AQA GCSE Physics | 8463

SPECIFICATION POINT 4.5.1.1

Scalar and vector quantities

Past-paper questions

Tier	**Higher**
Question groups	**3**
Available paper years	**2018–2025**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.5.1.1 Scalar and vector quantities

Question 01

June 2018 | 8463/2H | Original Q6

0 6 **Figure 8** shows a boat floating on the sea. The boat is stationary.

Figure 8



0 6 . 1 **Figure 9** shows part of the free body diagram for the boat.

Complete the free body diagram for the boat.

[2 marks]

Figure 9



4.5.1.1 Scalar and vector quantities

Question 01 · continued

0 6 . 2 Calculate the mass of the boat.

Use the information given in **Figure 9**.

gravitational field strength = 9.8 N/kg

Give your answer to **two** significant figures.

[4 marks]

Mass = _____ kg

0 6 . 3 When the boat propeller pushes water backwards, the boat moves forwards.
The force on the water causes an equal and opposite force to act on the boat.

Which law is this an example of?

[1 mark]

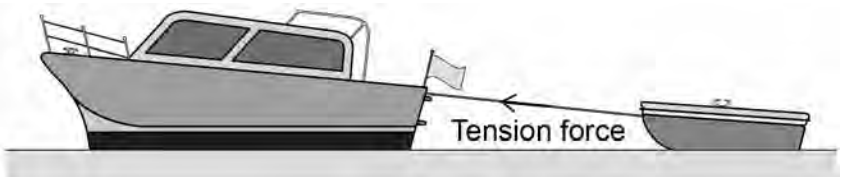
Question 6 continues on the next page

4.5.1.1 Scalar and vector quantities

Question 01 · continued

0 6 . 4 **Figure 10** shows the boat towing a small dinghy.

Figure 10



The tension force in the tow rope causes a horizontal force forwards and a vertical force upwards on the dinghy.

