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 .
 - (b) Write down the *y*-intercept of L_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.

The straight line L_2 passes through P and Q.

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

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.

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

(f) Find the area of the triangle PRS.

[3]

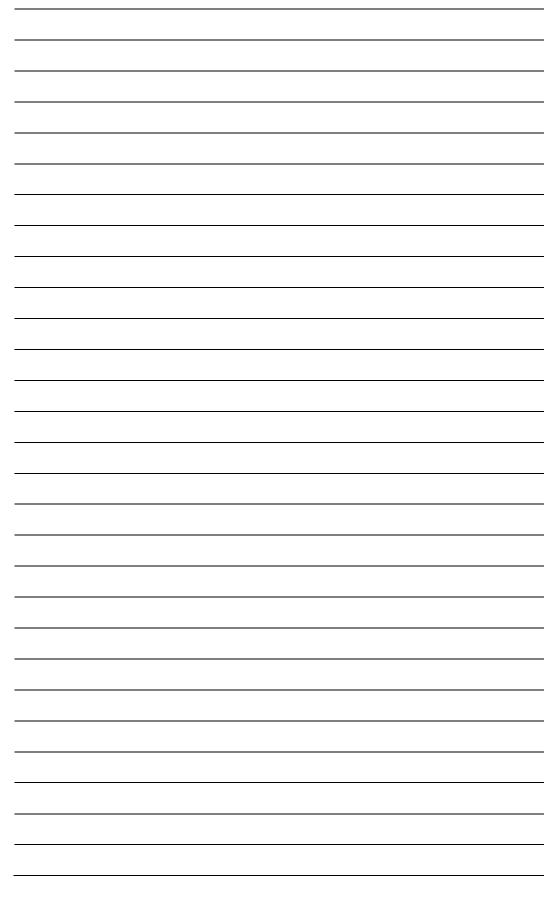
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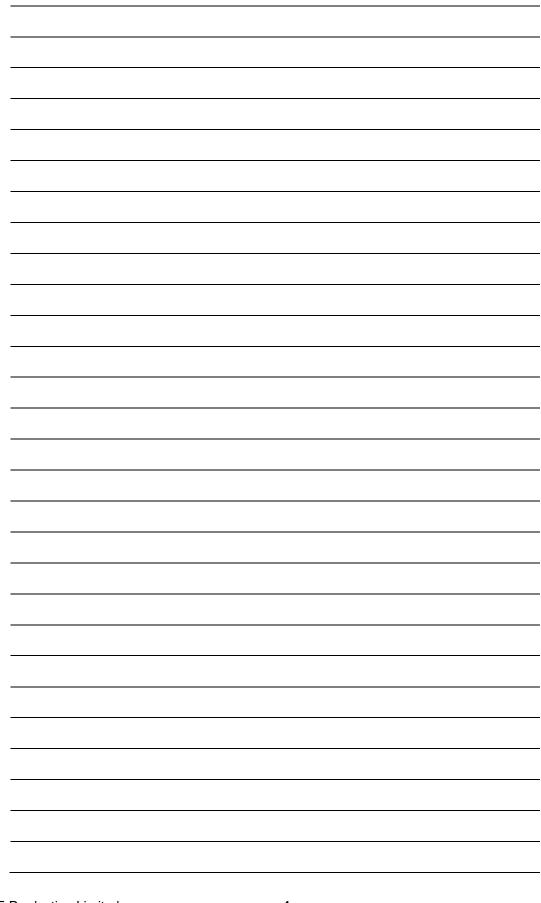
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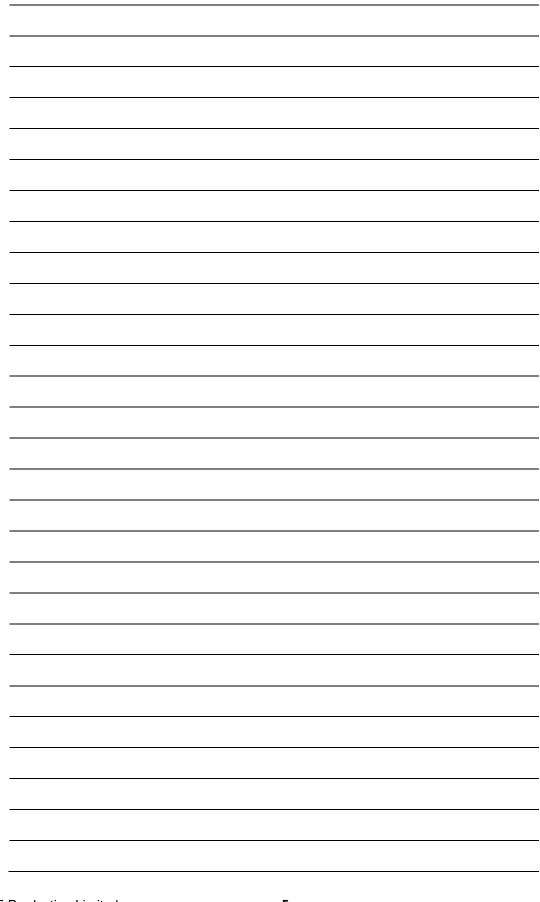
[1]

[6]

[2]







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

[2]

[2]

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 Wg	W < j	$j \le W \le k$	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.

