

Algebra and Functions – Paper 2
(non-Calculator)

IB HL

Part A [30 marks]

1. Give the set of solutions that satisfy the equation,

$$|x^2 - 2| > 3$$

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2. In the expansion of $(2 - ax)^5$ the coefficient of x^2 is 5.
Find the value of a .

3. a) An athletics final eight competitors. They are all to run in the lanes marked 1 to 8.

Calculate how many different ways the athletes can line up.

- b) In the final there are known to be two athletes from Gabon and two from Burkina Faso. The other 4 runners are from Sierra Leone, Cameroon, Gambia and Guinea.

Calculate how many different ways the **nationalities** can line up in the eight lanes.

a)

b)

4. Find how many numbers greater than 5000 and divisible by 3 can be formed from the digits 3, 4, 5, 6 and 0. Each digit can be used at most once in any number.

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5. Use logarithms to solve the equation,

$$3.1^x = 10^{x-1}.$$

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Part B [16 marks]

6. [Maximum marks 7]

The number of bacteria present in a culture at time t hours after the beginning of an experiment is denoted by N . The relation between N and t is modelled by,

$$N = 150e^{kt}$$

a) Write down the initial value of N . [1 mark]

b) At 6 hours the value of N is known to be 8189.7225.

Show that the value of k is $\frac{2}{3}$. [3 marks]

c) Find the value of t when the bacteria reaches 4.47043×10^5 . [3 marks]

7. [Maximum mark 9]

a) A sequence of numbers is such that,

$$\frac{1}{1 \times 3} + \frac{1}{3 \times 5} + \frac{1}{5 \times 7} + \dots + \frac{1}{(2n-1)(2n+1)} = \frac{n}{2n+1}$$

Proof the above statement by use of mathematical induction. [5 marks]

b) A geometric series has the first as 400, ten terms and a sum of 1295.67.

Find the common ratio, r , of the series. [4 marks]

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Answers

Part A

1. $x > \sqrt{5}$ and $x < -\sqrt{5}$.

2. $a = \frac{1}{4}$

3. a) 40320 b) 10080

4. 126

5. $x = 1.963$

Part B

6. a) 150 c) $t = 12$

7. b) $r = 0.7$