

GCSE Physics (9 – 1)

Resultant force Vector Diagrams

Name:

Group:



Instructions

- Read each question carefully before you begin to answer it.
- Use black ink or black ball-point pen for your answers.
- Fill in the boxes at the top of this page with your name and group.
- Attempt to answer every question in the booklet.
- Answer the questions in the spaces provided – there may be more space than you need in some answer spaces.
- Calculators may be used for this booklet.
- For any calculations, you **must** show all your working.
- Any and all drawings or graphs should be completed in pencil.
- Feel free to use a compass.

For markers use	
Question	Mark
1	/4
2	/3
3	/5
4	/5
5	/5
6	/5
7	/5
8	/5
Total	/37
%	
Grade	

Information

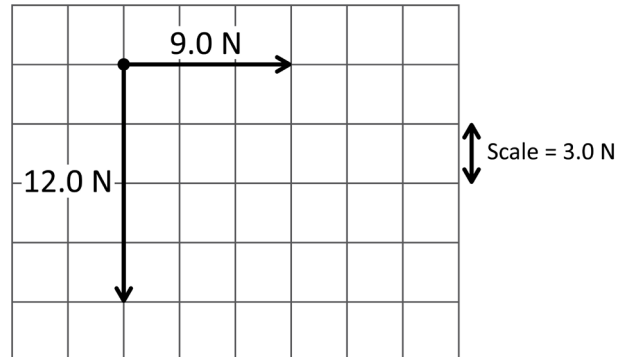
- The maximum mark for this paper is 37 marks.
- The marks for each question are shown in brackets.
- Please be aware that good English and clear presentation are required in your answers.



1. Whether it is an aeroplane fighting a heavy crosswind or two tugboats pulling a ship, vector diagrams visually map out exactly what happens when forces collide at an angle

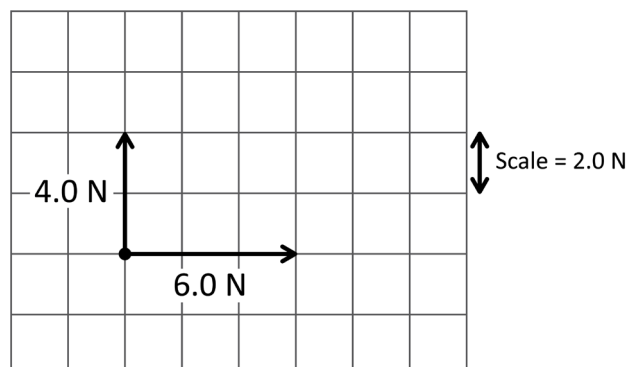
For each of the following questions **circle** the letter of the correct answer.

- a) On the figure shown below, what is the magnitude of the resultant force of the two vectors?



- | A | B | C | D |
|----------|--------|--------|---------|
| 3.0 N | 15.0 N | 21.0 N | 108.0 N |
| (1 mark) | | | |

- b) The figure below shows two forces acting at right angles to each other.
In which direction will the resultant force act?



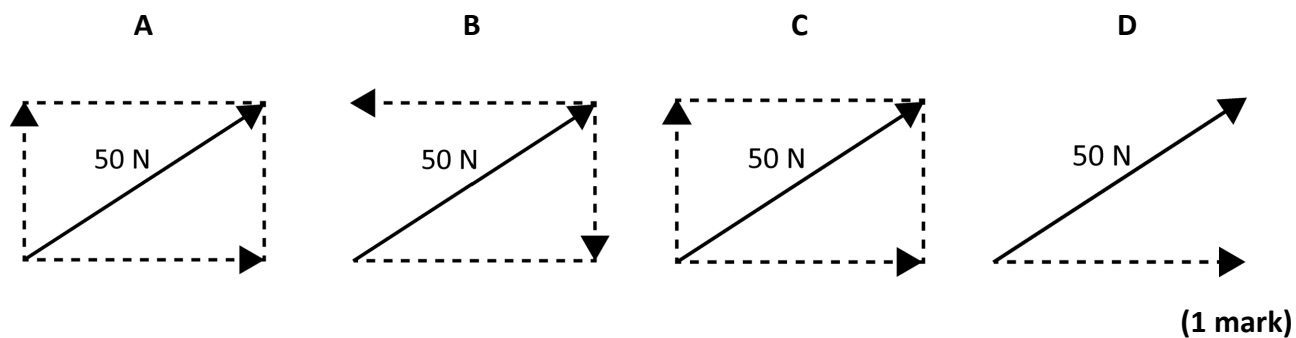
- A Directly upwards.
B Directly to the right.
C Diagonally upwards and to the right.
D Diagonally downwards and to the left.

