IYGB GCE

Mathematics MMS

Advanced Level

Practice Paper G

Difficulty Rating: 3.3367/0.7509

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 17 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 % marks, rounded to the nearest integer, of a recent Mathematics test taken by 16 students, were summarised in an ordered stem and leaf diagram.

4	7
5	2, 3, 8
6	0, 3, 4, a, b
7	3, 6, c, d, 8
8	1, 9

where $\overline{5|2} = 52$.

a) Determine the lower quartile of the data. **(1)**

b) Given the median is 68 and $a \neq b$, find the value of a and the value of b. **(2)**

It is further given that $c \neq d$.

c) Find the possible values of the upper quartile. **(4)**

Question 2

In a histogram the weights of apples, W grams, are plotted on the x axis.

In this histogram the class $125 \leq W < 130$ has a frequency of 75 and is represented by a rectangle of base 1.8 cm and height 12 cm.

In the same histogram the class $150 \leq W < 170$ has a frequency of 40.

Determine the measurements, in cm, of the rectangle that represents the class $150 \leq W < 170$. **(3)**

Question 3

An electrical appliances supplier wishes to investigate the impact of advertising on the sales of his washing machines.

He records the number of monthly advertisements placed on the local radio station and the number of washing machines sold.

This is a table of his results.

Number of Advertisements (x)	52	37	66	45	77	27	80	19	47	40
Number of Washing Machines Sold (y)	180	115	171	166	177	99	174	100	143	164

Test, at the 10% level of significance, whether there is evidence of correlation between x and y, and explain what conclusions the electrical appliances supplier should make from this value. **(7)**

Question 4

The recruitment director of a large accounting firm believes that maths graduates are more successful when applying for positions in his firm compared with graduates of other subjects.

One in five job applicants to this firm is successful.

The recruitment director selects a random sample of 25 maths graduate applicants.

a) Find the critical region to test at the 5% level of significance the director's belief.

State your hypotheses clearly. **(5)**

b) State the probability of incorrectly rejecting the null hypothesis in a test, using the critical region obtained in part **(a)**. **(1)**

Ten successful maths graduate applicants were found in the sample.

c) Complete the test. **(2)**

Question 5

The probability that a certain type of rose bush will exceed 2 metres in height is 0.25.

Sixty such rose bushes are planted.

Using a distributional approximation, find the probability that more than 13 but no more than 18 of these bushes, will exceed a height of 2 metres. **(7)**

Question 6

The events A and B are such so that

$$\mathrm{P}(A) = 0.2, \quad \mathrm{P}(B) = 0.6 \quad \text{and} \quad \mathrm{P}(A' \cap B') = 0.25.$$

Determine …

a) … $\mathrm{P}(A \cap B)$. **(3)**

b) … $\mathrm{P}(A \cap B') \cup \mathrm{P}(A' \cap B')$. **(1)**

c) … $\mathrm{P}(A' \cup B)$ **(1)**

Question 7

An airline service operates between Manchester and Madrid.

The flight times of this service, in minutes, may be modelled by a Normal distribution with mean of 85 and a standard deviation of 8.

a) Determine the probability that the next flight time of this service will take less than 75 minutes. **(4)**

b) Find the time **not** exceeded by 22.66% of the flights. **(4)**

c) If a flight from this service took less than 95 minutes, what is the probability that the actual flight time was in fact less than 75 minutes. **(3)**

Question 8

A certain genetic disease is present in 6% of the population.

A certain test has been developed for detecting this disease.

If a person has the disease the test returns a positive result in 92% of the cases.

If a person does **not** have the disease, the test returns a positive result in 5% of the cases.

A randomly chosen person from the general population is tested.

a) Determine the probability that his test returns a positive result. **(3)**

b) If this person's test returns a positive result, calculate the probability that he does not have the disease. **(3)**

A randomly chosen person that tested positive is tested again for a second time.

c) Find the probability that this person's test will again return a positive result. **(3)**

d) If the second test returns a positive result, calculate the probability that this person does have the disease. **(4)**

Question 9

*In this question you may **only** use the binomial table in the following page if you require **cumulative** probabilities.*

***No credit** will be given for answers directly obtained from a statistical calculator.*

Elastic cat collars are available in boxes of 50 collars and in two different varieties, standard and fluorescent. The proportions of different colours of these cat collars in the two varieties are shown in the tables below.

