Applications and Interpretation Standard Level for IBDP Mathematics
Practice Paper Set 1 – Paper 2 (90 Minutes)

Question – Answer Book

Instructions

1. Attempt **ALL** questions. Write your answers in the spaces provided in this Question - Answer Book.

2. A graphic display calculator is needed.

3. You are suggested to prepare a formula booklet of Applications and Interpretation for IBDP Mathematics when attempting the questions.

4. Supplementary answer sheets and graph papers will be supplied on request.

5. Unless otherwise specified, **ALL** working must be clearly shown.

6. Unless otherwise specified, numerical answers should be either **EXACT** or correct to **3 SIGNIFICANT FIGURES**.

7. The diagrams in this paper are **NOT** necessarily drawn to scale.

8. Information to be read before you start the exam:

	Marker's Use Only	Examiner's Use Only	
Question Number	**Marks**	**Marks**	**Maximum Mark**
1			**17**
2			**14**
3			**17**
4			**13**
5			**19**
Overall			
Paper 2 Total			**80**

1. The equation of the straight line L_1 is given by $3x + y - 10 = 0$. The coordinates of the point P are $(3, 1)$.

(a) Show that P lies on L_1.

[1]

(b) Write down the y-intercept of L_1.

[1]

The coordinates of the point Q are $(11, -3)$. M is the mid-point of PQ.

(c) Find

(i) the coordinates of M;

(ii) the gradient of PQ;

(iii) the distance between P and Q.

[6]

The straight line L_2 passes through P and Q.

(d) Show that L_1 and L_2 are not perpendicular.

[2]

The straight line L_3 passes through P and is perpendicular to L_1.

(e) Show that the equation of L_3 is $x - 3y = 0$.

[4]

L_1 and L_3 intersect with the y-axis at R and S respectively.

(f) Find the area of the triangle PRS.

[3]

2. A coffee shop provides 800 breakfast packages for customers every morning. The weights W g of the packages are normally distributed with mean 390 g and standard deviation 13 g.

(a) Find the probability that the weight of a randomly chosen package is less than 400 g.

[2]

(b) Hence, find the expected number of packages less than 400 g in any morning.

[2]

(c) Given that the weight of a randomly chosen package is less than 400 g, find the probability that its weight is less than 385 g.

[3]

The manager of the coffee shop wants to set the prices for the breakfast packages of different ranges of weights, as shown in the following table.

Weight W g	$W < j$	$j \leq W \leq k$	$W > k$
Price $\$P$	\$4	\$4.5	\$5

It is given that 50% and 20% of the breakfast packages provided in every morning cost $\$4$ and $\$5$ respectively.

(d) (i) Write down j.

(ii) Write down the percentage of the breakfast packages provided in every morning that costs $\$4.5$

(ii) Find k.

[4]

(e) Hence, find the expected daily income from selling the packages, assuming that all packages can be sold.

[3]

3. The relationship between the body temperature and the pulse rate of the students from a sports team is investigated. Six students from the group A of the team are first medically examined and their body temperature and their pulse rates are recorded in the table below.

Student	A	B	C	D	E	F
Body Temperature ($x^\circ\text{C}$)	35.8	36.2	36.4	36.7	37.4	37.1
Pulse Rate (y beats per minute)	80	81	87	117	100	93

(a) The relationship between the variables is modelled by the regression equation $y = ax + b$.

(i) Write down the value of a and of b.

(ii) Hence, estimate the pulse rate of a student whose body temperature is 37°C.

[4]

(b) (i) Write down the correlation coefficient.

(ii) State which **two** of the following describe the correlation between the variables.

[3]

positive	strong	zero
negative	weak	moderate

A similar investigation has been completed last year. The pulse rates of 100 students were recorded and the data was presented as follows:

Pulse Rate (y beats per minute)	Frequency
$75 \le y < 85$	16
$85 \le y < 95$	23
$95 \le y < 105$	32
$105 \le y < 115$	12
$115 \le y < 125$	17

Someone claims that the distribution of the data is expected to be evenly distributed. Hence, a χ^2 goodness of fit test is conducted at a 5% significance level.

(c) (i) Write down the null hypothesis of the test.

(ii) Find the p-value.

(iii) Hence, state the conclusion of the test with a reason.

[5]

Another five students from the Group B of the team are also medically examined and their pulse rates are recorded in the table below.

Student	G	H	I	J	K
Pulse Rate (y beats per minute)	95	99	117	87	110

The team manager wants to know whether the mean pulse rates μ_A and μ_B of the students from the Group A and the Group B respectively are different. A t-test is conducted at a 1% significance level.

(d) (i) Write down the alternative hypothesis of the test.

(ii) Find the p-value.

(iii) Hence, state the conclusion of the test with a reason.

[5]

4. A closed rectangular box has length $4x\,\text{cm}$, width $2x\,\text{cm}$ and height $y\,\text{cm}$, where x, $y > 0$. It is given that the sum of the length and the height of the rectangular box is $20\,\text{cm}$.

(a) Write down

(i) an expression for y in terms of x;

(ii) the possible range of values of x.

[2]

(b) Express V in terms of x, where $V\,\text{cm}^3$ is the volume of the rectangular box.

[2]

(c) Using the graphic display calculator to find

(i) the maximum volume;

(ii) the value of x when V attains its maximum;

(iii) the value of y when V attains its maximum.

[5]

(d) Express A in terms of x, where $A\,\text{cm}^2$ is the total surface area of the rectangular box.

[2]

(e) Someone claims that the total surface area of the box attains its maximum when its volume attains its maximum. Explain why the claim is incorrect.

[2]

5. The function f is given by $f(x) = \frac{4}{3}x^3 + 5x^2 - 6x + 2$, $x \in \mathbb{R}$.

(a) Write down the y-intercept of the graph of f.

[1]

(b) Find $f(3)$.

[2]

(c) Find $f'(x)$.

[2]

(d) Solve the equation $f'(x) = 0$.

[3]

(e) Write down the equations of the horizontal tangents of the graph of f.

[2]

(f) Write down the range of values of w such that the equation $f(x) = w$ has

(i) three solutions;

(ii) only one solution.

[4]

(g) Find the gradient of the tangent at $x = 3$.

[2]

(h) Hence, show that the equation of the normal at $x = 3$ is $x + 60y - 3903 = 0$.

[3]

END OF PAPER