

Relative velocities – Tutorial

1. With a tail wind a jet aircraft arrives at its destination 1890 miles away, in 3 hours exactly. Flying against the same wind at the same speed, the plane makes the return trip in 3hrs 22mins. (*hint: work in miles and hours*)

Calculate the wind speed and the plane's airspeed. (*34.3mph, 596mph*)

2. A vintage aeroplane, whose air-speed is 60m/s is flying in an easterly gale of 45m/s. ('easterly' means 'from the east')

(a) Calculate the plane's ground speed and bearing:

(i) when the pilot keeps it **heading** east, (*15m/s, 90°*)

(ii) when the pilot keeps it **heading** north.

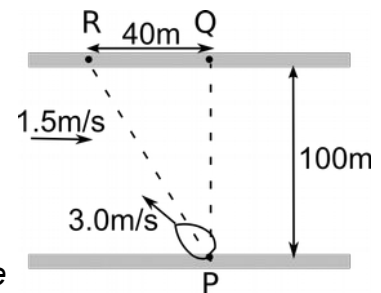
('heading north' means that the plane's nose is pointing north, even though the plane itself does not travel north) (*75m/s, 323°*)

(b) When the plane **travels** due north, calculate:

(i) the plane's ground speed,

(ii) the plane's heading. (*40m/s, 49°*)

3. A boat travels at 3.0m/s. It is crossing a river, 100m wide, flowing 1.5m/s from West to East. The boat starts at point P and needs to land at point R, 40m upstream from point Q, which is directly opposite P.



Calculate the bearing that the boat must steer. (*311°*)

(*hint: draw a diagram of distances, P, Q, R, to find the angle of the resultant velocities, then a diagram of velocities*)

4. Ship A is travelling South (180°) at 20km/h.
Ship B is 5km East (90°) of A and travels at 30km/h.
To meet ship A in the shortest time:

(a) what bearing should B steer?

(b) how long does B take to meet A? (*228°, 13min*)

5. A 'drone' aircraft is flying at a steady speed of 200km/h NE (45°).
An aircraft, flying at 300km/h, initially 100km due S (180°) wants to intercept it in the shortest time.

Calculate

(a) the bearing the jet should fly,

(b) the time taken to meet up with the drone. (*28°, 48min*)