
Scalars and vectors:

Scalars are quantities having only magnitude. Examples of scalars include mass, energy, power and speed

Vectors are quantities having magnitude as well direction .Examples of vectors include acceleration, velocity, weight

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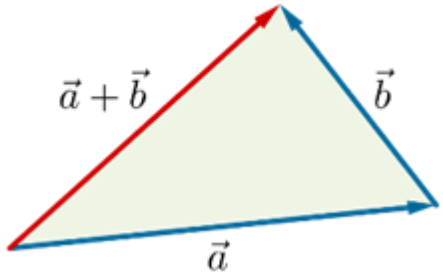
When two forces do not act in the same line, then their resultant force can be calculated using parallelogram law or triangle law of vector addition.

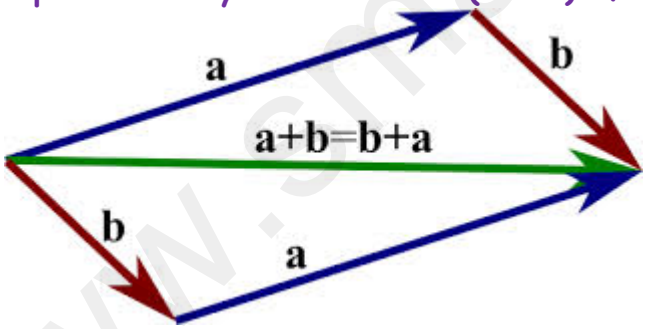
Triangle law of vector addition:



Given two vectors and $\vec{a}$, $\vec{b}$ their sum or resultant written as ($\vec{a}+\vec{b}$) is also a vector obtained by first bringing the initial point of b to the terminal point of a and then joining the initial point of a to the terminal point of b giving a uniform direction by completing the triangle OAB.

Parallelogram law of vector addition:

If two adjacent sides of a parallelogram are represented by two vectors, namely $\vec{a}$, $\vec{b}$ $respectively$, then the diagonal of the parallelogram is represented by the resultant ($\vec{a}+\vec{b}$) of both the vectors.



Example: O/N/15-P32

4 **(a)** Fig. 4.1 shows a top view of a tourist vehicle in a game park and two elephants pushing against the vehicle. The two forces indicated are at right angles to each other.

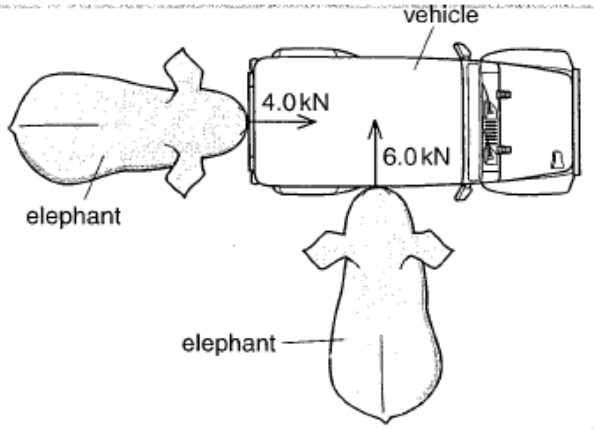
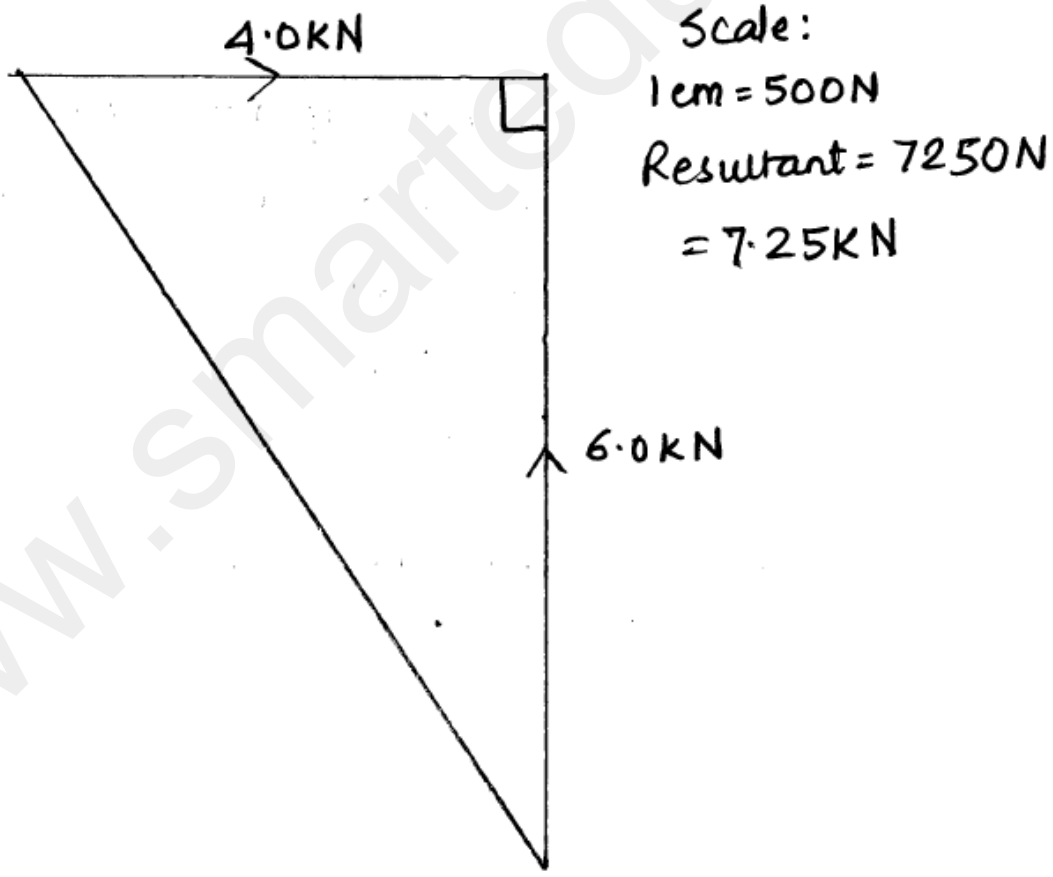


