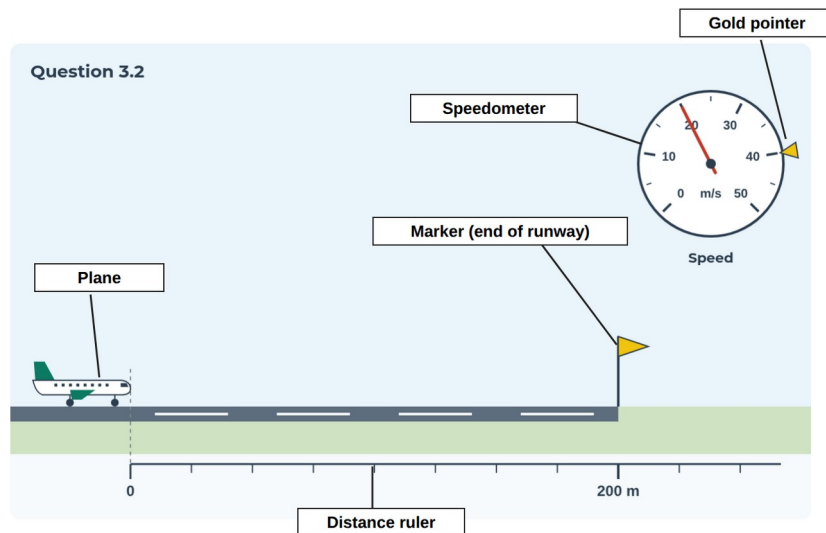


Using the Equation of Motion

Runway and Braking

Aim:

You are investigating whether the same equation can be used to find any one of v , u , a or s when the other three are known.



Prediction:

A car brakes with the same deceleration from two different speeds. The second speed is double the first. What do you think happens to the braking distance?

.....

.....

Test your prediction using questions 5.1, 5.2 and 5.3 in the simulation.

Method:

1. Choose **Level 1** and click question 1.1 in the **Results** table.
2. Write down the three known values and the unknown. Start from $v^2 = u^2 + 2as$.
3. Rearrange the equation to make the unknown the subject. Check your rearranging in the **Rearrange the equation** panel if you need to.
4. Substitute the values and calculate the unknown.
5. Type your answer into the empty cell for that question and press **Run**. Compare the speedometer needle with the gold pointer when the vehicle reaches the marker.
6. If your answer is marked wrong, read the hint, find the mistake in your working and try again.
7. Work through all 17 questions in Levels 1 to 5. Record each answer and its result in your results table.

Working:

Question 2.2

.....

.....

.....

Question 4.1

.....

.....

.....

Question 5.4

.....

.....

.....

Results:

Q	u (m/s)	v (m/s)	a (m/s ²)	s (m)	Result
1.1					
1.2					
1.3					
2.1					
2.2					
2.3					
3.1					
3.2					
3.3					
4.1					
4.2					
4.3					
5.1					
5.2					
5.3					
5.4					
5.5					

Analysis:

1. Does the plane's final speed depend on its starting speed, or only on the runway and acceleration? Use your Level 1 results.

.....

.....

2. For question 1.1, a student gives 1600 m/s as the answer. Does this look reasonable for a plane? Which step did they miss?

.....

.....

3. In Levels 2 and 3, what was the first thing you did to both sides of the equation each time?

.....

.....

4. Use your results for 5.1, 5.2 and 5.3. What happens to the braking distance each time the speed doubles? How does this compare with your prediction?

.....

.....

5. Explain why u^2 must be moved to the other side before you divide by $2a$.

.....

.....

6. In Level 5 the acceleration is negative. Explain what this means for the car, and what it does to the sign of the $2as$ term.

.....

.....

7. A car travels at 15 m/s and can brake at 5 m/s^2 . Then it travels at 30 m/s with the same brakes. Compare the two braking distances and explain the result in terms of the equation.

.....

.....

8. A student calculates a runway length and gets a negative answer. Suggest two different mistakes that could cause this.

.....

.....