

PQ 2 Q

Vectors

Q1

Calculate the resultants of the following combinations of vectors. Your answer must include both magnitude and direction.

- (a) 30 km north + 50 km south.
- (b) 15 newtons east + 5 newtons west.
- (c) 20 m s^{-1} north + 20 m s^{-1} east.
- (d) Acceleration of 30 m s^{-2} west and 40 m s^{-2} south.

Q2

A ship sailed 15.0 km north, then 20.0 km east, followed by 10.0 km south. Calculate its final displacement from its starting point.

Q3

A motor boat heads due east at 10.0 m s^{-1} on a current moving towards south 30° west at 5.0 m s^{-1} . Find the resultant velocity of the boat.

Q4

Two cars collide on an icy road. Car A had a momentum of $3.0 \times 10^4 \text{ kg m s}^{-1}$ in a direction south 20° east and car B had a momentum of $4.0 \times 10^4 \text{ kg m s}^{-1}$ in a direction east 20° north. After the collision the cars locked together and slid off with a momentum equal to the vector sum of the original momenta. Calculate this vector sum.

Q5

Calculate the resultants of the following. Your answers must contain both magnitude and direction.

- (a) 26 m east – 13 m west.
- (b) 15 m s^{-1} south – 24 m s^{-1} north.
- (c) 40.0 kg m s^{-1} south – 30.0 kg m s^{-1} east.
- (d) 20.0 newtons at 200° – 15.0 newtons at 110° .
- (e) 48 m s^{-2} west 30° south – 36 m s^{-2} north 40° west.

Q6

Two forces act on an object. One force is 35 newtons towards the west. Calculate the other force given that the resultant of the two forces is 35 newtons towards 240° .

Q7

An aeroplane is to fly 200 km to the east in 1 hour. There is, however a wind blowing at 50 km h^{-1} from the south. Calculate the direction and speed the aeroplane has to fly to reach its destination on time.

Q8

A car travelling north at 16 m s^{-1} turned a corner to the east maintaining the same speed. Calculate the change in velocity.

Q9

In order to keep going in a direction of north 10° east at 15 km h^{-1} a boat had to sail on a heading of north 20° east at 18 km h^{-1} to counteract the current. Calculate the strength of the current in magnitude and direction.