ASSIGNMENT 2

Q1

(a) Distinguish between scalars and vectors.

(b) Underline **all** the vector quantities in the list below.

acceleration kinetic energy momentum power weight

(c) A force of 7.5 N acts at 40° to the horizontal, as shown in Fig. 1.1.

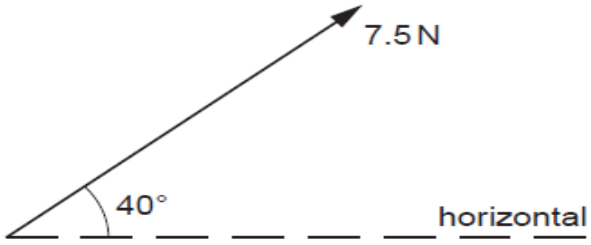

Fig. 1.1

Calculate the component of the force that acts

(i) horizontally,

(ii) vertically.

(d) Two strings support a load of weight 7.5 N, as shown in Fig. 1.2.

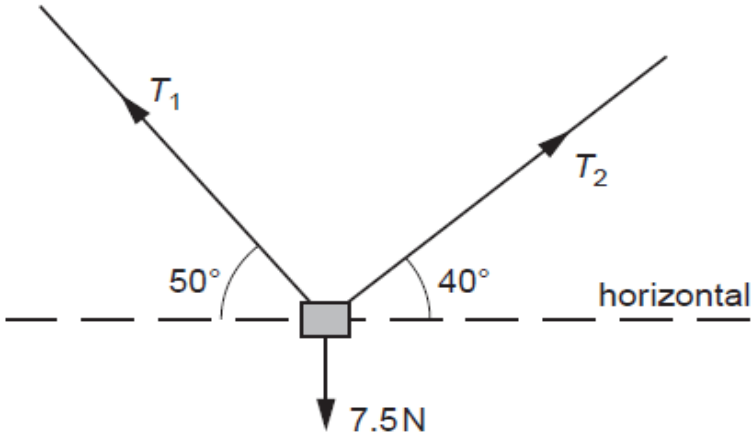

Fig. 1.2

One string has a tension T_1 and is at an angle 50° to the horizontal. The other string has a tension T_2 and is at an angle 40° to the horizontal. The object is in equilibrium. Determine the values of T_1 and T_2 by using a vector triangle or by resolving forces.

Q2

A climber is supported by a rope on a vertical wall, as shown in Fig. 2.1.

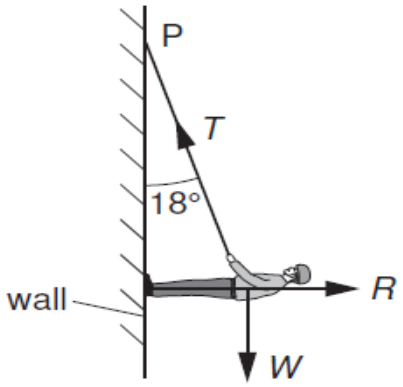

Fig. 2.1

The weight *W* of the climber is 520 N. The rope, of negligible weight, is attached to the climber and to a fixed point P where it makes an angle of 18° to the vertical. The reaction force *R* acts at right-angles to the wall.
The climber is in equilibrium.

(a) State the conditions necessary for the climber to be in equilibrium.

(b) Complete Fig. 2.2 by drawing a labelled vector triangle to represent the forces acting on the climber.

(c) Resolve forces or use your vector triangle to calculate

(i) the tension *T* in the rope,

(ii) the reaction force *R*.

(d) The climber moves up the wall and the angle the rope makes with the vertical increases. Explain why the magnitude of the tension in the rope increases.

Q3

(a) State what is meant by a *scalar* quantity and by a *vector* quantity.

(b) Complete Fig. 1.1 to indicate whether each of the quantities is a vector or a scalar.

quantity	vector or scalar
power	
temperature	
momentum	

Fig. 1.1

(c) An aircraft is travelling in wind. Fig. 1.2 shows the velocities for the aircraft in still air and for the wind.

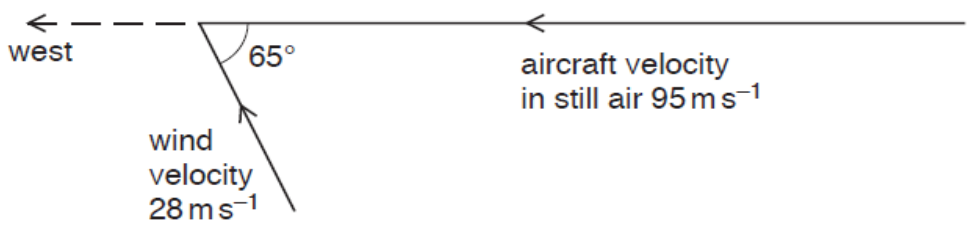

Fig. 1.2

The velocity of the aircraft in still air is $95\,m\,s^{-1}$ to the west.
The velocity of the wind is $28\,m\,s^{-1}$ from 65° south of east.

(i) On Fig. 1.2, draw an arrow, labelled R, in the direction of the resultant velocity of the aircraft. [1]

(ii) Determine the magnitude of the resultant velocity of the aircraft.

Q4

(a) Two forces, with magnitudes 5.0 N and 12 N, act from the same point on an object. Calculate the magnitude of the resultant force *R* for the forces acting

(i) in opposite directions,

(ii) at right angles to each other.

(b) An object X rests on a smooth horizontal surface. Two horizontal forces act on X as shown in Fig. 1.1.

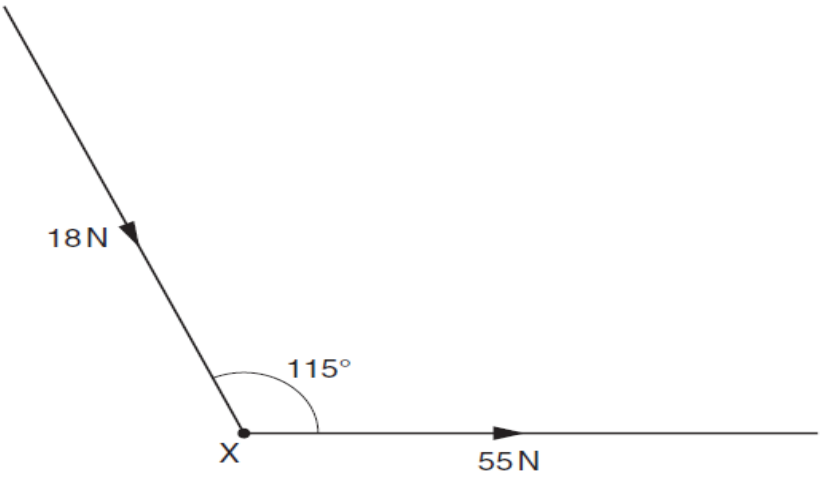

Fig. 1.1 (not to scale)

A force of 55 N is applied to the right. A force of 18 N is applied at an angle of 115° to the direction of the 55 N force.

(i) Use the resolution of forces or a scale diagram to show that the magnitude of the resultant force acting on X is 65 N.

(ii) Determine the angle between the resultant force and the 55 N force.