

Question 20 (3 marks)

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A student is investigating inertial and non-inertial frames of reference. The student carries out a series of activities on a boat floating on a large, calm lake. The boat remained level during these activities.

Each activity and the student's observed results are recorded in the table.

Activity	Observation
Dropped a ball from a set height	Ball fell vertically with increasing velocity
Rolled a ball from one side of the boat to the other	Ball rolled across the floor with a constant velocity
Rolled a ball from the back of the boat towards the front of the boat	Ball rolled across the floor with a constant velocity

Justify the student's conclusion that: 'The boat can be regarded as an inertial frame of reference'.

- An inertial frame of reference is one that is stationary or moving with constant velocity. In such frames, mechanical experiments wholly within one frame cannot determine whether it is stationary or moving with constant velocity.

- In this case, all the activities conducted on the boat would occur in a stationary frame, where all the laws of physics hold.

- For the first activity, the ball dropped straight down acting only under gravity, with no external forces, as would be happened in an inertial frame.

- For the second and third activity activities, the ball rolled with a constant velocity, with no external ~~no~~ accelerations changing its velocity, as would have occurred in an inertial (non-accelerating) frame of reference.

- In ~~an~~ a non-inertial frame of reference, the ball rolling ~~across~~ across the floor would have ~~been~~ accelerated and changed velocity, and the ball when dropped would not have fallen vertically.

- Therefore the student is justified in stating that the frame is inertial.