Surname	Forename(s)	Centre Number	Candidate Number

For Performance Measurement

ZIMBABWE SCHOOL EXAMINATIONS COUNCIL

General Certificate of Education Ordinary Level

ADDITIONAL MATHEMATICS 4026/2

PAPER 2

SPECIMEN PAPER 2 hours 30 minutes

Additional materials:
Mathematical tables **Data Booklet**
Graph paper (4 sheets)

Allow candidates 5 minutes to count pages before the examination.

TIME 2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces provided on the question paper.
Check if the booklet has all the pages and ask the invigilator for a replacement if there are duplicate or missing pages.
Answer **all** questions in Section **A** and any **five** questions from Section **B** and Section **C**.
Do **not** answer more than **four** questions in Section **B** and **not** more than **four** questions in Section **C**
Write your answers on the spaces provided on the question paper.
All working must be shown clearly.
Where necessary take $g = 10\ ms^{-2}$.

Electronic calculators may be used.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.
If the degree of accuracy is not specified in the question and if the answer is not exact, the answer should be given to three significant figures. Answers in degrees should be given to one decimal place.

This question paper consists of 19 printed pages and 1 blank page.

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Section A [40 marks]

Mechanics and Statistics

Answer **all** questions in this section

1 The table shows the annual incomes, in thousands of dollars, for 120 employees at a certain university.

Income (thousand)	10-20	20-30	30-40	40-60	60-100
Frequency	40	48	18	x	4

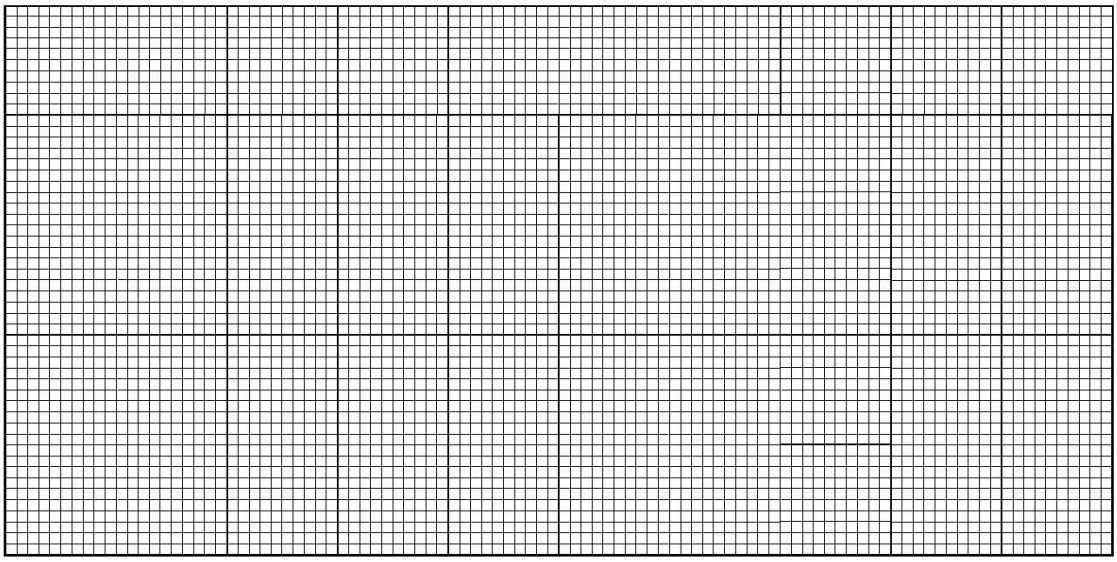
(a) Find the value of x.

$x =$ _____ [2]

(b) Calculate an estimate of the mean income.

Answer _____ [3]

1 **(c)** Draw a histogram to illustrate this data



[5]