(1 mark)

- c) A child pulls a toy cart with a diagonal force of 50 N.



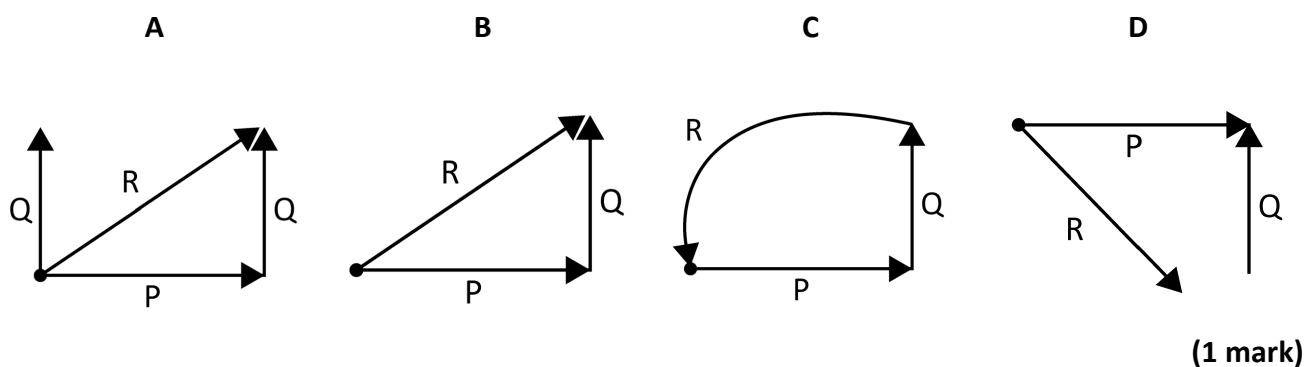
Which diagram correctly shows the horizontal and vertical components of this 50 N force?



- d) Two forces, P and Q, act on an object.

A student draws a vector diagram to find the resultant force, R.

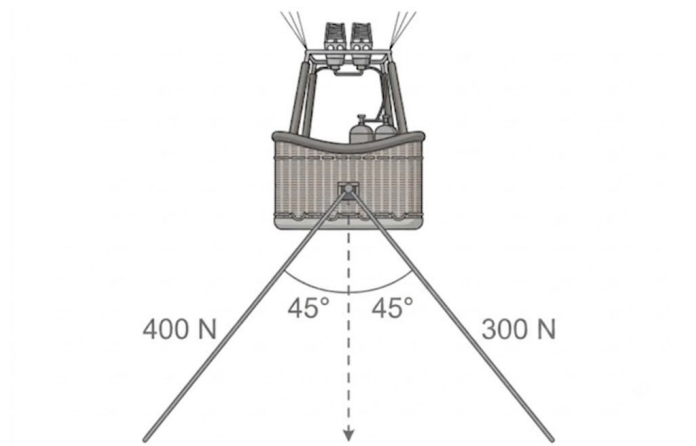
Which diagram correctly shows how the resultant force R should be drawn?



(Total for Question 1 is 4 marks)

