction 40° west of north (320).

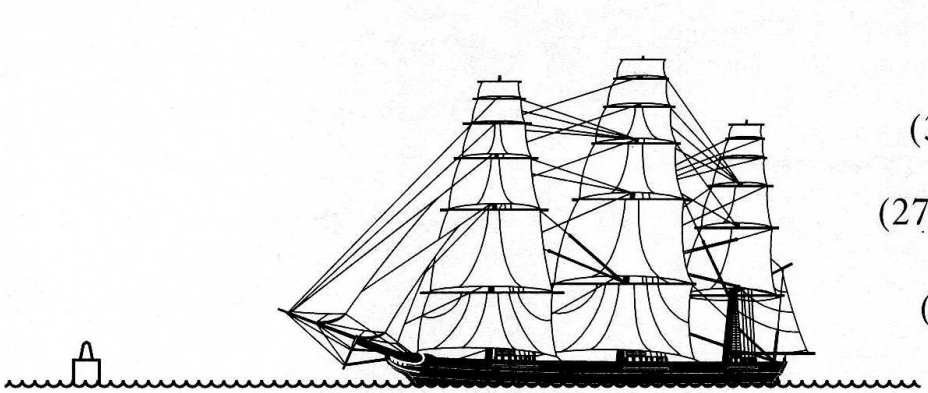


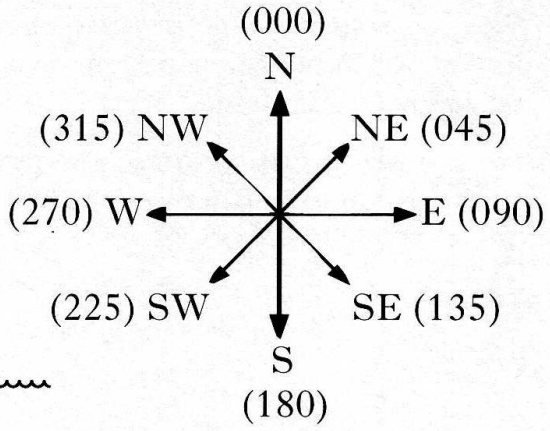
Find the magnitude and direction of the resultant velocity of the aircraft.

9.

(*a*) State the difference between speed and velocity.

(*b*) During a tall ships race, a ship called the Mir passes a marker buoy X and sails due West (270). It sails on this course for 30 minutes at a speed of $10{\cdot}0\,\text{km}\,\text{h}^{-1}$, then changes course to 20° West of North (340). The Mir continues on this new course for 1½ hours at a speed of $8{\cdot}0\,\text{km}\,\text{h}^{-1}$ until it passes marker buoy Y.





(i) Show that the Mir travels a total distance of 17 km between marker buoys X and Y.

(ii) By scale drawing or otherwise, find the displacement from marker buoy X to marker buoy Y.

(iii) Calculate the average velocity, in $\text{km}\,\text{h}^{-1}$, of the Mir between marker buoys X and Y.

(*c*) A second ship, the Leeuvin, passes marker buoy X 15 minutes after the Mir and sails directly for marker buoy Y at a speed of $7{\cdot}5\,\text{km}\,\text{h}^{-1}$.

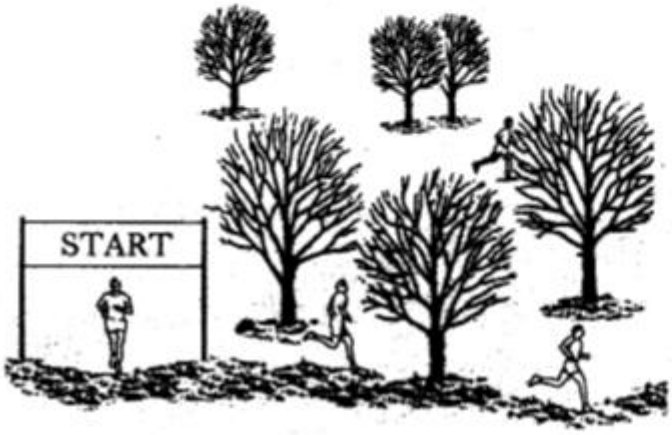
Show by calculation which ship first passes marker buoy Y.

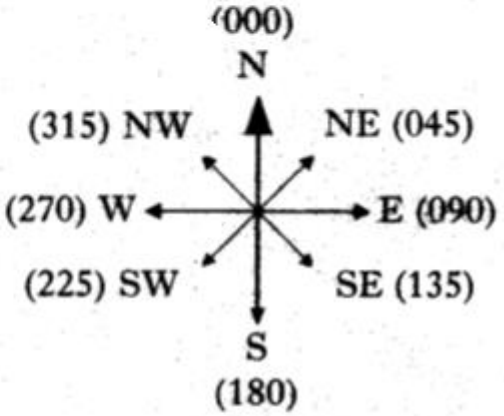
10.

(*a*) State the difference between vector and scalar quantities.

(*b*) In an orienteering event, competitors navigate from the start to control points around a set course.

Two orienteers, Andy and Paul, take part in a race in a flat area. Andy can run faster than Paul, but Paul is a better navigator.





From the start, Andy runs 700 m north (000) then 700 m south-east (135) to arrive at the first control point. He has an average running speed of $3\,m\,s^{-1}$.

(i) By scale drawing or otherwise, find the displacement of Andy, from the starting point, when he reaches the first control point.

(ii) Calculate the average velocity of Andy between the start and the first control point.

(iii) Paul runs directly from the start to the first control point with an average running speed of $2{\cdot}5\,m\,s^{-1}$.

Determine the average velocity of Paul.

(iv) Paul leaves the starting point 5 minutes after Andy.

Show by calculation who is first to arrive at this control point.