Standard Colour	Red	Blue	White	Black
Proportion	0.175	0.4	0.325	0.1

Fluorescent Colour	Yellow	Pink	Green	Orange
Proportion	0.18	0.4	0.15	0.27

A box of 50 **standard colour** cat collars is selected at random.

a) Determine the probability that this box will contain …

i. … exactly 6 red cat collars. **(2)**

ii. … at least 15 but less than 25 blue cat collars. **(2)**

Next, another box of 50 **standard colour** cat collars and a box of 50 **fluorescent colour** cat collars are selected at random.

b) Determine the probability that in these 100 cat collars there will be …

i. … no black collars **(2)**

ii. … fewer than 20 blue or black cat collars **and** more than 30 yellow or orange cat collars. **(4)**

Finally, another box of 50 **fluorescent colour** cat collars are selected at random.

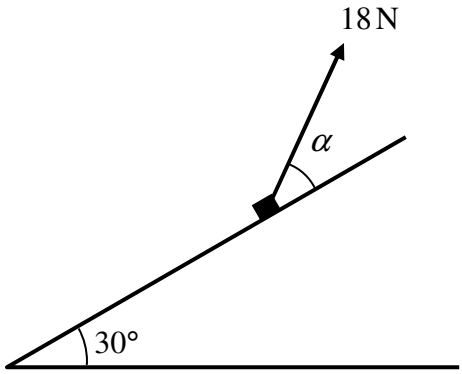
c) Determine the probability that in these cat collars there will be at least 25 but less than 33 cat collars, that are **not pink**. **(4)**

[Binomial Cumulative Probability Table Overleaf]

p =	0.05	0.10	0.15	0.20	0.25	0.30	0.35	0.40	0.45	0.50
$n = 50, x = 0$	0.0769	0.0052	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1	0.2794	0.0338	0.0029	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.5405	0.1117	0.0142	0.0013	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
3	0.7604	0.2503	0.0460	0.0057	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000
4	0.8964	0.4312	0.1121	0.0185	0.0021	0.0002	0.0000	0.0000	0.0000	0.0000
5	0.9622	0.6161	0.2194	0.0480	0.0070	0.0007	0.0001	0.0000	0.0000	0.0000
6	0.9882	0.7702	0.3613	0.1034	0.0194	0.0025	0.0002	0.0000	0.0000	0.0000
7	0.9968	0.8779	0.5188	0.1904	0.0453	0.0073	0.0008	0.0001	0.0000	0.0000
8	0.9992	0.9421	0.6681	0.3073	0.0916	0.0183	0.0025	0.0002	0.0000	0.0000
9	0.9998	0.9755	0.7911	0.4437	0.1637	0.0402	0.0067	0.0008	0.0001	0.0000
10	1.0000	0.9906	0.8801	0.5836	0.2622	0.0789	0.0160	0.0022	0.0002	0.0000
11	1.0000	0.9968	0.9372	0.7107	0.3816	0.1390	0.0342	0.0057	0.0006	0.0000
12	1.0000	0.9990	0.9699	0.8139	0.5110	0.2229	0.0661	0.0133	0.0018	0.0002
13	1.0000	0.9997	0.9868	0.8894	0.6370	0.3279	0.1163	0.0280	0.0045	0.0005
14	1.0000	0.9999	0.9947	0.9393	0.7481	0.4468	0.1878	0.0540	0.0104	0.0013
15	1.0000	1.0000	0.9981	0.9692	0.8369	0.5692	0.2801	0.0955	0.0220	0.0033
16	1.0000	1.0000	0.9993	0.9856	0.9017	0.6839	0.3889	0.1561	0.0427	0.0077
17	1.0000	1.0000	0.9998	0.9937	0.9449	0.7822	0.5060	0.2369	0.0765	0.0164
18	1.0000	1.0000	0.9999	0.9975	0.9713	0.8594	0.6216	0.3356	0.1273	0.0325
19	1.0000	1.0000	1.0000	0.9991	0.9861	0.9152	0.7264	0.4465	0.1974	0.0595
20	1.0000	1.0000	1.0000	0.9997	0.9937	0.9522	0.8139	0.5610	0.2862	0.1013
21	1.0000	1.0000	1.0000	0.9999	0.9974	0.9749	0.8813	0.6701	0.3900	0.1611
22	1.0000	1.0000	1.0000	1.0000	0.9990	0.9877	0.9290	0.7660	0.5019	0.2399
23	1.0000	1.0000	1.0000	1.0000	0.9996	0.9944	0.9604	0.8438	0.6134	0.3359
24	1.0000	1.0000	1.0000	1.0000	0.9999	0.9976	0.9793	0.9022	0.7160	0.4439
25	1.0000	1.0000	1.0000	1.0000	1.0000	0.9991	0.9900	0.9427	0.8034	0.5561
26	1.0000	1.0000	1.0000	1.0000	1.0000	0.9997	0.9955	0.9686	0.8721	0.6641
27	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9981	0.9840	0.9220	0.7601
28	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9993	0.9924	0.9556	0.8389
29	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9997	0.9966	0.9765	0.8987
30	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9986	0.9884	0.9405
31	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9995	0.9947	0.9675
32	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9998	0.9978	0.9836
33	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9991	0.9923
34	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9997	0.9967
35	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999	0.9987
36	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9995
37	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.9998
38	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