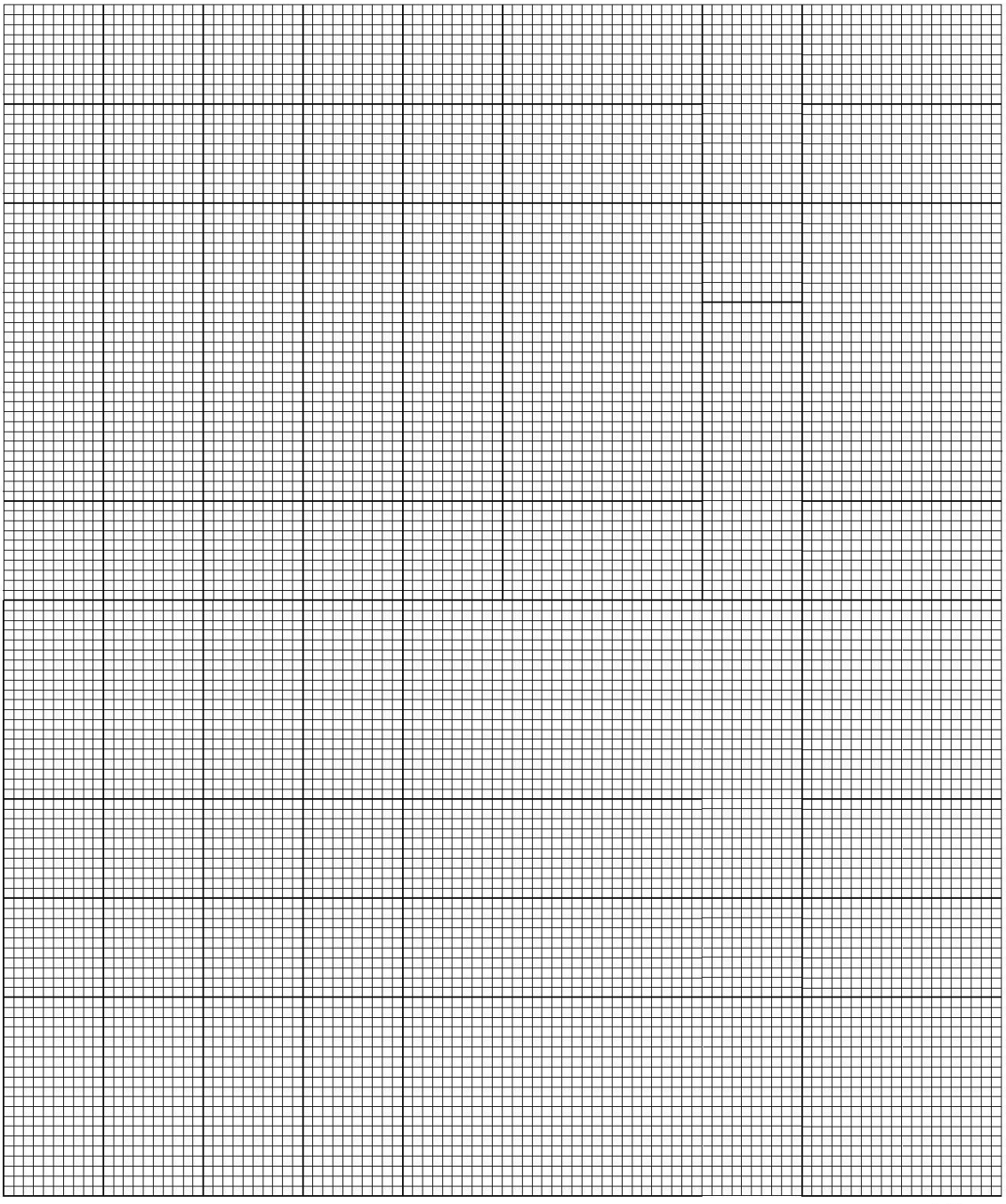
2. During a particular day, the time (in minutes) taken by people entering a food outlet during lunch hour were as follows shown in the table below.

Time (min)	**Frequency**	**Cumulative frequency**
$0 < x \leq 10$	43	43
$10 < x \leq 20$	51	94
$20 < x \leq 30$	69	163
$30 < x \leq 40$	22	x
$40 < x \leq 60$	y	204

(a) Find the value of x and the value y.

$x =$_____ y =_____ [2]

(b) Draw a cumulative frequency curve to represent the information in the table.