2. This question is about forces.

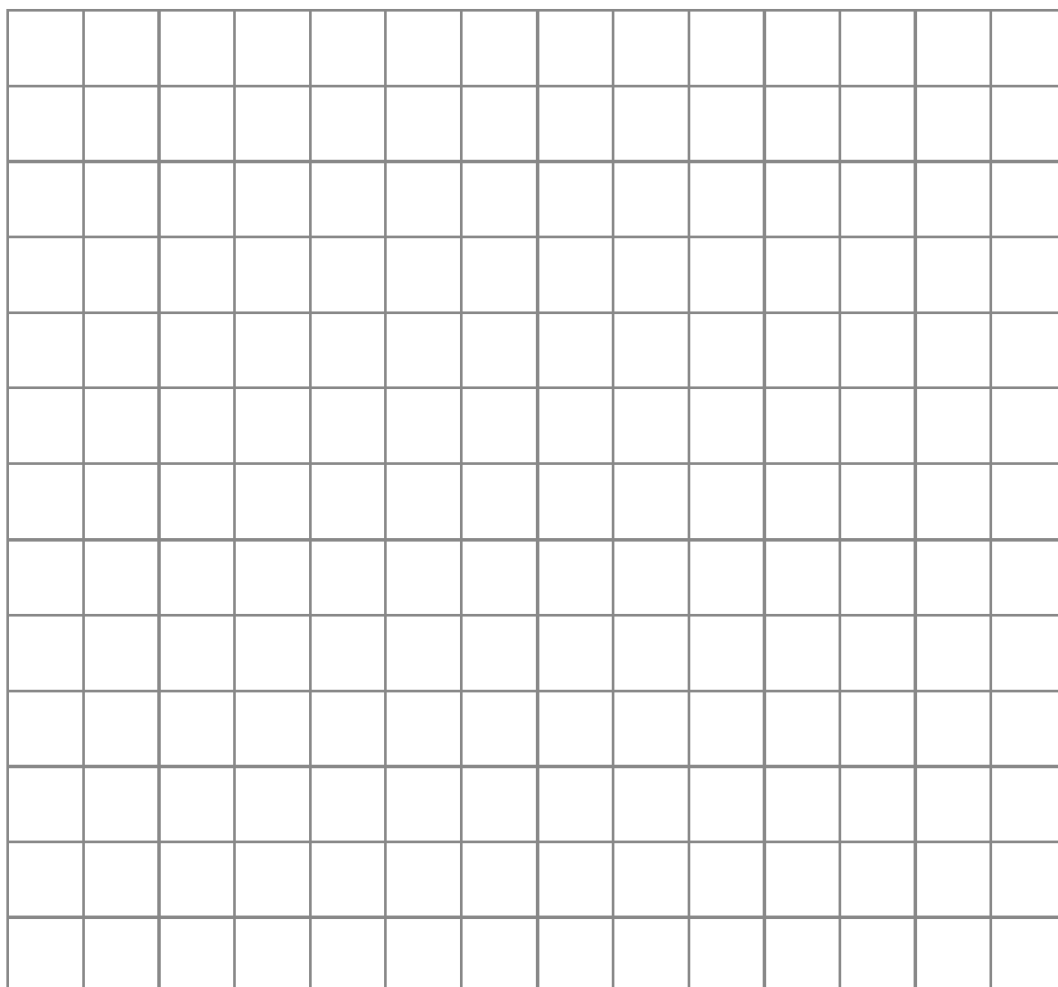
The figure below shows a hot air balloon tethered to the ground by two ropes.



The hot air balloon is held in place by two ropes.

On the grid below, draw a scale drawing to find the magnitude of the resultant force acting downwards on the balloon. Use a scale of 1 cm = 50 N.

Clearly label the 400 N force, the 300 N force, and the resultant force on your drawing.

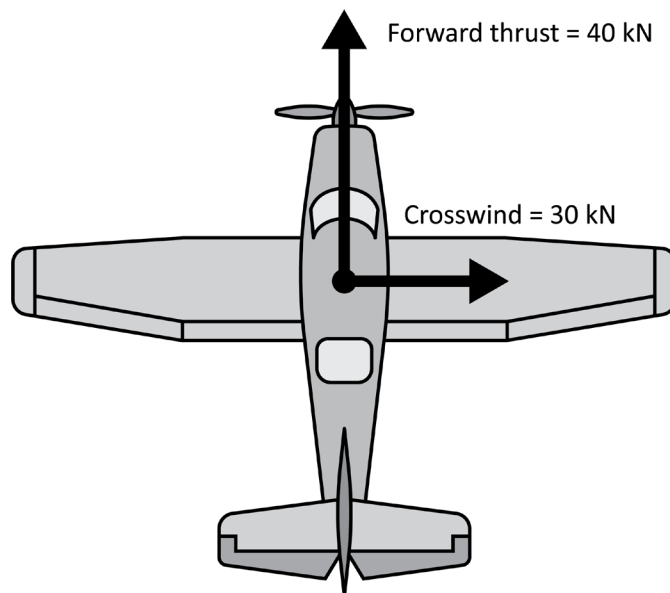


Magnitude of resultant force = ... N

(3 marks)

(Total for Question 2 is 3 marks)

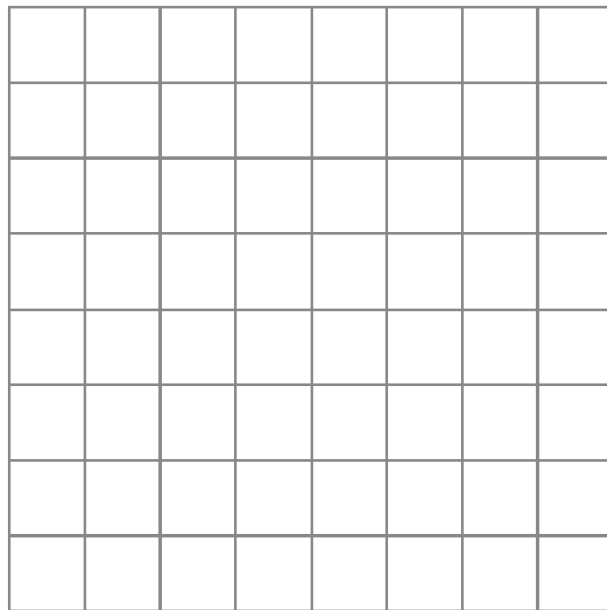
3. A small aeroplane is landing on a runway. The figure below shows the plane.



