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<h1 style="margin: 0;">Mathematics</h1> <h2 style="margin: 0;">Advanced Subsidiary</h2> <h3 style="margin: 0;">Paper 2: Statistics and Mechanics</h3>	
Sample Assessment Material for first teaching September 2017 Time: 1 hour 15 minutes	Paper Reference 8MA0/02
You must have: Mathematical Formulae and Statistical Tables, calculator	Total Marks <div style="border: 1px solid black; width: 60px; height: 40px; margin: 0 auto;"></div>

Candidates may use any calculator permitted by Pearson regulations. Calculators must not have the facility for algebraic manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- There are **two** sections in this question paper. Answer **all** the questions in Section A and **all** the questions in Section B.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 8 questions in this question paper. The total mark for this paper is 60.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

Turn over ►

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SECTION A: STATISTICS

Answer ALL questions. Write your answers in the spaces provided.

1. A company manager is investigating the time taken, t minutes, to complete an aptitude test. The human resources manager produced the table below of coded times, x minutes, for a random sample of 30 applicants.

Coded time (x minutes)	Frequency (f)	Coded time midpoint (y minutes)
$0 \leq x < 5$	3	2.5
$5 \leq x < 10$	15	7.5
$10 \leq x < 15$	2	12.5
$15 \leq x < 25$	9	20
$25 \leq x < 35$	1	30

(You may use $\sum fy = 355$ and $\sum fy^2 = 5675$)

- (a) Use linear interpolation to estimate the median of the coded times.

(2)

- (b) Estimate the standard deviation of the coded times.

(2)

The company manager is told by the human resources manager that he subtracted 15 from each of the times and then divided by 2, to calculate the coded times.

- (c) Calculate an estimate for the median and the standard deviation of t .

(3)

The following year, the company has 25 positions available. The company manager decides not to offer a position to any applicant who takes 35 minutes or more to complete the aptitude test.

The company has 60 applicants.

- (d) Comment on whether or not the company manager's decision will result in the company being able to fill the 25 positions available from these 60 applicants. Give a reason for your answer.

(2)

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(Total for Question 1 is 9 marks)

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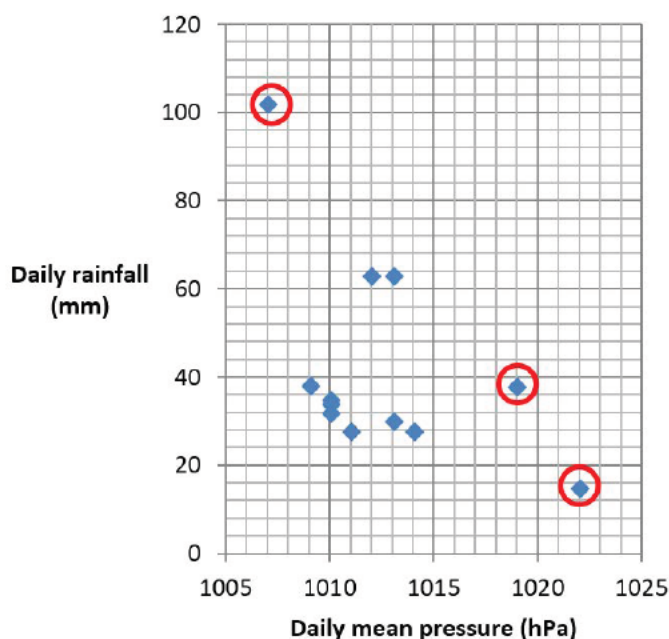
(Total for Question 2 is 8 marks)

3. Pete is investigating the relationship between daily rainfall, w mm, and daily mean pressure, p hPa, in Perth during 2015. He used the large data set to take a sample of size 12. He obtained the following results.

p	1007	1012	1013	1009	1019	1010	1010	1010	1013	1011	1014	1022
w	102.0	63.0	63.0	38.4	38.0	35.0	34.2	32.0	30.4	28.0	28.0	15

Pete drew the following scatter diagram for the values of w and p and calculated the quartiles.

	Q_1	Q_2	Q_3
p	1010	1011.5	1013.5
w	29.2	34.6	50.7



An outlier is a value which is more than 1.5 times the interquartile range above Q_3 or more than 1.5 times the interquartile range below Q_1 .

(a) Show that the 3 points circled on the scatter diagram above are outliers.

(2)

(b) Describe the effect of removing the 3 outliers on the correlation between daily rainfall and daily mean pressure in this sample.

(1)

John has also been studying the large data set and believes that the sample Pete has taken is not random.

(c) From your knowledge of the large data set, explain why Pete's sample is unlikely to be a random sample.

(1)

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- John decided to use the regression line to estimate the daily rainfall for a day in December when the daily mean pressure is 1011 hPa.