[4]

(c) Use the graph to estimate the lower quartile and upper quartile.
Hence calculate the interquartile range.

lower quartile = _____ upper quartile _____

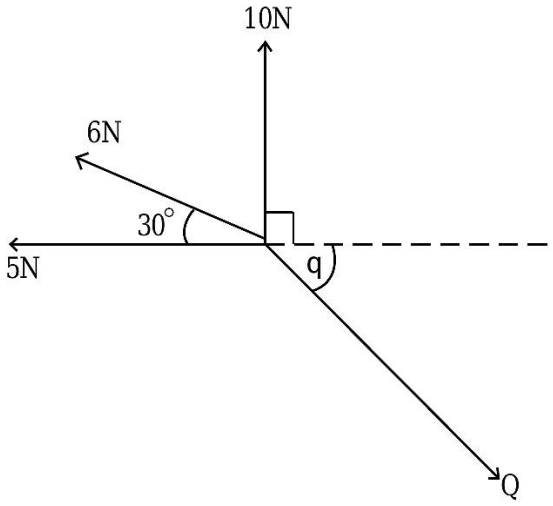
interquartile range = _____ [4]

3. **(a)** Two forces of magnitudes 6 **N** and P **N** have a resultant of magnitude 15 **N**.
Given that the angle between the two forces is 60^0.

Find the value of P.

P = _____ [4]

3 **(b)** A particle is in equilibrium under the forces 10**N**, 6**N** and Q**N** as shown in the diagram.



Find the value of

(i) θ,

θ = _____ [3]

(ii) Q.

Q = _____ [3]

4. A particle starts from rest and accelerates uniformly at 3,2 m/s^2 for 12 s to reach a speed of V m/s. then it decelerates at 1,8 m/s^2 until its speed is 10 m/s.
Calculate,

(a) the value of V,

V = _____ [2]

(b) the time taken when decelerating,

Answer: _____ [2]

(c) the total distance covered during this journey.

Answer: _____ [6]

Section B: Mechanics

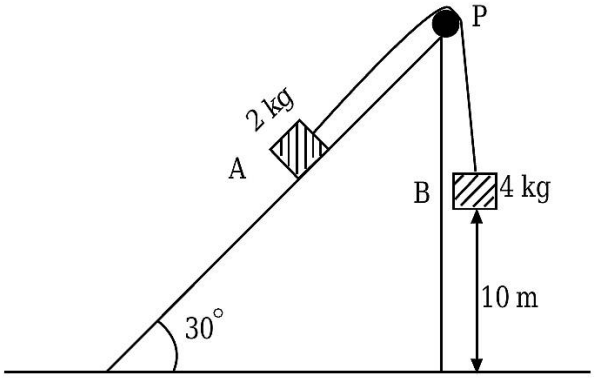
Answer **not** more than **four** questions in this section.

5. **(a)** State any **two** contact forces.

1. _____

2. _____ [2]

(b) Particle A of mass 2 kg rests on a smooth plane inclined at 30^0 to the horizon. It is attached to a particle B of mass 4 kg, by a light inextensible string passing over a smooth pulley P at the top of the plane.



Given that B hangs freely and the system is released from rest, find the

(i) acceleration of the system and the tension in the string,

Acceleration _____ tension _____ [6]

5 **(b)** **(ii)** speed with which B hits the ground,

Answer: _____ [2]

(iii) time B takes to reach the ground

Answer: _____ [2]

6. A horizontal force of magnitude 2,5 **N** pushes a rubber ball of mass M kg along a horizontal surface. When the force is removed , the ball moves with uniform retardation and passes through the points A and B with speeds 7 m/s and 4 m/s, respectively, in 6 seconds.

(a) Find the

(i) retardation of the ball,

Answer: _____ [2]

6 **(a)** **(ii)** distance AB,

Answer: _____ [3]

(iii) work done by the force

Answer: _____ [2]

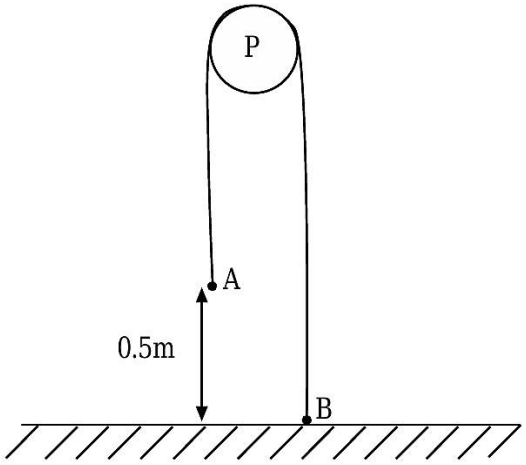
(b) Assuming that there are no other resistances to the motion of the ball, find the value of M.

M = _____ [3]

(c) Find the time it takes the ball to come to rest from A.