As the plane lands, it experiences a forward thrust of 40 kN from its engine, and a sideways force of 30 kN from a strong crosswind.

On the grid below, draw a scale vector diagram to determine the magnitude and direction of the resultant force. Use a scale of 1 cm = 10 kN.

You **must** measure the angle of the resultant force relative to the forward direction of the runway.

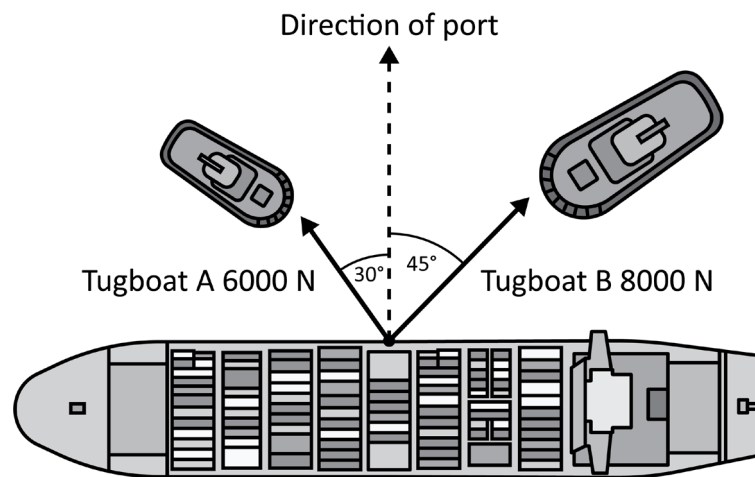


Magnitude of resultant force = ... kN

Angle from the forward direction = ... °
(5 marks)

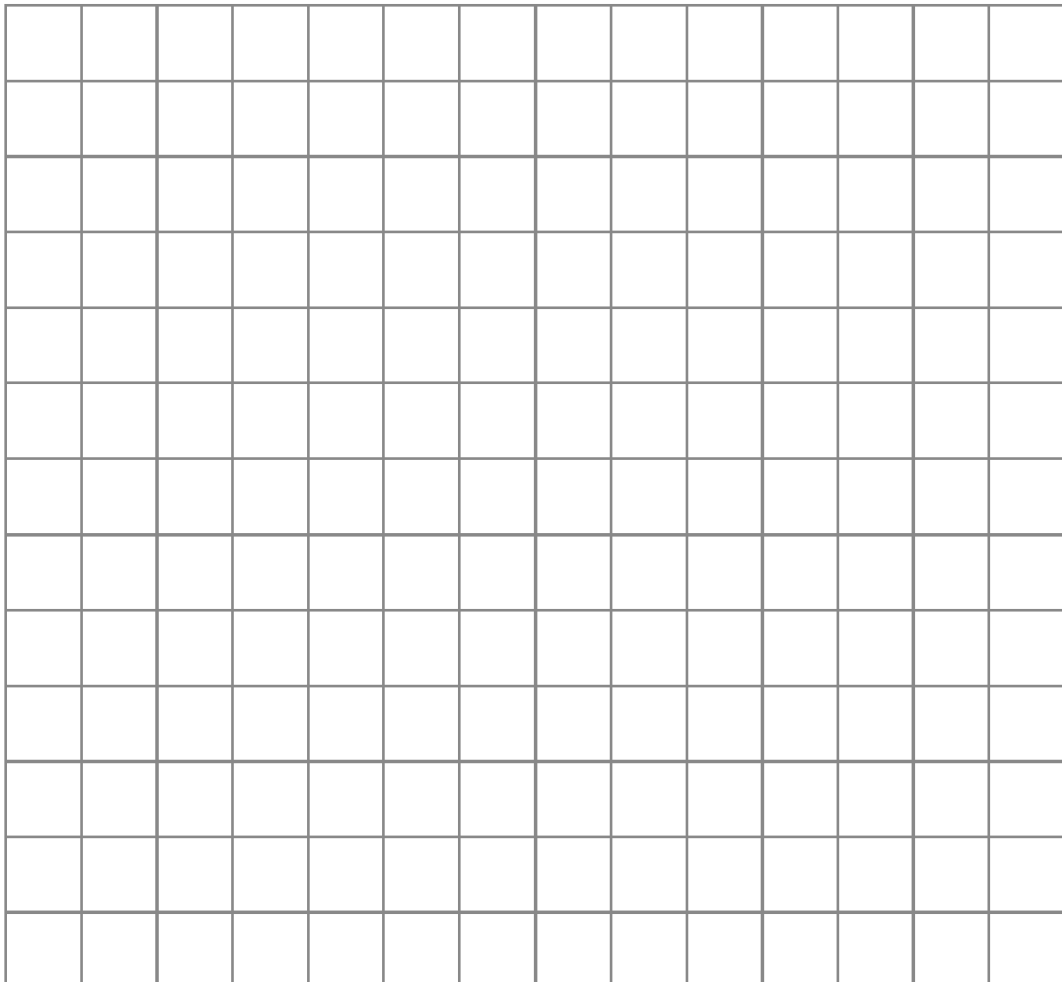
(Total for Question 3 is 5 marks)

