ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Advanced Level

ADDITIONAL MATHEMATICS 6006/2

PAPER 2

SPECIMEN PAPER 3 hours

Additional materials:
Answer paper
Graph paper
List of Formulae
Scientific calculator

TIME 3 hours

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces provided on the answer paper/answer booklet.

Answer all questions

If a numerical answer cannot be given exactly, and the accuracy required is not specified in the question, then in the case of an angle it should be given to the nearest degree, and in other cases it should be given correct to 2 significant figures.

If a numerical value for g is necessary, take $g = 9.81\ ms^{-2}$.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

The total number of marks for this paper is 120.

The use of a scientific calculator is expected, where appropriate.

You are reminded of the need for clear presentation in your answers.

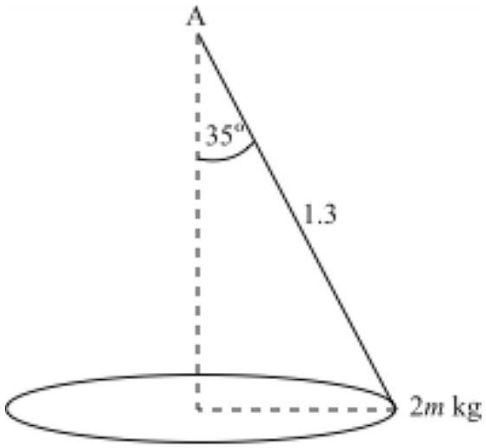
This question paper consists of 6 printed pages and 2 blank pages.

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Section (A) : Mechanics [60]

1



The diagram shows a particle of mass 2m kg attached to one end of a light inextensible string of length 1.3 metres. The other end of the string is attached to a fixed point A. The particle moves at a constant speed in a horizontal circle with the string inclined at an angle of 35° to the vertical.

Calculate the angular speed of the particle. [6]

2 A uniform rectangular lamina ABCD has a mass of 10 kg. AD = BC = 2a and AB = DC = a. The lamina rests in a fixed vertical plane with A on a rough horizontal table. Side AD is inclined at 30° to the horizontal. A force, P, acting along the side DC maintains equilibrium.

Find

(i) P correct to 2 decimal places, [4]

(ii) the normal reaction at A. [5]

3 A small particle, P, of mass 1 kg is threaded on to a smooth circular wire which is fixed in a vertical plane. The radius of the circle with centre O is 0.5 m. The particle is slightly disturbed from rest at the highest point A of the wire.

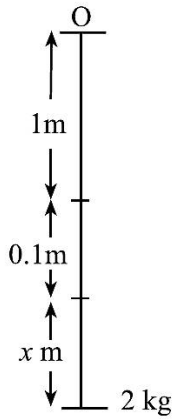
Find in terms of g, the

(i) speed of P when $A\hat{O}P$ is 90°, [3]

(ii) speed of P when it reached the lowest point, [3]

(iii) reaction, R, between the wire and the particle at the lowest point. [3]

4



The diagram shows a particle of mass 2 kg which is suspended from a spring of modulus of elasticity, λ. The end of the spring is attached to a fixed point O and the natural length of the spring is 1 metre. The particle remains at rest when the stretch is 0.1 m. The spring is stretched a further x metres.

(i) Find the modulus of elasticity, λ, in terms of g. [3]

(ii) Hence show that $\ddot{x} = -10gx$. [4]

(iii) Find the period of the motion. [3]

5 A smooth sphere, A, of mass 2 kg moving in a straight line, with a speed of 4 ms^{-1}, on a smooth horizontal plane, collides with a stationary smooth sphere, B, of mass 3 kg. B then collides with a vertical wall which is perpendicular to the direction of motion of the sphere. After rebounding from the wall, B collides with A and coalesce. The coefficient of restitution is $\frac{1}{4}$ at all impacts.

Find the

(i) speed of the spheres after the first impact, [5]

(ii) impulse the wall exerts on sphere B, [4]

(iii) speed of the spheres when they coalesce. [3]

6 A particle moves in a straight line with an initial velocity of $5\sqrt{6}$ ms^{-1}. The particle moves against a resistive force that produces a retardation. The retardation increases at a rate directly proportional to the distance moved. It is also given that the retardation increases from 2 ms^{-2} to 6 ms^{-2} to cover a distance of 10 metres.

The particle has a velocity, v ms^{-1}, when it has moved a distance of x metres.

(a) Show that $v\frac{dv}{dx} = -\frac{1}{5}(10 + 2x)$. [5]

(b) Hence or otherwise, find the

(i) distance moved by the particle in coming to rest,

(ii) time taken in coming to rest.

[9]

Section (B): Statistics [60]

7 At Chizo Secondary School, the average pass rate in mathematics at 'A' level was 40 %. The school hired an experienced mathematics teacher and 4 out of 9 students passed.

Test at 5 % level of significance whether there is evidence of an improvement in the results. [7]

8 The distance travelled by a commuter driver in a day is assumed to be normally distributed with a mean 360 km and a standard deviation 60 km.

(a) Find the probability that the average distance travelled per day will be more than 370 km. [4]

(b) A random sample of 30 days travelled gave a mean distance of 350 km.

Calculate the 98 % confidence interval of the mean distance travelled correct to 1 decimal place. [3]

9 Motor vehicles pass through a toll-gate independently and at random. Heavy vehicles pass at an average rate of 2 in any 30-minute period and light vehicles at a mean rate of 6 in any 30-minute period.

Calculate the probability that in any

(i) 30-minute period, there will be exactly 4 vehicles passing through the toll gate, [3]

(ii) 5 minute period, there will be more than 2 vehicles passing through the toll gate. [4]

10 Some dogs whose mean mass was 6.5 kg, were given a special diet and were to undergo a routine inspection of their masses. After a certain period, five dogs were chosen at random and their masses in kgs, were

6.2; 5.8; 7.0; 8.7; 9.1.

(a) State **two** conditions that are necessary for the valid use of a t-test to test a hypothesis about the mean mass of the dogs. [2]

(b) Use a 5 % level of significance, to find out whether the special diet increases the masses of the dogs. [7]

11 In a hospital maternity unit, the weights of newly born babies were recorded. The mean weight of female babies was 2 200 g with a standard deviation of 60 g. The mean weight of male babies was 3 000 g with a standard deviation of 50 g. Two newly born babies, a male and a female, were chosen at random and their weights observed .

(a) Find the probability that 3 times the weight of the female baby is less than 2 times the weight of the male baby. [5]

(b) It is found that 2 % of the babies develop some respiratory problems immediately after birth.

Find using a suitable approximation, the probability that out of 100 randomly chosen babies, more than 2 develop respiratory problems. [4]

12 The table shows values of two variables x and y, x being the mass of a child immediately after birth and y being the mass of the mother's placenta.

x (kg)	2.2	2.4	2.6	2.8	3.0	3.2
y (kg)	0.37	0.42	0.43	0.45	0.5	0.54

(a) Explain what is meant by the term correlation. [1]

(b) **(i)** Calculate the product moment correlation coefficient between the mass of baby x, and the mass of the mother's placenta y and comment on the value.

(ii) Find the equation of the regression line y on x.

(iii) Find the mass of the mother's placenta when the mass of the baby is 2.3 kg. [9]

13 A manufacturing company has to make 5 deliveries of a particular product per day to retail outlets. The probability that a delivery is accepted is 0.3. During 90 days the number of deliveries accepted in each day were recorded as shown:

number of deliveries	0	1	2	3	4	5
frequency	5	10	15	30	20	10

Test at 5 % level of significance whether a Binomial distribution is an adequate model for testing this data. [11]

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