horizontal force forwards = 150 N
vertical force upwards = 50 N

4.5.1.1 Scalar and vector quantities

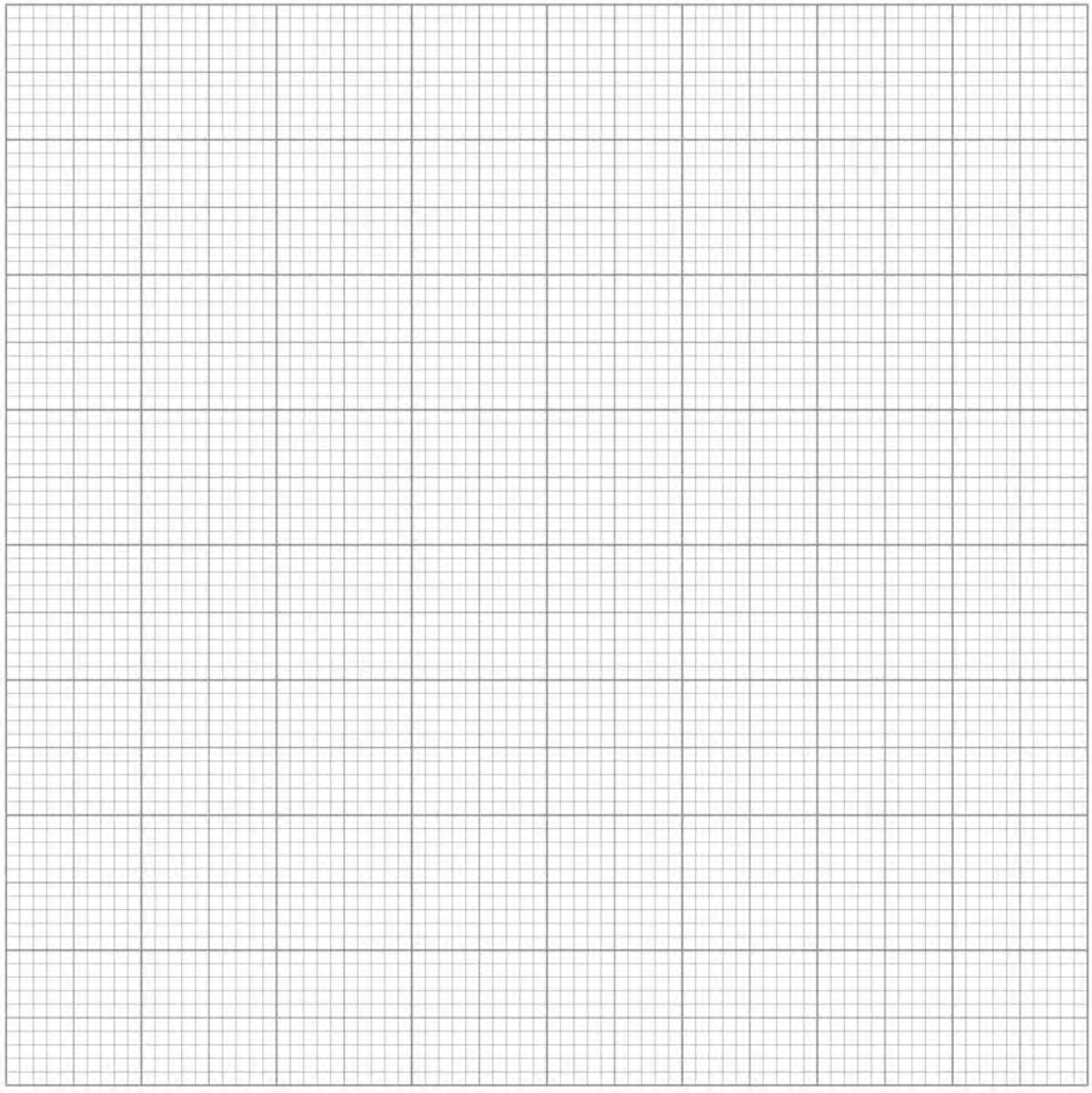
Question 01 · continued

Figure 11 shows a grid.

Draw a vector diagram to determine the magnitude of the tension force in the tow rope and the direction of the force this causes on the dinghy.

[4 marks]

Figure 11



Magnitude of the tension force in the tow rope = _____ N

Direction of the force on the dinghy caused by the tension force in the tow rope = _____

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4.5.1.1 Scalar and vector quantities

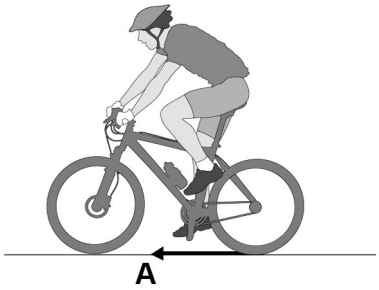
Question 02

November 2021 | 8463/2H | Original Q7

0 7 **Figure 11** shows a cyclist riding a bicycle.

Force **A** causes the bicycle to accelerate forwards.

Figure 11

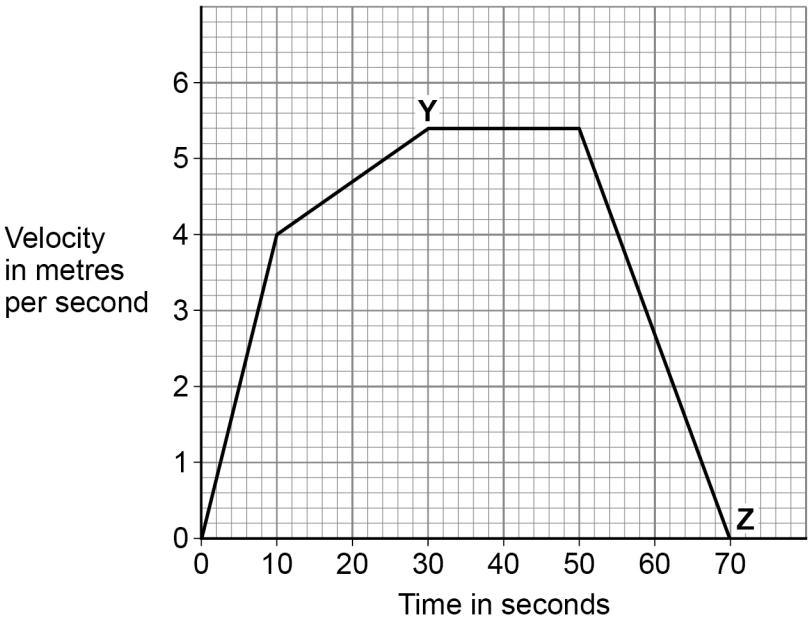


0 7 . 1 What name is given to force **A**?

[1 mark]

Figure 12 shows how the velocity of the cyclist changes during a short journey.