4. A large cargo ship is being guided into port by two small tugboats.



In the space below, draw a scale vector diagram to determine the magnitude and direction of the resultant force acting on the cargo ship. **Use a scale of 1 cm = 1000 N.**

You **must** state the angle of the resultant force relative to the forward direction.



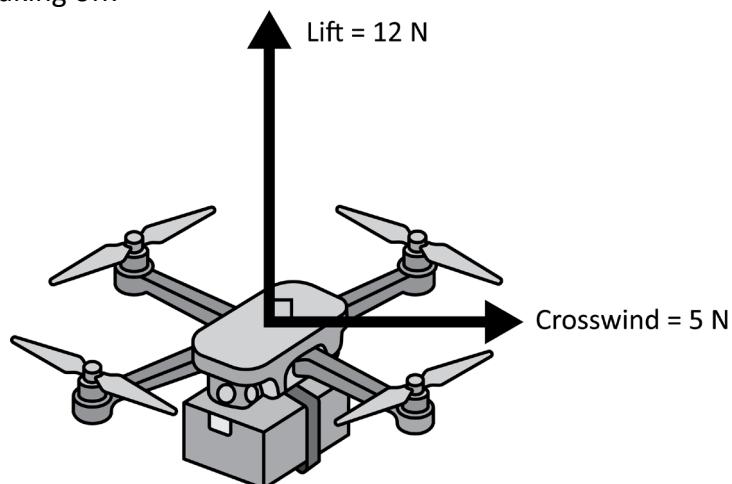
Magnitude of resultant force = ... N

Angle from the forward direction = ... $^\circ$

(5 marks)

(Total for Question 4 is 5 marks)

5. A delivery drone is taking off.



The drone's rotors produce a vertical lift force of 12 N.
Suddenly, a horizontal crosswind blows to the right with a force of 5 N.
The two forces act at right angles (90°) to each other.

a) Calculate the magnitude of the resultant force acting on the drone.

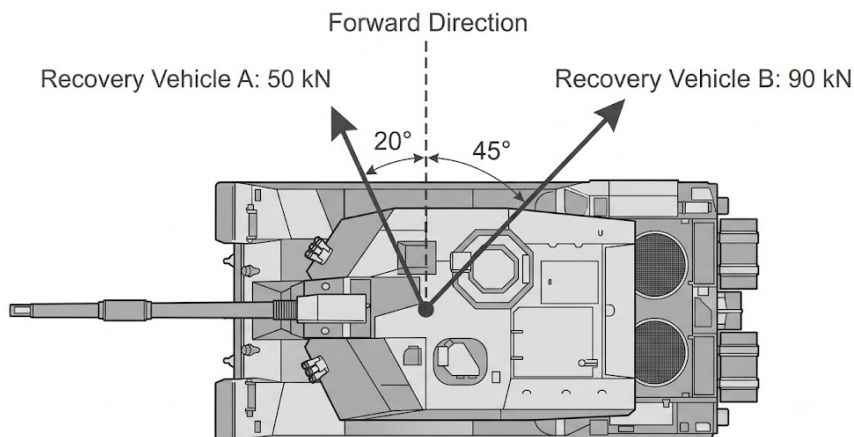
Magnitude of resultant force = ... N
(3 marks)

b) Calculate or measure the angle of the resultant force relative to the vertical lift force.