- (e) Using your knowledge of the large data set, comment on the reliability of John's estimate. (1)

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(Total for Question 3 is 6 marks)

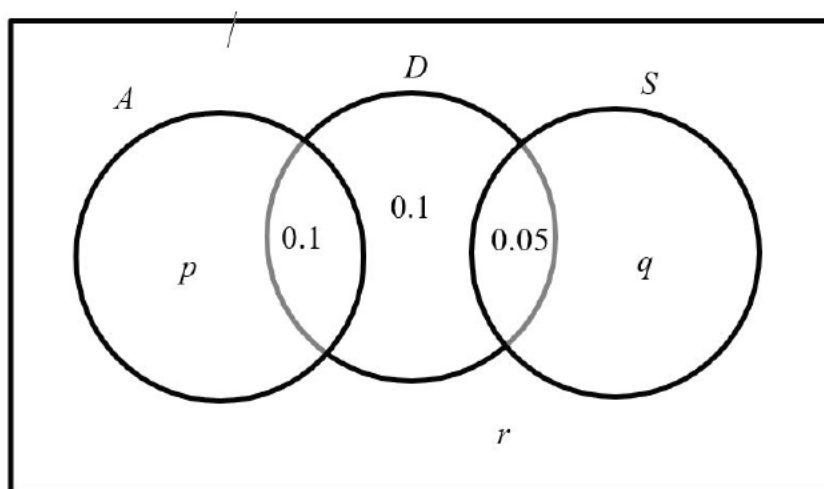
4. Alyona, Dawn and Sergei are sometimes late for school.
The events A , D and S are as follows

A Alyona is late for school

D Dawn is late for school

S Sergei is late for school

The Venn diagram below shows the three events A , D and S and the probabilities associated with each region of D . The constants p , q and r each represent probabilities associated with the three separate regions outside D .



- (a) Write down 2 of the events A , D and S that are mutually exclusive. Give a reason for your answer.

(1)

The probability that Sergei is late for school is 0.2
The events A and D are independent.

- (b) Find the value of r

(4)

Dawn and Sergei's teacher believes that when Sergei is late for school, Dawn tends to be late for school.

- (c) State whether or not D and S are independent, giving a reason for your answer.

(1)

- (d) Comment on the teacher's belief in the light of your answer to part (c).

(1)

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TOTAL FOR SECTION A IS 30 MARKS

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(1)

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(Total for Question 5 is 6 marks)

- (d) Suggest one improvement to the model that would make it more realistic.



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(Total for Question 6 is 7 marks)

7.

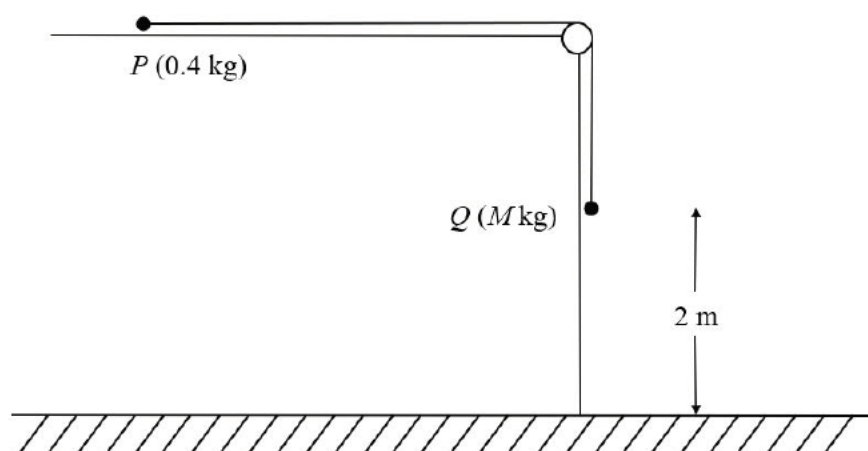


Figure 1

A ball, P , of mass 0.4 kg rests on a rough horizontal table and is attached to one end of a thin rope. The rope passes over a pulley which is fixed at the edge of the table.

The other end of the rope is attached to another ball, Q , of mass $M \text{ kg}$, which hangs freely below the pulley, as shown in Figure 1.

The system is released from rest with the rope taut and with Q at a height of 2 m above the ground and Q moves downwards with acceleration 2.5 m s^{-2} .

In the subsequent motion, P does not reach the pulley before Q reaches the ground.

The balls are modelled as particles, the rope as a light and inextensible string and the pulley as being small and smooth.

The total resistance to the motion of P is modelled as having constant magnitude 1.5 N .

The acceleration due to gravity is modelled as being 10 m s^{-2} .

Using this model, find, to 2 significant figures,

- (a) (i) the tension in the rope, (6)
- (ii) the value of M , (2)
- (b) the time, after release, for Q to hit the ground. (2)
- (c) State one limitation of the model which will affect the accuracy of your answer to part (a). (1)

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(Total for Question 7 is 9 marks)

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- the distance travelled by P in the first second, (3)
- the value of t at the instant when P changes its direction of motion, (2)
- the value of t at the instant when P returns to its starting point. (3)

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Question 8 continued

Lined area for writing the answer to Question 8.

(Total for Question 8 is 8 marks)

TOTAL FOR SECTION B IS 30 MARKS
TOTAL FOR PAPER IS 60 MARKS