Figure 12



4.5.1.1 Scalar and vector quantities

Question 02 · continued

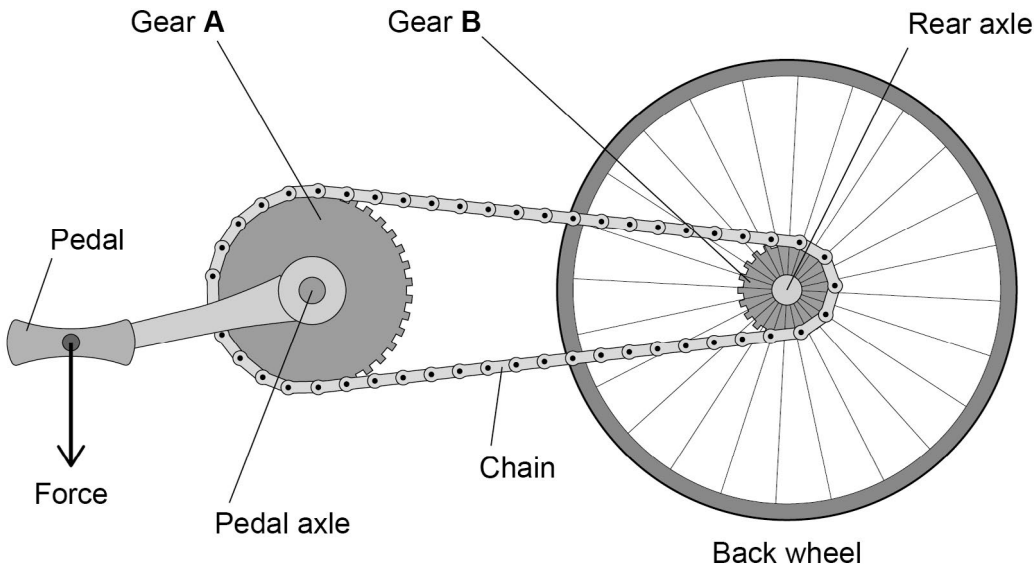
0 7 . 2 Determine the distance travelled by the cyclist between **Y** and **Z**.

[3 marks]

Distance travelled by the cyclist between **Y** and **Z** = _____ m

0 7 . 3 **Figure 13** shows the gears on the bicycle.

Figure 13



Describe how the force on the pedal causes a moment about the rear axle.

[2 marks]

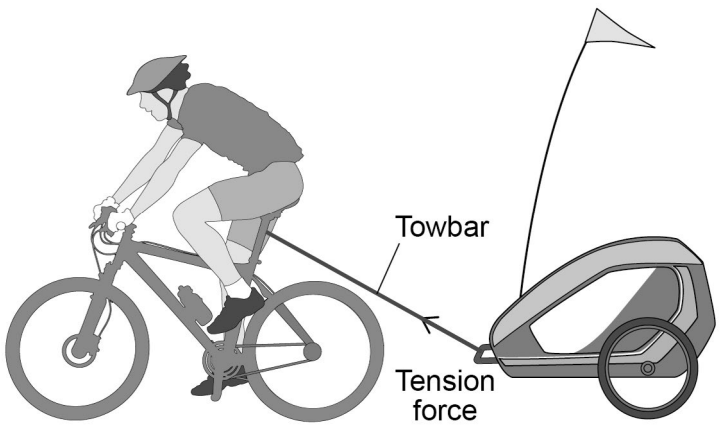
Question 7 continues on the next page

4.5.1.1 Scalar and vector quantities

Question 02 · continued

Figure 14 shows a different cyclist towing a trailer.

Figure 14



0 7 . 4 The speed of the cyclist and trailer increased uniformly from 0 m/s to 2.4 m/s.

The cyclist travelled 0.018 km while accelerating.

Calculate the initial acceleration of the cyclist.

[3 marks]

