## Applications and Interpretation Standard Level for IBDP Mathematics <br> Practice Paper Set 1 - Paper 1 (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.

|  | Marker's <br> Use Only | Examiner's <br> Use Only |  |
| :---: | :---: | :---: | :---: |
| Question <br> Number | Marks | Marks | Maximum <br> Mark |
| 1 |  |  | 4 |
| 2 |  |  | 5 |
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| 13 |  |  | 6 |
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| Total |  |  |  |

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

9. A rectangle is constructed with sides of length $8.4 \times 10^{3} \mathrm{~cm}$ and $5.5 \times 10^{4} \mathrm{~cm}$.
(a) Write down the area of the rectangle in the form $a \times 10^{k}$, where $1 \leq a<10$ and $k \in \mathbb{Z}$.

Karen's estimate of the area of the rectangle is $450000000 \mathrm{~cm}^{2}$.
(b) Find the percentage error in Karen's estimate.
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2. The number of seats in a theatre is investigated. The number of seats in the first row of the theatre $u_{1}$ is 100 . The number of seats in each subsequent row forms an arithmetic sequence. The number of seats in the tenth row $u_{10}$ is 181 .
(a) Find the value of $d$, the common difference.
(b) Hence, write down the number of seats in the thirteenth row.

There are 15 rows in the theatre.
(c) Find the total number of seats in the theatre.
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3. In a football match, eight players take penalty kicks one by one. The table below shows the ball speed of each penalty kick:

| Player | Ball Speed | Player | Ball Speed |
| :---: | :---: | :---: | :---: |
| Abraham | $80 \mathrm{kmh}^{-1}$ | Essien | $40 \mathrm{kmh}^{-1}$ |
| Berg | $76 \mathrm{kmh}^{-1}$ | Flores | $116 \mathrm{kmh}^{-1}$ |
| Clyne | $100 \mathrm{kmh}^{-1}$ | Gana | $90 \mathrm{kmh}^{-1}$ |
| Denayer | $66 \mathrm{kmh}^{-1}$ | Harry | $76 \mathrm{kmh}^{-1}$ |

(a) Find the mean ball speed.
(b) Write down
(i) the median speed;
(ii) the standard deviation of the speeds;
(iii) the range of the speeds.
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4. Isaac pays 20 USD for a zoo admission ticket. The total amount Isaac pays for zoo admission tickets in a year can be modelled by $y=20 x$, where $x$ represents the number of tickets purchased per year and $y$ represents the amount of money paid per year.
(a) Determine the minimum number of tickets Isaac purchased if he spent more than 250 USD last year.

Jordan joins a zoo admission plan for 90 USD and then pays 5 USD for each zoo admission ticket.
(b) Write down an equation using Jordan's information, giving the answer in terms of $x$ and $y$.

In 2021, Isaac and Jordan will each buy the same number of zoo admission tickets and will each pay the same total amount of money.
(c) Find the amount of money Isaac will pay in 2021.
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5. The graph of the function $f(x)=\frac{2-4 x}{5-x}, x \neq 5$ is considered.
(a) Write down the equation of
(i) the vertical asymptote;
(ii) the horizontal asymptote.
(b) Solve the equation $f(x)=0$.
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6. Aleksandr carries out a $\chi^{2}$ test at the $5 \%$ significance level to determine whether a teacher's gender would have impacts on their chosen teaching subjects. 300 teachers are surveyed and the results are shown in the table.

|  | English | Spanish | Mathematics | Economics |
| :---: | :---: | :---: | :---: | :---: |
| Male | 35 | 10 | 65 | 45 |
| Female | 32 | 35 | 33 | 45 |

(a) State the null hypothesis $\mathrm{H}_{0}$ for this test.
(b) Show that the expected number of male Spanish teacher is 23.25 .
(c) Find the $p$-value for this test.
(d) Hence, state the conclusion of the test with a reason.
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7. Consider the geometric sequence $24576,18432,13824, \cdots$.
(a) Write down
(i) the common ratio $r$;
(ii) the fourth term of the sequence.
(b) Find the smallest term in the sequence that is an integer.
(c) Find the sum of the first 27 terms.
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8. A fair eight-faced die with numbered faces $1,2,3,4,5,6,7$ and 8 is tossed for thirteen times.
(a) Find the expected number of multiples of 3 landed.
(b) Find the variance of the number of multiples of 3 landed.
(c) Find the probability that the number of multiples of 3 landed is 8 .
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9. A triangular park ABC is built such that $\mathrm{AB}=28 \mathrm{~m}, \mathrm{AC}=32 \mathrm{~m}$ and $\mathrm{BC}=41 \mathrm{~m}$.
(a) Find ABC.
(b) Hence, find the area of the park.
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10. The diagram below shows the Voronoi diagram of three restaurants for takeaway meals, $\mathrm{A}, \mathrm{B}$ and C , in a town bounded by the coordinate axes, the lines $x=8$ and $y=8$, where 1 unit represents 1 km .


The straight line $L$ is the boundary separating the Voronoi cells of B and C . It is given that $(4,4)$ is a point on $L$.
(a) (i) Find the gradient of $L$.
(ii) Hence, find the equation of $L$, giving the answer in slopeintercept form.

Kimberly would like to find a restaurant closest to her office to minimize the delivery time of her meal during lunchtime. The position of her office is at $(7,2.5)$.
(b) State the reason that she is indifferent from choosing the restaurant B and the restaurant C .
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11. Mitsuhide is going to purchase a boat. He is suggested a plan to repay the loan of \$950000:

A total of 120 equal monthly payments have to be paid at the end of each month, with a nominal annual interest rate of $3.3 \%$, compounded monthly.
(a) Find the amount of monthly payment.
(b) Find the total amount to be paid.
(c) Hence, find the amount of interest paid.
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12. In an experiment, it is given that the population of a type of bacteria doubles for every three hours. Initially there are 100 units of bacteria.
(a) Find the amount of bacteria after one day.

The amount of bacteria $N$ can be modelled by the function $N=a \times b^{t}$, where $t$ is the number of hours after the start of the experiment, and $a, b$ are constants.
(b) Find the values of
(i) $a$;
(ii) $b$.
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13. The following table shows the functional values of $f(x)=\pi^{-x}$ from $x=0$ to $x=0.5$ :

| $x$ | 0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $f(x)$ | $a$ | $b$ | $\pi^{-0.2}$ | $\pi^{-0.3}$ | $\pi^{-0.4}$ | $\pi^{-0.5}$ |

(a) Write down the exact values of $a$ and $b$.
(b) Hence, use trapezoidal rule with 5 intervals to find an estimate of $\int_{0}^{0.5} f(x) \mathrm{d} x$.

It is given that the exact value of $\int_{0}^{0.5} f(x) \mathrm{d} x$ is 0.3807102635 .
(c) State whether the estimate in (b) overestimates or underestimates $\int_{0.3}^{0.6} f(x) \mathrm{d} x$.
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14. The graph of a quadratic function has $y$-intercept 150 and one of its $x$ intercept is -5 . The $x$-coordinate of the vertex of the graph is 5 . The equation of the quadratic function is in the form $y=a x^{2}+b x+c$.
(a) Write down the value of $c$.
(b) Write down the second $x$-intercept of the function.
(c) Find the value of $a$ and of $b$.
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