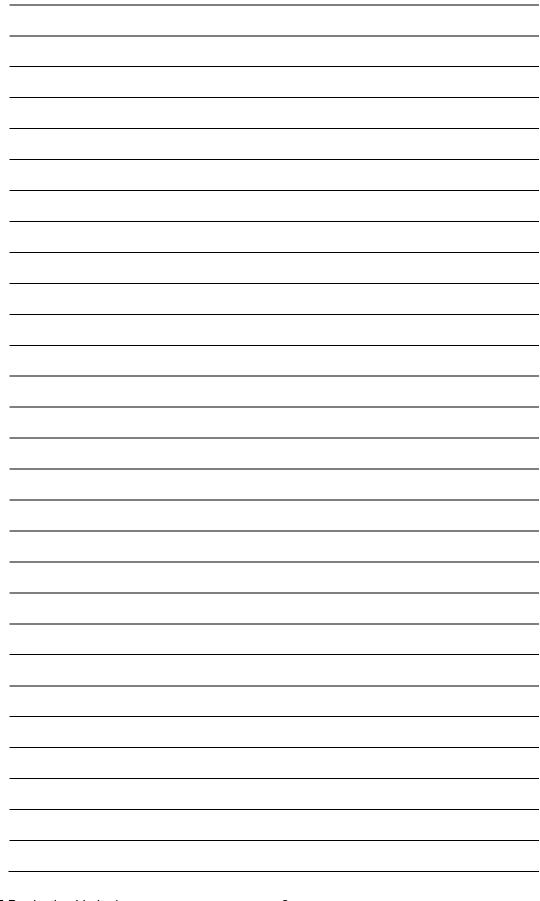
- (d) (i) Write down j.
 - (ii) Write down the percentage of the breakfast packages provided in every morning that costs \$4.5
 - (ii) Find k.
- (e) Hence, find the expected daily income from selling the packages, assuming that all packages can be sold.

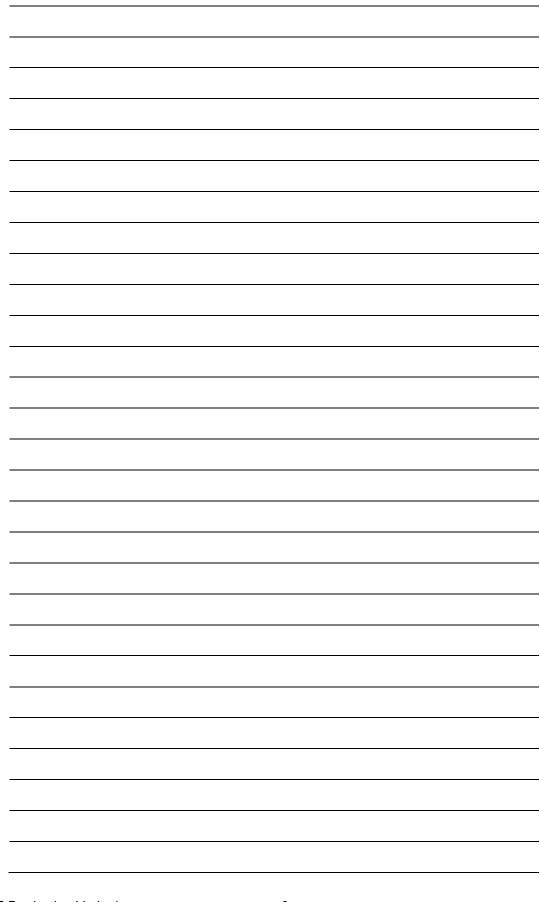
[3]

[4]

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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	А	В	С	D	Е	F
Body Temperature ($x^{\circ}C$)	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 $37^{\circ}C$.

[4]

[3]

- (b) (i) Write down the correlation coefficient.
 - (ii) State which **two** of the following describe the correlation between the variables.

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.

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	Н	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.