Acceleration = _____ m/s^2

4.5.1.1 Scalar and vector quantities

Question 02 · continued

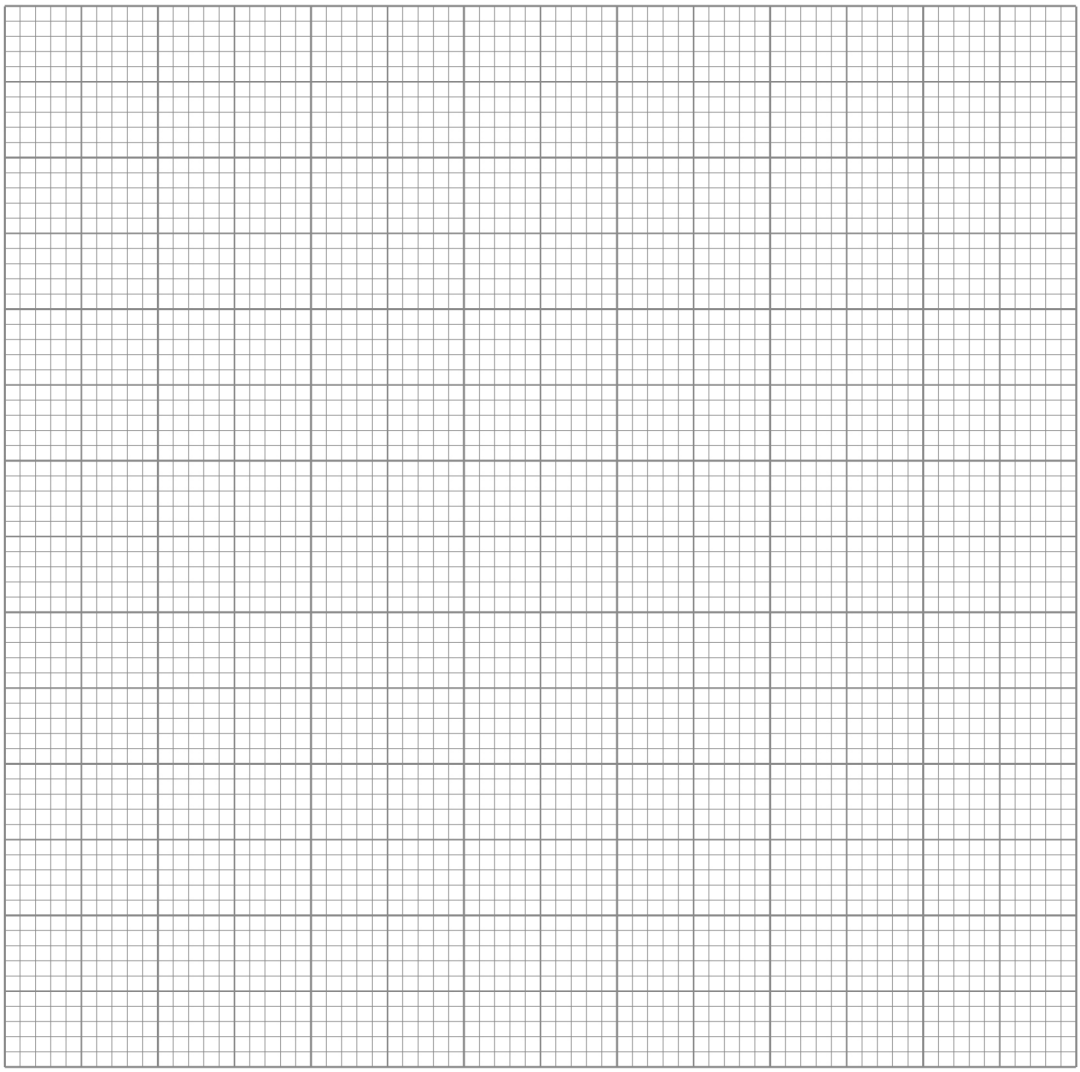
0 7 . 5 The resultant force of the towbar on the trailer has a horizontal component and a vertical component.

horizontal force = 200 N

vertical force = 75 N

Determine the magnitude and direction of the resultant force of the towbar on the trailer by drawing a vector diagram.

[4 marks]



Magnitude of force = _____ N

Direction of force = _____ degrees

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4.5.1.1 Scalar and vector quantities

Question 03

June 2025 | 8463/2H | Original Q5

0 5 In a world record attempt, a skydiver jumped from a height of 40 km above the Earth.

0 5 . 1 **Figure 6** shows an incomplete free-body diagram for the skydiver a few seconds after the start of the jump.

Figure 6



The skydiver has not reached terminal velocity.

Complete the free-body diagram in **Figure 6**.

[2 marks]

4.5.1.1 Scalar and vector quantities

Question 03 · continued

0 5 . 2 During the first 2.5 minutes the mean acceleration of the skydiver was 0.64 m/s^2.

The initial velocity of the skydiver was 0 m/s.

Calculate the velocity of the skydiver 2.5 minutes after the start of the jump.

Use the Physics Equations Sheet.

[4 marks]

Velocity = _____ m/s

Question 5 continues on the next page

4.5.1.1 Scalar and vector quantities

Question 03 · continued

0 5 . 3 The skydiver accelerated until reaching terminal velocity.