Angle from the vertical = ... °
(2 marks)

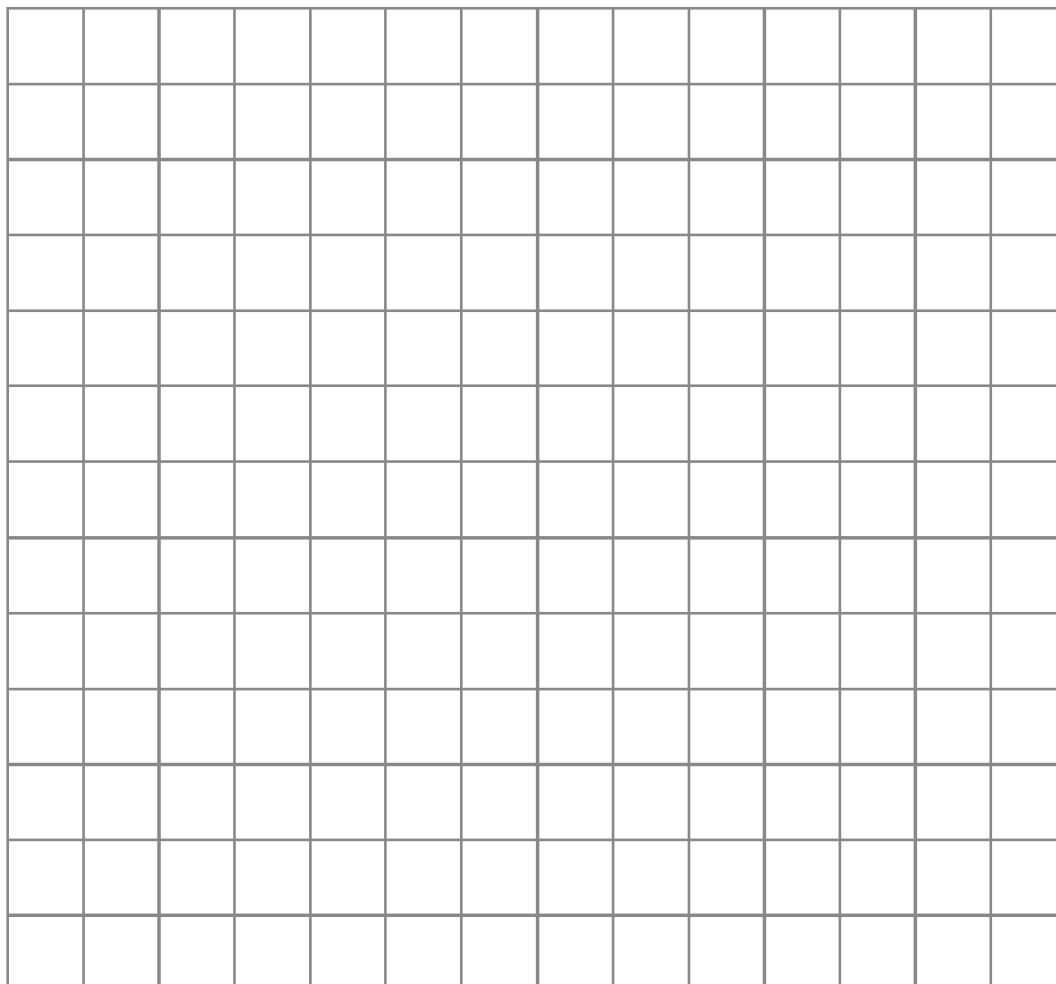
(Total for Question 5 is 5 marks)

6. A 62-tonne Challenger 2 main battle tank has become stuck in deep mud during a military exercise. Two armoured recovery vehicles are using heavy-duty winches to pull it out.



In the space below, draw a scale vector diagram to determine the magnitude and direction of the resultant force acting on the Challenger 2 tank. **Use a scale of 1 cm = 10 kN.**

You must state the angle of the resultant force relative to the forward direction.



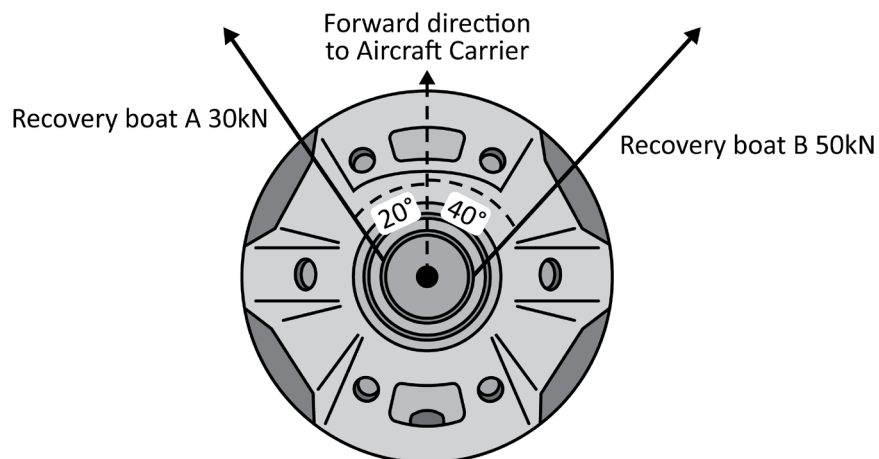
Magnitude of resultant force = ... kN

Angle of the resultant force = ... °

(5 marks)

