IYGB GCE

Mathematics MMS

Advanced Level

Practice Paper R

Difficulty Rating: 3.500/0.8000

Time: 3 hours

Candidates may use any calculator allowed by the regulations of this examination.

Information for Candidates

This practice paper follows closely the Pearson Edexcel Syllabus, suitable for first assessment Summer 2018.

The standard booklet "Mathematical Formulae and Statistical Tables" may be used.
Full marks may be obtained for answers to ALL questions.
The marks for the parts of questions are shown in round brackets, e.g. **(2)**.
There are 14 questions in this question paper.
The total mark for this paper is 150.

Advice to Candidates

You must ensure that your answers to parts of questions are clearly labelled.
You must show sufficient working to make your methods clear to the Examiner.
Answers without working may not gain full credit.
Non exact answers should be given to an appropriate degree of accuracy.
The examiner may refuse to mark any parts of questions if deemed not to be legible.

SECTION 1 - STATISTICS

Question 1

The table below shows the amount spent per month by a car dealership on marketing and advertising m, in £1000, and the number of cars c sold that month.

m	6	7	8	9	10
c	8	13	11	12	14

a) Use a statistical calculator to find …

i. … the value of the product moment correlation coefficient between m and c. **(1)**

ii. … the equation of the regression line between m and c, giving the answer in the form

$$c = a + bm,$$

where a and b are constants. **(2)**

b) Use the equation of the regression line to estimate the number of cars that are expected to be sold in a month where the amount spent on marketing and advertising is …

i. … £8,800.

ii. … £20,000.

Comment further on the reliability of each of these two estimates. **(4)**

c) Interpret in the context of this question the physical meaning of a and b. **(2)**

Question 2

The masses of 68 cows, in kg, are summarised in the table below.

Mass (m)	Frequency
$600 < m \leq 625$	11
$625 < m \leq 650$	14
$650 < m \leq 675$	28
$675 < m \leq 700$	7
$700 < m \leq 725$	5
$725 < m \leq 750$	2
$750 < m \leq 775$	1

a) By using the coding

$$y = \frac{x - 662.5}{25},$$

where x represents the midpoint of each class, estimate the mean and standard deviation of this data. **(7)**

b) Estimate, by the method of linear interpolation, the median mass of these cows. **(2)**

Question 3

A mayoral candidate, Hans Van Dyke, claims that 40% of the electoral will vote for him in the next election. In a recent opinion poll of 20 recently selected voters it was found that **only 4** people will vote for Hans Van Dyke.

a) Test, at the 5% level of significance whether, or not, the opinion poll supports Hans Van Dyke's claim. **(7)**

In a second opinion poll of n randomly selected people, it was found that no one will be voting for Hans Van Dyke. As a result of this poll, Hans Van Dyke's claim is rejected at 1% significance.

b) Determine the smallest value of n. **(3)**

Question 4

A candidate is attempting a test at which a **maximum of two attempts** is allowed.

The outcome of this test is deemed to be a pass or a fail.

The probability that a candidate passes the test in the first attempt is 0.6

The probability that a candidate passes the test is 0.76 .

If a candidate passed the test, determine the probability that he failed the first attempt.

(6)

Question 5

A geologist is looking for fossils in rocks. In a certain area it has been established over a long period of time that 10% of the rocks contain fossils. The geologist selects twenty rocks from this area.

a) State 2 conditions that must be apply in order for a binomial model to be valid.

(2)

Find the probability that in the geologist's sample there will be …

b) … one rock containing fossils. **(2)**

c) … at least one rock containing fossils. **(2)**

The geologist selects a new sample of n rocks.

He wants to have at least a 95% chance that his new sample will contain fossils.

d) Determine the smallest value of n . **(5)**

Question 6

In a clothing factory, the time taken by machines to manufacture a certain type of shirt, are assumed to be Normally distributed with a mean of 44 minutes and a standard deviation of 4 minutes.

a) Determine the value of t, if 10.56% of the shirts take more than t minutes to be manufactured. **(4)**

b) Find the probability that a shirt picked at random, took between 42 and 51 minutes to manufacture. **(4)**

c) If a shirt took less than 45 minutes to be made, calculate the probability that it in fact took more than 42 minutes to make. **(5)**

The owner of the factory believes that the mean time is greater than 44 minutes, due to the aging machinery. He finds that the mean manufacturing time of a random sample of 4 shirts to be 47 minutes.

d) By clearly stating suitable hypotheses, test at the 5% level of significance the owner's belief. **(6)**

Question 7

The events A and B satisfy

$$\mathrm{P}(A) = x, \qquad \mathrm{P}(B) = y, \qquad \mathrm{P}(A \cup B) = 0.6, \qquad \mathrm{P}(B|A) = 0.2.$$

a) Show clearly that

$$4x + 5y = 3. \quad \textbf{(5)}$$

The events B and C are mutually exclusive such that

$$\mathrm{P}(B \cup C) = 0.9, \qquad \mathrm{P}(C) = x + y.$$

b) Find the value of x and the value of y. **(4)**

c) Determine, showing all the relevant workings, whether the events A and B are statistically independent. **(2)**

SECTION 2 - MECHANICS

Question 8



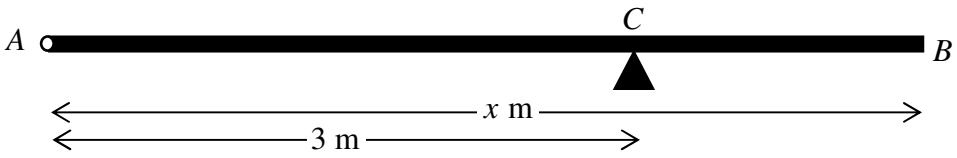
Two blocks A and B of respective masses 4 kg and 6 kg lie on a smooth horizontal surface and are connected by a light inextensible string.