Explain why the skydiver reached terminal velocity.

[4 marks]

0 5 . 4 Explain why the atmospheric pressure acting on the skydiver increased as the skydiver fell.

[2 marks]

4.5.1.1 Scalar and vector quantities

Question 03 · continued

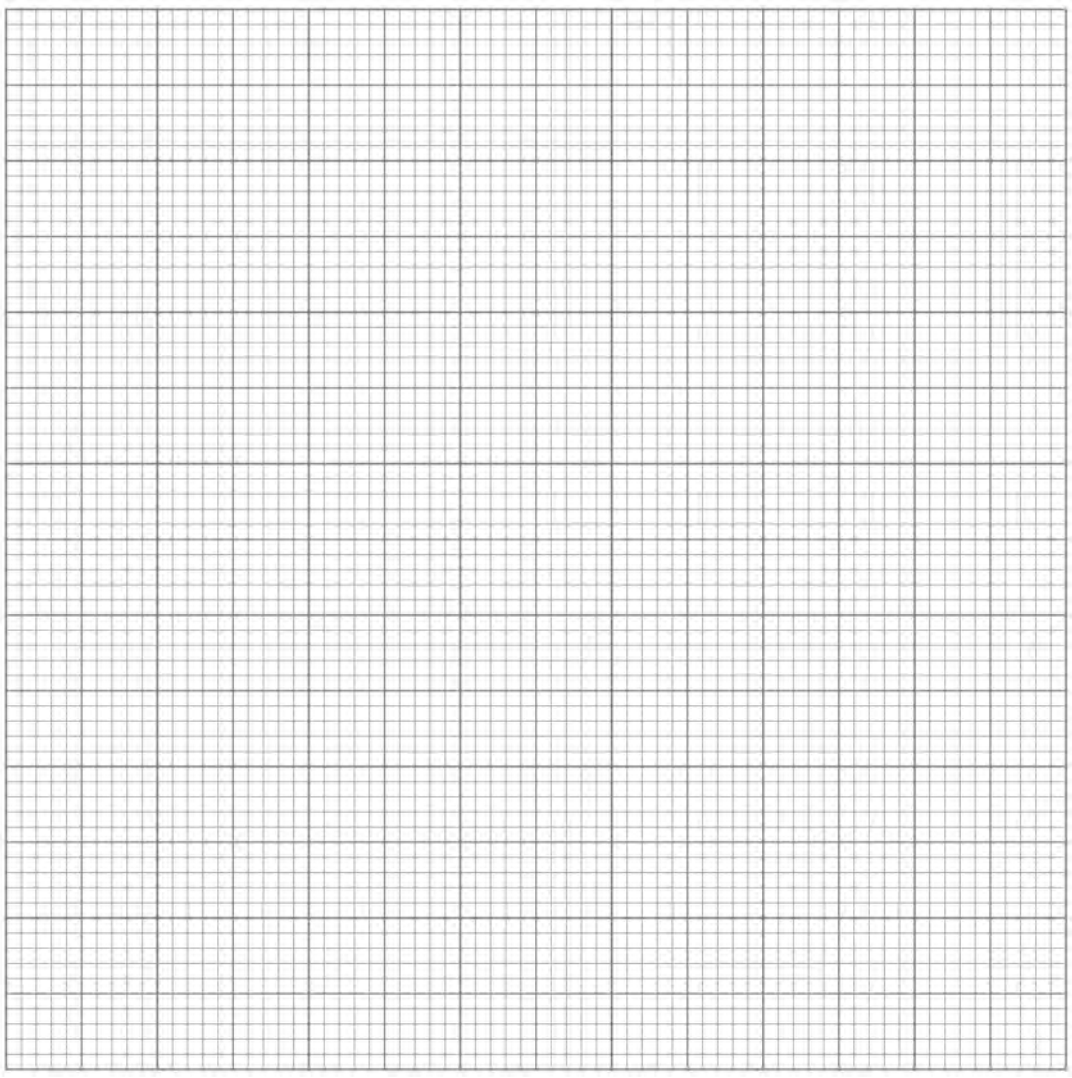
0 5 . 5 The skydiver opened his parachute.

A few seconds after opening the parachute, the resultant vertical force on the skydiver was 240 N upwards.

The wind caused a resultant horizontal force of 200 N to the left on the skydiver.

Draw a vector diagram to determine the resultant force on the skydiver.

[4 marks]



Magnitude of resultant force = _____ N

Angle to vertical of resultant force = _____ degrees

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