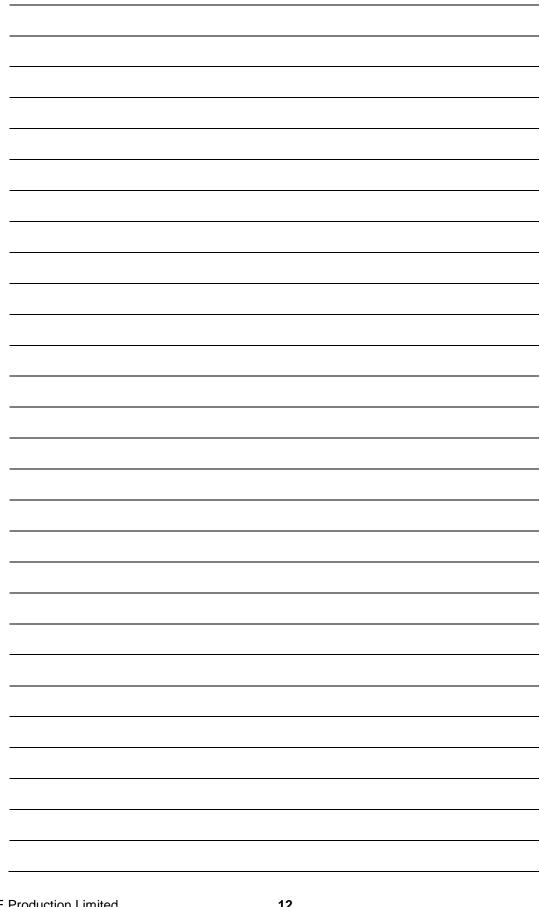
(d) (i) Write down the alternative hypothesis of the test.

- (ii) Find the *p*-value.
- (iii) Hence, state the conclusion of the test with a reason.

[5]

[5]







- **4.** A closed rectangular box has length 4x cm, width 2x cm and height y cm, where x, y > 0. It is given that the sum of the length and the height of the rectangular box is 20 cm.
 - (a) Write down
 - (i) an expression for y in terms of x;
 - (ii) the possible range of values of x.
 - (b) Express V in terms of x, where $V \text{ cm}^3$ is the volume of the rectangular box.
 - (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.
 - (d) Express A in terms of x, where $A \text{ cm}^2$ is the total surface area of the rectangular box.
 - (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]

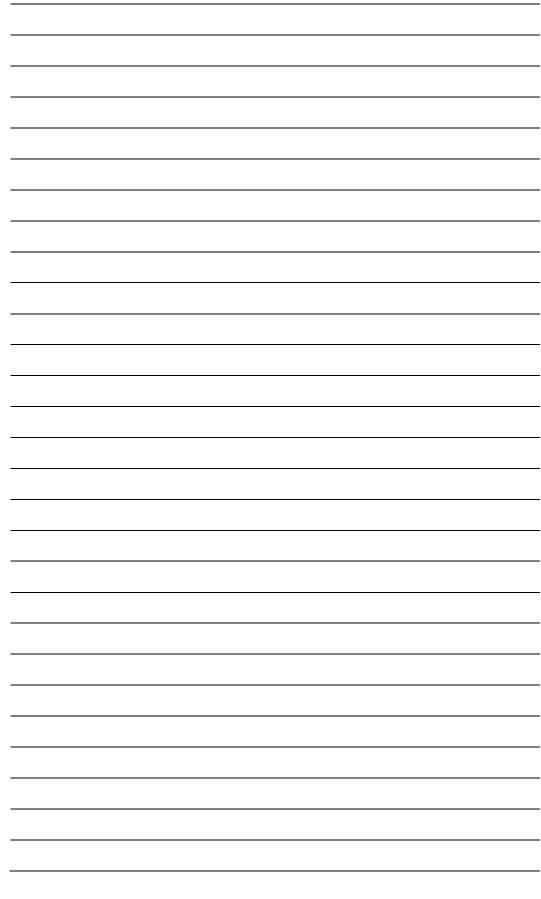
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[2]

[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 .	
(b)	Find $f(3)$.	[1]
(c)	Find $f'(x)$.	[2]
		[2]
(d)	Solve the equation $f'(x) = 0$.	[3]
(e)	Write down the equations of the horizontal tangents of the graph of	<i>f</i> .
(f)	Write down the range of values of w such that the equation $f(x) =$ has	[2] w
	(i) three solutions;	
	(ii) only one solution.	
(g)	Find the gradient of the tangent at $x = 3$.	[4]
		[2]
(h)	Hence, show that the equation of the normal at $x=3$ is $x+60y-3903=0$.	
		[3]





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