Two collinear forces, of magnitudes F N and 30 N, act on each of the blocks, and in opposite directions, as shown in the figure above.

The system has constant acceleration of magnitude 2 ms^{-2}.

Determine the possible values of F, and in each case the corresponding value of the tension in the string. **(8)**

Question 9



The figure above shows a uniform wooden beam AB, of length x m and weight 80 N. The beam is smoothly hinged at A and rests in a horizontal position on a smooth support at C, where $AC = 3$ m.

When a rock of weight 70 N is placed on the beam at B the magnitude of the reaction force on the beam at C is 165 N.

The beam is modelled as a uniform rod and the rock as a particle.

a) Calculate the value of x. **(3)**

b) Explain briefly the model …

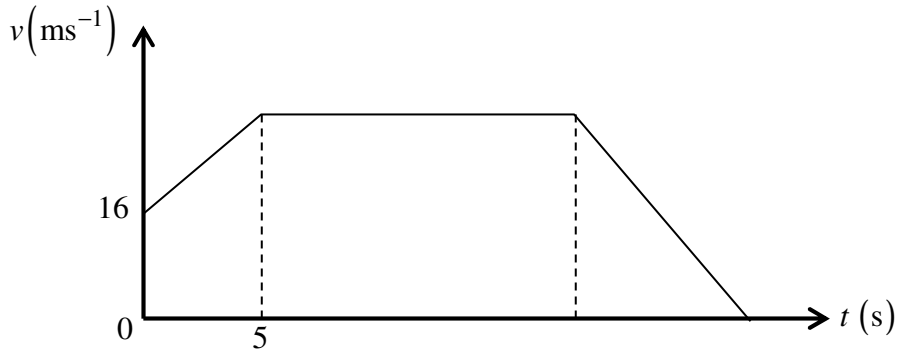
i. … the beam is a uniform rod. **(1)**

ii. … the rock is a particle. **(1)**

The rock is next moved to a new position D on the beam, so that the beam with the rock at D remains in equilibrium in a horizontal position. The magnitude of reaction force at the support at C is now twenty times as large as the reaction force at the hinge at A.

c) Calculate the distance AD. **(4)**

Question 10



The figure above shows the speed time graph (t, v) of a particle in a straight line between two points, A and B.

At $t = 0$, the particle is observed passing through A with speed 16 ms^{-1} and constant acceleration of 1.6 ms^{-2}, which it maintains until $t = 5$.

For $t \geq 5$, the particle moves with constant speed which it maintains until it is 820 m from A.

As soon the particle is reaches a distance of 820 m from A, it decelerates uniformly at 4 ms^{-2}, coming to rest at B.

Determine in any order the distance AB and the total time taken for the particle to travel from A to B. **(10)**

Question 11

A particle P is moving on a straight line.

At time t seconds, the distance of P from a fixed origin O is x metres and its acceleration is

$$(8-2t) \text{ ms}^{-1}$$

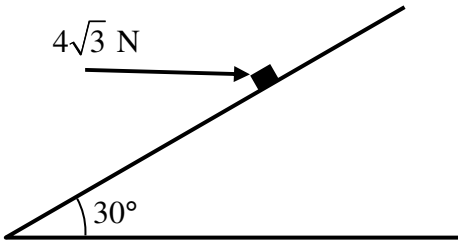
in the direction of x increasing.

It is further given that when $t=0$, P was moving towards O with speed 7 ms^{-1}.

Determine the total distance covered by P in the first 7 seconds. **(10)**

Question 12

When a particle is gently placed on a rough plane inclined at an angle of $30°$ to the horizontal, it is at the point of slipping down a line of greatest slope of the plane.



When a horizontal force of magnitude $4\sqrt{3}$ N is acting on the same particle and on the same incline plane, as shown in the above figure, the particle is accelerating up a line of greatest slope of the plane with constant acceleration 0.2 ms^{-2}.

This horizontal force acts in a vertical plane, which contains the box and a line of greatest slope of the plane.

Determine the mass of the particle. **(12)**

Question 13

A man in a park throws a small ball and his dog catches it with his mouth.

The man throws the ball from a height of 1.6 m and the dog catches the ball at a height of 0.7 m.

The man throws the ball with speed $15\ \text{ms}^{-1}$ at an angle of $30°$ above the horizontal.

The ball is modelled as a particle and the park grounds as a level horizontal plane.

a) Calculate the horizontal distance covered by the ball during its flight from the man's hand to the dog's mouth. **(7)**

b) Find the greatest speed of the ball during its flight.

You may not use direct energy calculations for this part. **(4)**

Question 14

Relative to a fixed origin O, the horizontal unit vectors $\mathbf{i}$ and $\mathbf{j}$ are pointing due east and due north, respectively.

A boat is sailing with constant velocity. At time t hours after noon the position vector of the boat is $\mathbf{r}$ km.

When $t = 0$, $\mathbf{r} = (-5\mathbf{i} + 10\mathbf{j})$ km and when $t = 3$, $\mathbf{r} = (4\mathbf{i} - 2\mathbf{j})$ km.

a) Calculate the speed of the boat. **(4)**

b) Find the direction in which the boat is moving, giving the answer as a bearing. **(2)**

c) Determine an expression for $\mathbf{r}$, in terms of t. **(2)**

A beacon is located at the point with position vector $(10\mathbf{i} - 10\mathbf{j})$ km.

When $t = T$, the boat is at a distance of 15 km from the beacon.

d) Determine the two possible values of T. **(7)**