(Total for Question 6 is 5 marks)

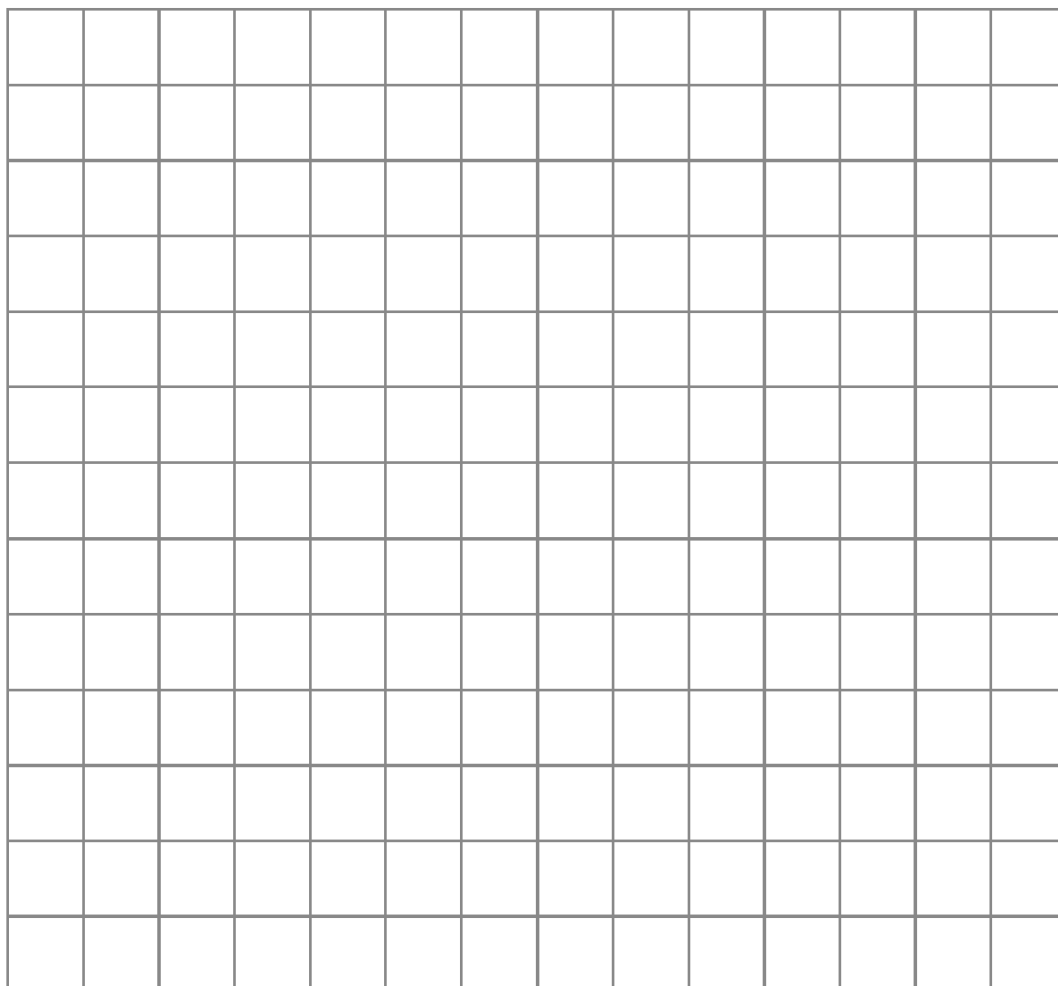
7. A space capsule weighing several tonnes has just splashed down in the Pacific Ocean.
Two fast recovery boats are using tow cables to pull the capsule towards the main aircraft carrier.



To prevent the cables from tangling, the boats must pull at different angles.

On the grid below, draw a scale vector diagram to determine the magnitude and direction of the resultant force acting on the space capsule. **Use a scale of 1 cm = 5 kN.**

You must state the angle of the resultant force relative to the forward direction.



