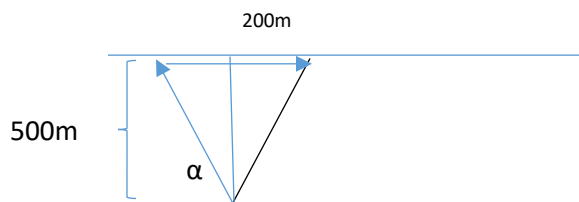
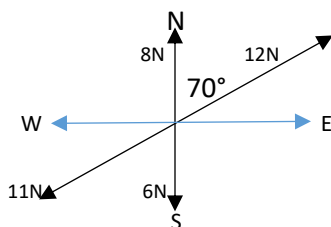


## Force and Velocity Questions

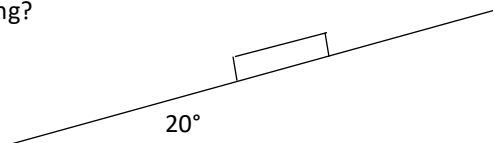
- Determine the magnitude and direction of the resultant if an 8N force and an 11N force act at an angle of  $50^\circ$  to each other.
- Determine the magnitude and direction of the equilibrant if a 13N force and a 7N force act at an angle of  $120^\circ$  to each other.
- If the component wind is from  $N30^\circ W$  at 40 km/h and the plane is steering  $E20^\circ S$  at an airspeed of 200 km/h, determine the resultant velocity of the plane.
- An airplane is being steered at  $N10^\circ W$  with an airspeed of 250 km/h. The resultant velocity of the plane is  $N15^\circ W$  at 260 km/h. What is the velocity of the wind?
- Joe is walking 5 m/s at  $N40^\circ E$  and Tim is walking 4 m/s  $S10^\circ E$ . What is Joe's velocity relative to Tim?
- Fiona is driving 80km/h  $S30^\circ E$  and Geraldine's velocity relative to Fiona is 100 km/h  $N10^\circ W$ . What is Geraldine's velocity?
- Determine the magnitude of the tension in the two ropes in each of the following situations:
  - Two ropes make angles of  $50^\circ$  and  $30^\circ$  with the ceiling, holding a weight of 16kg
  - Two ropes of length 5m and 4m are placed 7m apart on a ceiling and hold a weight of 20 kg.
- Determine the magnitude of the resultant force if two forces of 30N and 60 N, acting at an angle of  $70^\circ$  to each other, are met by a 100N force acting perpendicularly to the plane containing the two component forces.
- A river is 400 m wide. Lou's motorboat travels 15 m/s (component vector). It wants to end up at a spot 250 m upstream on the other side of the river. If the current flows at 4m/s (component vector), how long will this take?
- Sarah wants to end up on the other side of a 500m wide river, 200 m downstream from where she started. If the current runs at 22m/s (component vector), and her boat travels 21m/s (component vector), what angle should she make with the bank (i.e., state all possible values for  $\alpha$  in the diagram below)? Then, determine how long it will take Sarah to cross to the other side.



- Four forces are arranged as follows. State the magnitude of the resultant force.



- Resolve a force of 20N into two forces perpendicular to each other, such that one component force makes an angle of  $25^\circ$  with the 20 N force. State the magnitudes of the two forces (don't worry about stating direction).
- A 15kg block lies on a smooth ramp that is inclined at  $20^\circ$  to the horizontal. What force, parallel to the ramp, would prevent the block from moving?



- Determine the angle between the two largest forces when forces of 8N, 10 N and 11 N are placed in equilibrium.

**Answers:** ① 17.3N in a direction  $29.2^\circ$  from the 8N force towards the 11N force (or  $20.8^\circ$  from the 11N force towards the 8N force)  
 ② 11.3 N in a direction  $147.6^\circ$  from the 13 N force away from the 7N force (or  $92.4^\circ$  from the 7N force away from the 13 N force)  
 ③ 232.1 km/h  $E26.4^\circ S$  ④ 24.4 km/h  $W11.7^\circ N$  (not  $S58.3^\circ W$  or  $W31.7^\circ S$ ; if you got these answers you may have used the sin law to find an angle when the cos law was the appropriate law to use) ⑤ 8.2 km/h  $N18.1^\circ E$  ⑥ 36.9 km/h  $N37.8^\circ E$  ⑦ a) 102.4 N and 138.0 N; b) 165.8 N and 143.1 N ⑧ 125.4N ⑨ 37.8 s ⑩  $35.2^\circ$  or  $8.4^\circ$  ; length of time is 41.3 seconds or 163.0 seconds ⑪ 2.5N  
 ⑫ 8.5 N and 18.1 N ⑬ 50.3 N ⑭  $135.5^\circ$  (if you said  $44.5^\circ$ , remember that you need to place the vectors tail to tail to determine the angle between them, unlike the diagram that you likely drew ☺)