Fig. 4.1

In the space below, draw a scale vector diagram to determine the magnitude of the resultant force. Label the two forces applied and the resultant, and clearly state the scale you use.



(b) Fig. 4.2 shows another elephant pushing horizontally against a vehicle with a force of 11 kN at a distance 1.8 m above the ground. Point M is the centre of mass of the vehicle.

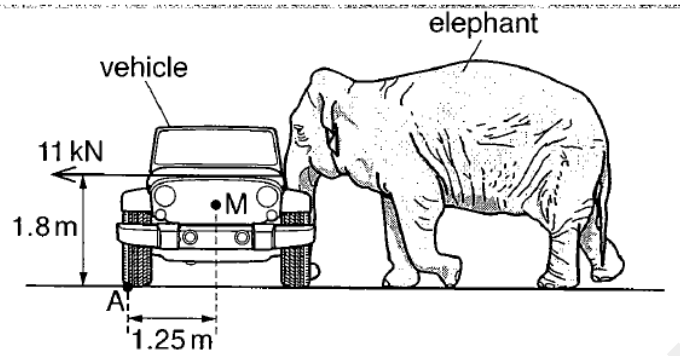


Fig. 4.2

(i) Calculate the moment about point A of the force exerted by the elephant.

Moment = Force x distance

= 11000 x 1·8

= 20kNm

(ii) The mass of the vehicle is 1900 kg, and it does not slide when pushed by the elephant.

Determine whether the elephant tips the vehicle over. Show your working.

calculation

Moment of the weight = 19000 x 1·25

= 24kNm

conclusion

No the vehicle does not tip over as CM > ACM

3 (a) (i) State one similarity and one difference between vector and scalar quantities.

similarity *both have magnitude*

difference *only vector has direction*

(ii) Give an example of each quantity.

vector quantity *displacement*

scalar quantity *distance*

(b) Fig. 3.1 is an overhead view of two tractors pulling a tree trunk.

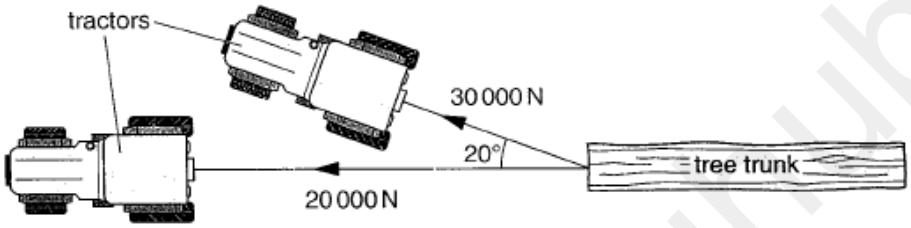


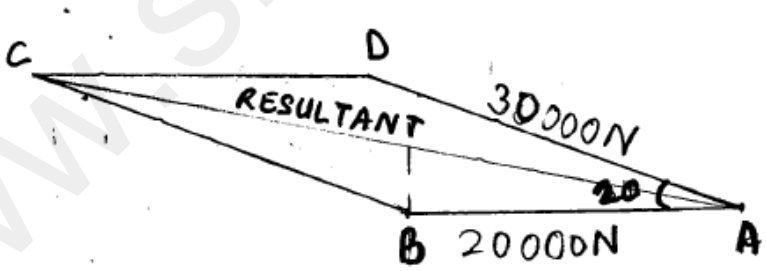
Fig. 3.1

The force exerted by each tractor is indicated in the diagram.

In the space below, carefully draw a scale diagram to determine the resultant force on the tree trunk. State the scale you use.
Write down the magnitude of the resultant force **and** the angle between the resultant force and one of the original forces.

1cm = 5000 N

11·8 cm



magnitude of resultant force = 5400N

direction of resultant force = 10° from 30000N

1 **(a)** Complete the table below to identify the physical quantities as scalars or vectors.

physical quantity	scalar or vector
speed	
velocity	
distance	
force	
kinetic energy	

M/J/11-P33

[3]

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2 **(a)** Underline the vectors in the following list of quantities. M/J/-P31

density energy force mass velocity volume [2]
