Lagan College Mathematics Department

GCSE
FURTHER MATHS

Uniform Acceleration

PP Questions

4 A light fitting of mass 2 kg is held in equilibrium at a point C by two light chains CA and CB attached to the ceiling of a garage. The chains are inclined to the horizontal at 25° and 42° respectively as shown in **Fig. 2**.

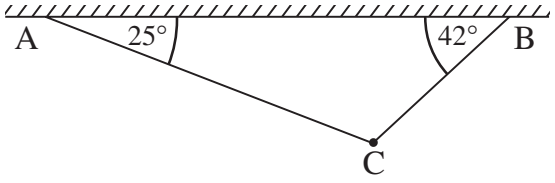

Fig. 2

(i) Copy **Fig. 2** showing clearly all the forces acting on the light fitting at the point C. [1]

(ii) Calculate the tensions in the chains CA and CB, giving each answer correct to 1 decimal place. [5]

5 A car starts from rest with uniform acceleration a m/s^2 in a straight line.

(i) Write down expressions in terms of a for the distances travelled by the car

(a) in the first 17 seconds,

(b) in the first 18 seconds. [2]

Given that the car travels 28 metres in the 18th second, calculate

(ii) the acceleration of the car, [3]

(iii) the speed of the car when it has travelled a distance of 80 metres from the start, [1]

(iv) the time it takes to travel this distance. [1]

9 The practice manager at a local surgery recorded the number of patients treated in the surgery by the doctors over the past 3 years. **Table 4** summarises the results.

Table 4

	Jan–Mar	Apr–Jun	Jul–Sep	Oct–Dec
2004	1003	841	728	900
2005	1055	905	784	968
2006	1111	965	836	1036

These data have been plotted on the graph given in **Fig. 6** in your Supplementary Answer Booklet.

(i) Calculate appropriate moving averages to smooth the data. [3]

(ii) Plot these averages on the graph and draw the trend line. [3]

(iii) Showing clearly where any reading is taken, use the trend line to calculate an estimate of the number of patients likely to be treated in the period January to March 2007. [4]

10 A boy is standing at the edge of the flat roof of a building. He is 10 metres above the pavement. He throws a ball vertically upwards with a speed of 8 m/s.

(i) Find the maximum height above the pavement reached by the ball. [3]

The boy fails to catch the ball as it falls back down again towards the pavement.

Calculate

(ii) the speed of the ball, in m/s, at the instant when it strikes the pavement, giving your answer correct to 1 decimal place. [2]

(iii) the time, in seconds, which elapses from the instant the ball leaves the boy's hand until it strikes the pavement, giving your answer correct to 1 decimal place. [4]

The ball rebounds with half the speed with which it strikes the pavement.

(iv) Calculate the height to which the ball rebounds after the first bounce, giving your answer correct to 1 decimal place. [2]

5 **(a)** In a study of a town's leisure facilities for children and young people, the data collected gave a mean of 22.8 and a standard deviation of 4.3

(i) What is the variance of these data? [1]

To compare the results of a study with similar data collected in a second town each data item was adjusted by adding 10 and then multiplying by 2.

(ii) Find the mean and standard deviation of the adjusted data. [3]

(b) Ellen achieved the following percentages in her class tests this term:

62, 72, 41, 89, 86, 72, 42, 50

Which average (mean, mode or median) should she use to best impress her parents?

Give a reason for your answer and show any calculations used. [3]

6 A boy stands at the edge of a balcony 8 metres above horizontal ground. He throws a ball vertically upwards with a speed of 6 m/s.

(i) Show that the greatest height above the **ground** reached by the ball is 9.8 m. [2]

Assume that the ball does not hit the balcony as it descends.

Find

(ii) the speed of the ball, in m/s, as it strikes the ground, [2]

(iii) the time which elapses from the instant the ball is thrown until it strikes the ground. [3]

7 The outside doors in a school security system are protected by a keypad device which is based on a 3 digit number. To open the doors the correct 3 digit number must be entered on the keypad. This number will be in the range 000 to 999

(i) What is the probability of guessing the correct number at the first attempt? [2]

The number is changed each week. I cannot remember this week's number but I do know that the three digits are all different.

(ii) What is the probability that I can guess this week's number correctly at the first attempt? [2]

(iii) **Hence**, what is the probability that I fail to get it correct at my first attempt? [1]

(iv) What is the probability that I fail to get it correct at my first attempt but get it correct at my second attempt? [4]

5 **(a)** **(i)** Give an example of a discrete variable. [1]

(ii) Give an example of a continuous variable. [1]

(b) At a local community festival one of the attractions was a Wellie Wanging competition to see how far competitors could throw a Wellington boot. The results are summarised in **Table 2**.

Table 2

Distance d (m)	$0 < d \leqslant 5$	$5 < d \leqslant 15$	$15 < d \leqslant 25$	$25 < d \leqslant 35$	$d > 35$
Number of competitors	8	47	33	5	2

(i) What is the **upper** limit of the modal class? [1]

(ii) Calculate an estimate of the median distance thrown. [4]

6 A particle moves with constant acceleration from point A to point B to point C along a straight line.

The initial velocity of the particle is 4.5 m/s. It takes 6 seconds to move from A to B, where AB = 70.2 m.

(i) Find the acceleration of the particle. [2]

(ii) Find the velocity of the particle when it is at B. [2]

The particle has a velocity of 23.7 m/s when it reaches C.

(iii) Find the distance BC. [2]

(iv) Find the time taken for the particle to travel from B to C. [1]

10 A missile is fired vertically upwards from the ground. It starts from rest and rises with a constant acceleration of $5\,m/s^2$. The missile's fuel burns out after 10 seconds.

Calculate

(i) the height of the missile after 10 seconds, [2]

(ii) the speed of the missile after 10 seconds. [2]

After the fuel runs out, the missile continues to rise vertically, and can be modelled as a particle travelling freely under gravity.

Calculate

(iii) the maximum height above the **ground** reached by the missile, [3]

(iv) the time taken from the moment the missile leaves the ground until it reaches the ground again. [4]

3 A particle is projected vertically upwards with velocity 4 m/s from a point 6 m above the ground.

Calculate

(i) the velocity of the particle when it hits the ground, [2]

(ii) the **total** time taken by the particle to reach the ground. [4]