

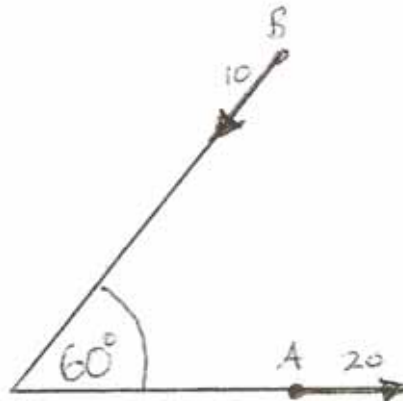
Round One

Note : For all questions in this quiz, take $g = 10 \text{ m/s}^2$

1. A particle which is moving in a straight line with constant acceleration of 2 m/s^2 is initially at rest. Find the distance covered by the particle in the third second of its motion.
2. A stone is dropped from rest from the top of a building and at the same time a second stone is thrown vertically upward from the bottom of the building with a speed of 20 m/s . They pass each other 3 seconds later. Find the height of the building. [Use $g = 10 \text{ m/s}^2$]
3. Earlier this year, the White Rabbit said to me, 'Two days ago, Alice was still thirteen, but her sixteenth birthday will be next year.' When is Alice's birthday?
A. Jan 1st B. Feb 28th C. Feb 29th D. Dec 30th E. Dec 31st

Round Two

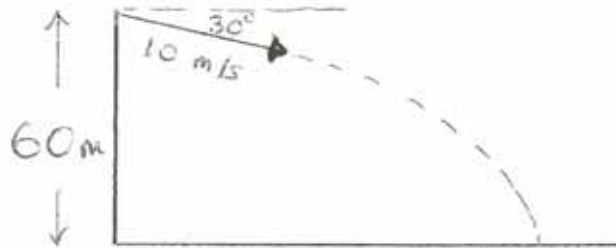
1. Two crossroads intersect at an angle of 60° .
Car A moves away from the junction at 20 m/s .
Car B moves towards the junction at 10 m/s .
Calculate the speed of A relative to B to the nearest m/s .



2. A bird sets out to fly to its nest which is 200 m west of its present position. There is a wind blowing from the south-east at 5 m/s . If the bird can fly in still air at 5 m/s , find the time taken to reach its nest to the nearest second.
3. Albert Einstein was standing on the station platform thinking about relativity when he noticed that he could see two station clocks. Each clock was digital, showing only hours and minutes. He observed that the display on one clock changed to the next minute 10 seconds before the correct time, whereas the display on the other clock changed to the next minute 10 seconds after the correct time. For what fraction of the day did the clocks show the same time?
A. $\frac{1}{6}$ B. $\frac{1}{3}$ C. $\frac{2}{3}$ D. $\frac{5}{6}$ E. $\frac{7}{6}$

Round Three

1.



- A body is projected, as shown at an angle of 30° to the horizontal. Determine the horizontal distance covered to the nearest metre, using $g = 10 \text{ m/s}^2$.
2. A tennis ball is hit at a height of 20 cm above the ground with a speed of 10 m/s. The ball just clears the net which is 8 m away and 1.2 m high. Taking $g = 10 \text{ m/s}^2$ find the smaller angle of projection to the nearest degree.
3. A *Langford number* is one in which each digit of the number occurs twice; the digits 1 are separated by one digit, the digits 2 are separated by two others, and so on. Which of the following is a Langford number?
- A. 12142334 B. 41312432 C. 14132342 D. 32432141 E. 31213244

Round Four

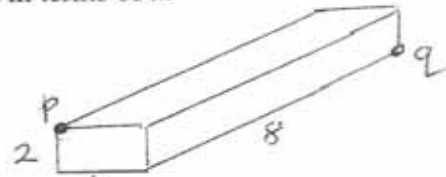
1. A crate of mass 25 kg sits at rest on a horizontal floor of the back of the lorry. The coefficient of friction between the crate and the floor of the lorry is 0.4. The lorry moves off with an acceleration $a \text{ m/s}^2$ along a horizontal road.

Find the value of a when the crate is just about to slide, taking g to be 10 m/s^2 .

2. A particle of mass 5 kg rests on a rough horizontal table. It is connected by a light inextensible string passing over a smooth pulley at the edge of the table to a particle of mass 6 kg, which is hanging freely. The coefficient of friction between the 5 kg mass and the table is $\frac{1}{3}$. Find the acceleration of the system in terms of g , giving your answer in simplest fractional form.
3. Pascal, Newton, Galileo and Fermat all took the same test. The average score for all four candidates was 16. Pascal and Newton had an average of 16. Pascal and Fermat had an average of 13, while Newton and Fermat had an average of 18. What was Galileo's score?
- A. 14 B. 15 C. 16 D. 17 E. 18

Round Five

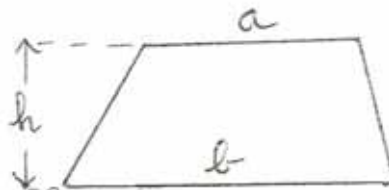
- Sphere A has mass 0.2 kg and sphere B has mass 0.5 kg. The spheres are travelling towards each other in the same line when they collide. Immediately before the collision the speed of A is 6 m/s and the speed of B is 4 m/s. Sphere B is brought to rest by the collision. Find the kinetic energy lost in the collision.
- Three **perfectly elastic** ($e = 1$) smooth spheres A, B and C of equal radii but of masses $3m$, $2m$, and m respectively, lie at rest on a horizontal plane with their centres in a straight line. Sphere A is projected with speed u to collide directly with sphere B which then collides directly with sphere C. Find the speed of sphere C immediately after this second collision in terms of u .
- An ant has to travel from the corner p to the corner q on the surface of a wooden block. The dimensions of the block are $2 \times 4 \times 8$, as shown.