SECTION 2 - MECHANICS

Question 10



A box of weight 20 N is held by a rope, in limiting equilibrium on a fixed rough inclined plane. The rope is modelled as a light inextensible string and the box is modelled as a particle.

The rope lies in a vertical plane containing a line of greatest slope of the incline plane and is inclined to the plane at an angle α, where $\tan\alpha = \frac{3}{4}$.

The plane is at an angle of $30°$ to the horizontal, as shown in the figure above.

When the tension in the rope is 18 N the box is at the point of slipping up the plane.

Calculate the value of the coefficient of friction between the box and the plane. **(9)**

Question 11

A golf ball is struck from a point O on level horizontal ground with a speed of $28\ \text{ms}^{-1}$ at an angle of elevation of $30°$.

The ball is travelling freely under gravity and on its way down just clears the top of a tree T, whose height is $8.4\ \text{m}$. The ball is modelled as a particle.

a) Determine the greatest height achieved by the ball as it travels from O to T. **(2)**

b) Calculate the time it takes the ball to travel from O to T. **(5)**

c) Find the speed of the ball as it passes through T. **(5)**

Question 12

Three coplanar forces $\mathbf{F}_1$, $\mathbf{F}_2$ and $\mathbf{F}_3$ act on a particle.

$\mathbf{F}_1$ has magnitude $25\ \text{N}$, acting in a bearing of $270°$.

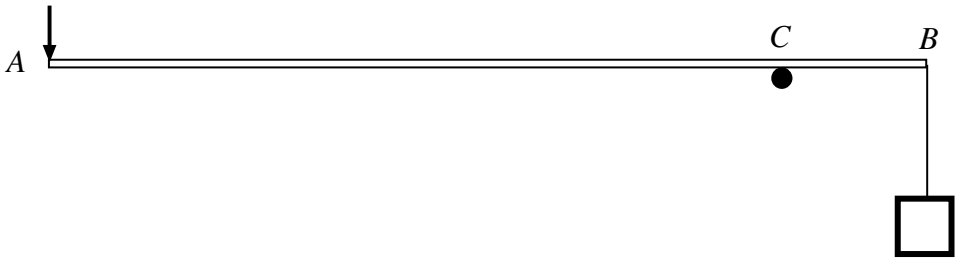
$\mathbf{F}_2$ has magnitude $X\ \text{N}$, acting in a bearing of $180°$.

$\mathbf{F}_3$ has magnitude $(X+2)\ \text{N}$, acting in a bearing of $90°$.