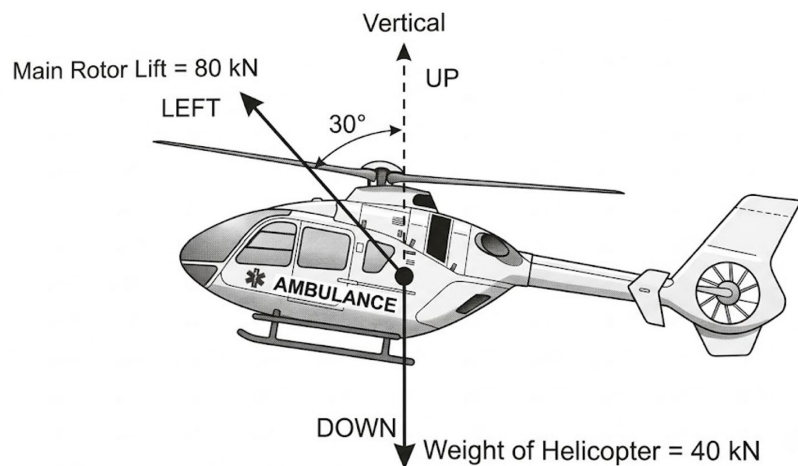
Magnitude of resultant force = ... kN

Angle of the resultant force = ... °

(5 marks)

(Total for Question 7 is 5 marks)

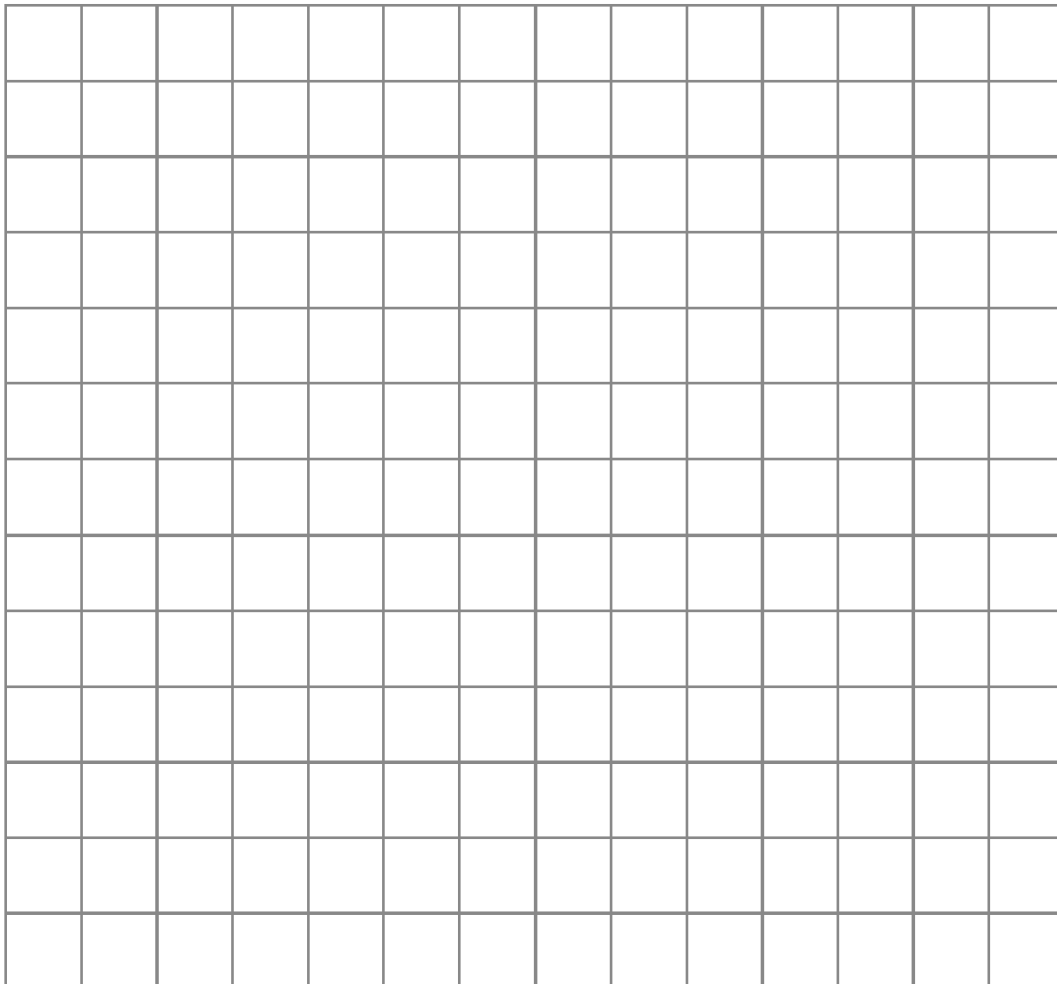
8. An air ambulance is taking off from a hospital helipad to respond to an emergency.



To climb and accelerate forwards at the same time, the pilot tilts the helicopter forward.

In the space below, draw a scale vector diagram to determine the magnitude and direction of the resultant force acting on the helicopter. Use an appropriate scale.

You must state the angle of the resultant force relative to the vertical line.



Magnitude of resultant force = ... kN

Angle of the resultant force = ... °

(5 marks)

(Total for Question 8 is 5 marks)