- The shortest distance it can walk is
 A. 14 B. $2 + \sqrt{80}$ C. $8 + \sqrt{20}$ D. $4 + \sqrt{68}$ E. 10

Round Six

- A particle is projected vertically upward from ground level with a speed of 75 m/s. For how long will it be more than 70 m above the ground? [Take $g = 10 \text{ m/s}^2$]
- Two stunt drivers drive their cars along a straight horizontal road. The first car is travelling at 30 m/s and is followed by the second car, 22 m directly behind, travelling at the same speed. At time $t = 0$, the driver of the first car applies the breaks and his car decelerates at 4 m/s^2 . Two seconds later, the second car brakes and decelerates at 4 m/s^2 . Find the time when the cars collide.



- A trapezium has parallel sides of length a and b , and height h . Sides a and b are both decreased by 10% and the height h is increased by 10%. What is the percentage change in the area of the trapezium?
 A. 10% decrease B. 1% decrease C. No change
 D. 10% increase E. 30% increase

Round Seven

1. In a playground, Seán is 5 m due north of Aoife. Seán and Aoife are running with velocities of 4 m/s due south and $4\sqrt{3}$ m/s due east, respectively. If they maintain these velocities, find the shortest distance between them in subsequent motion. Give your answer in surd form or correct to one decimal place.
2. A river flows with a constant speed of 6 m/s parallel to the straight banks. A canoeist can row at 5 m/s in still water. She sets out at an angle of 40° to the bank, upstream at full speed. The river is of width 50 m. How far downstream will the canoeist be carried before she lands on the opposite side? [Answer to the nearest metre]
3. In a class of 30 pupils, there are 22 pupils who are right-handed and there are 14 girls. What is the smallest number of girls who could be right-handed?
A. 0 B. 2 C. 4 D. 6 E. 8

Round Eight

1. A particle is projected up a plane which is inclined at 30° to the horizontal. The particle is launched at $20\sqrt{g}$ m/s and lands at a speed of $10\sqrt{3g}$ m/s. Find the range of the particle along the plane.
2. A particle is projected DOWN a plane at 39 m/s. If the angle between the line of projection and the plane is $\tan^{-1}(\frac{5}{12})$ and the plane is inclined at an angle $\tan^{-1}(\frac{4}{3})$ to the horizontal, find the landing angle to the nearest degree, using $g = 10 \text{ m/s}^2$.
3. Sue can mow a lawn in 3 hours. Molly takes 4 hours to mow the same lawn, and Chris takes 6 hours to do the same. If they work together and don't get in each other's way, how long would they take to mow the lawn together?
A. 1 hour 20 mins B. 1 hour 30 mins C. 3 hours
D. 4 hours 20 mins E. 13 hours

Tie Breakers

1. A person drives from Dublin to Cork at an average speed of 20 m/s and returns to Dublin at an average speed of 30 m/s. What is the average speed for the entire journey?
2. A projectile is fired at an angle to the horizontal. In its flight it passes through two points p and q on the same horizontal level. The particle takes 10 seconds to travel from p to q . What is the greatest height which the particle reaches above the horizontal line pq ? [Take $g = 10\text{m/s}^2$]
3. A car is travelling at 35 m/s along a straight road. It is 100 m behind a bus which is travelling in the same direction at a constant 15 m/s. What is the minimum deceleration of the car which will ensure that no collision will occur?
4. A parachutist of mass m jumps out of a plane and opens her parachute. The air resistance due to the parachute is $0.1mv^2$, when her speed is v . The parachutist's speed tends to a terminal velocity. Find the terminal velocity. [$g = 10\text{m/s}^2$]
5. What is the smallest composite (non-prime) Natural number (greater than 1) which is not divisible by 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 or 13?

Answers:

Round 1:	1.	5 m	2.	60 m	3.	E
Round 2:	1.	26 m/s	2.	28 s	3.	C
Round 3:	1.	26 m	2.	37°	3.	B
Round 4:	1.	4 m/s ²	2.	$\frac{13g}{33}$	3.	D
Round 5:	1.	6 J	2.	$\frac{8u}{5} = 1.6u$	3.	E
Round 6:	1.	3.75 s	2.	13 s	3.	B
Round 7:	1.	$\frac{5\sqrt{3}}{2} = 4.3 \text{ m}$	2.	34 m	3.	D
Round 8:	1.	100 m	2.	11°	3.	A
Round 9:	1.	1.75 m/s ²	2.	$\mu = \frac{6}{17}$	3.	B
Round 10:	1.	$\sqrt{50} = 5\sqrt{2} \text{ m/s}$	2.	30°	3.	B