The resultant of these three forces has magnitude $37\ \text{N}$.

Determine, as a three figure bearing, the angle at which the resultant of these three forces is acting. **(8)**

Question 13



A mechanical lever consists of a uniform steel rigid rod AB, of length 2 m and weight 100 N, placed over a smooth pivot at C.

A box of weight 2400 N is suspended by a light inextensible string at B. When a vertical force is applied at A, as shown in the figure above, the lever remains in equilibrium, with AB horizontal.

a) Given that $CB = 0.3$ m, determine the magnitude of the force applied at A. **(4)**

The position of the pivot is changed so that lever remains in equilibrium when the vertical force applied at A has magnitude 200 N.

b) Calculate the new distance of the pivot from B. **(4)**

Question 14

At time $t = 0$ s, two particles A and B are projected vertically upwards with speeds 13 ms^{-1} and 3 ms^{-1}, respectively.

The projection of A is from a point on level horizontal ground while the projection of B is from a point which is 20 m vertically above the projection point of A.

When $t = T$ s, both particles are at a height H m above ground.

a) Calculate the value of T. **(6)**

b) Determine the value of H. **(2)**

Question 15

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

The velocity of a particle, $\mathbf{v}$ ms^{-1}, at time t s after a given instant is

$$\mathbf{v} = (3-2t)\mathbf{i} + (3t-6)\mathbf{j}.$$

a) Find the speed of the particle when $t = 0$. **(2)**

b) Determine the bearing on which the particle is moving when $t = 4$. **(3)**

c) Calculate the value of t when the particle is moving …

i. … parallel to $\mathbf{i}$. **(2)**

ii. … parallel to $5\mathbf{i} - 7\mathbf{j}$. **(3)**

Question 16

Two cars, A and B, are each travelling with constant speed along the same straight horizontal road.

The speed of A is 20 ms^{-1} and the speed of B is 30 ms^{-1}.

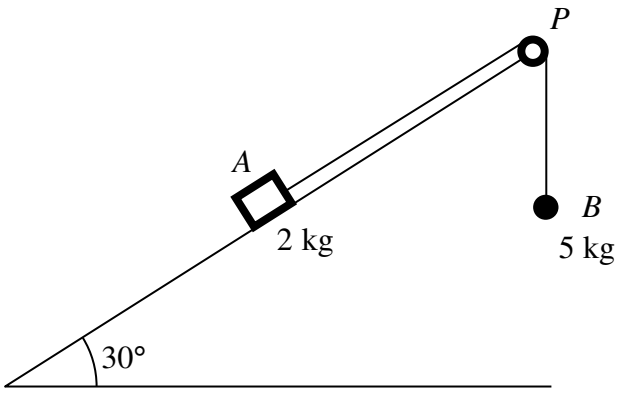
At time $t = 0$ s, B overtakes A.

At time $t = T$ s, B begins to decelerate uniformly coming to rest at the end of a traffic queue. At time $t = 40$ s, A begins to decelerate uniformly coming to rest at the end of a traffic queue, next to B. Both cars come to rest at the same time, 900 m from the point where B first overtook A.

a) Sketch, on the same set of axes, a speed time graph to show the motion of the two cars from $t = 0$ until both come to rest. **(4)**

b) Determine the value of T, showing a fully detailed method. **(6)**

Question 17



Two particles A and B, of mass 2 kg and 5 kg respectively, are attached to each of the ends of a light inextensible string. The string passes over a smooth pulley P, at the top of a fixed rough plane, inclined at $30°$ to the horizontal.

Particle A is placed at rest on the incline plane while B is hanging freely at the end of the incline plane vertically below P, as shown in the figure above. The two particles, the pulley and the string lie in a vertical plane parallel to the line of greatest slope of the incline plane.

The particles are released from rest with the string taut. Particle A begins to move up the incline plane, where the coefficient between A and the plane is $\frac{1}{2}\sqrt{3}$.

Ignoring air resistance, calculate the tension in the string immediately after the particles are released. **(10)**