Answer: _____ [2]

7. Particles A, of mass 0,3kg and B, of mass 0,2kg are attached to the ends of a light inextensible string. The string passes over a smooth pulley P. Initially the system is held at rest with the string taut, B on the floor and A at a height of 0,5m above the floor (see diagram). The system is then released.



(a) Find the acceleration of the system and the tension in the string.

Answer: _____ [6]

7 **(b)** At the instant when particle A hits the floor, the string becomes detached from particle A.

Find the

(i) greatest height reached by particle B,

Answer: _____ [2]

(ii) speed with which particle A hits the floor,

Answer: _____ [2]

(iii) time taken by particle A to hit the floor.

Answer: _____ [2]

8. **(a)** A particle of mass 5 kg is attached to two strings and hangs freely in equilibrium under gravity with the two strings making angles of 35^0 and 47^0 with horizontal. Calculate to three significant figures, the tension in each string.

Tension = _____ [6]

(b) A water pump raises 60 kg of water per second through a height of 20 m. The water emerges at the surface with a speed of 30 m/s.

(i) Find the kinetic energy and the potential energy given to the water each second.

Answer: _____ [4]

(ii) Hence, find the effective power developed by the pump.

Answer: _____ [2]

9. A car of mass 20 000 kg is travelling at a constant speed of 25 m/s. The engine of the car is working at 70 kw.

(a) Calculate the resistance to motion.

Answer: _____ [2]

(b) Given that the power output and resistance to motion remain constant, calculate the

(i) maximum speed of the car up a plane inclined at an angle θ to the, horizontal where $\sin\theta = \frac{1}{200}$,

Answer: _____ [3]

(ii) acceleration up the slope at the instant when speed of the car is 10 m/s.

Answer: _____ [7]

Section C: Statistics

Answer **not** more than **four** questions in this section.

10 **(a)** The table shows the probability distribution for the discrete random variable X.

X	1	2	3	4	5	6
P(X = x)	k	2k	3k	4k	5k	6k

(i) Find the value of k.

k = _____ [2]

(ii) Show that $E(X) = 4\frac{1}{3}$.

Answer: _____ [2]

(iii) Calculate Var (X).

Var(X) = _____ [3]

10 **(b)** In a basketball tournament the scores of 128 players on the first day of the tournament were recorded. The results are as shown in the table below.

score	3	4	5	6	7
frequency	21	83	17	5	2

Find the mean and variance of the scores.

Mean = _____ Variance = _____ [5]

11 A bag contains 6 red balls and 3 blue balls. The balls are identical except for colour. Three balls are drawn from the bag one after the other and not replaced.

(a) Draw a tree diagram to illustrate probabilities for all the possible outcomes.

[4]

(b) Use the tree diagram to find the probability that

(i) two balls are red and one is blue, in any order,

Answer: _____ [2]

(ii) at least one ball is blue,

Answer: _____ [2]

(iii) the balls are of the same colour,

Answer: _____ [2]

(iv) the first ball is red, given that at least one ball is blue.

Answer: _____ [2]

12 **(a)** A random variable $X \sim Bin(10; p)$, where $p < 0,5$.

Given that variance of X is 1,875 find,

(i) the value of p,

P = _____ [4]

(ii) E(X),

E(X) = _____ [1]

(iii) $P(X \geq 3)$.

Answer: _____ [3]

12 **(b)** It is given that $X \sim N(15;\sigma^2)$
If $P(X<10) = 0,1$.
calculate the value of σ.

$\sigma =$ _____ [4]

13 The mass of a packet of soup coming off a production line is normally distributed with mean 50 g and standard deviation 8 g. A random sample of 25 packets from the production line were selected.

(a) State the distribution of $\overline{X}$

Answer: _____ [2]

(b) Find $P(\overline{X} > 54)$

Answer: _____ [3]

(c) Find $P(48 < \overline{X} < 53)$

Answer: _____ [4]

(d) Find the symmetric 95% confidence interval about the mean.

Answer: _____ [3]

14 A continuous random variable, X, has probability density function given by,

$$f(x) = \begin{cases} ax + b, & 0 \le x \le 2 \\ 0, & \text{otherwise} \end{cases}$$

where a and b are positive constants.

Given that $P(X \le 1) = \frac{1}{3}$.

(a) find the value of a and b.

$a =$ _____ $b =$ _____ [5]

(b) show that $E(X) = \frac{11}{9}$.

[2]

(c) calculate Var (X).

Var(X): _____ [5]

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