

ST. STEPHEN'S GIRLS' COLLEGE
Mid-Year Examination 2020 – 2021

Form 4

WYL

11 students

Mathematics Extended Part Module 1 (Calculus and Statistics)

Time allowed: 45 minutes

Total marks: 35

Question/Answer Paper

Please read the following instructions very carefully.

1. Write your class, class number and name in the spaces provided on this cover.

2. Attempt ALL questions in this paper. Write your answers in the spaces provided in this Question/Answer Paper.

3. Unless otherwise specified, all working must be clearly shown.

4. Unless otherwise specified, numerical answers should be exact or given to **4 decimal places**.

Class	
Class No.	
Name	

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Total	/35

1. Solve each of the following equations by finding x in terms of a , where $a > 0$ and $a \neq e^2$.

(a) $a^x = e^{2x+1}$

(b) $\ln(2x) = 1 + \ln a$

(4 marks)

2. It is given that $\frac{1}{k(k+2)} = \frac{1}{2} \left(\frac{1}{k} - \frac{1}{k+2} \right)$. Find the value of $\sum_{k=1}^{50} \frac{1}{k(k+2)}$.

(3 marks)

4. Let $f(x) = (1 + e^{-kx})^2$, where k is a non-zero constant.
- (a) Expand $f(x)$ in ascending powers of x as far as the term in x^2 .
 - (b) Let n be a positive integer. If the coefficients of x and x^2 in the expansion of $(1 + e^{-kx})^2(1 + x)^n$ are 8 and 12 respectively, find the values of k and n .

(6 marks)

Dotted lines for writing the answer.

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5. In an experiment, when a certain substance is placed inside a room for t hours, the humidity $H\%$ of the room is given by $H = 65 - 35e^{-0.25t}$.
- (a) Find the initial humidity of the room.
 - (b) Find the time required for the humidity of the room to become 50%.
 - (c) Find the humidity of the room after a very long time.

(4 marks)

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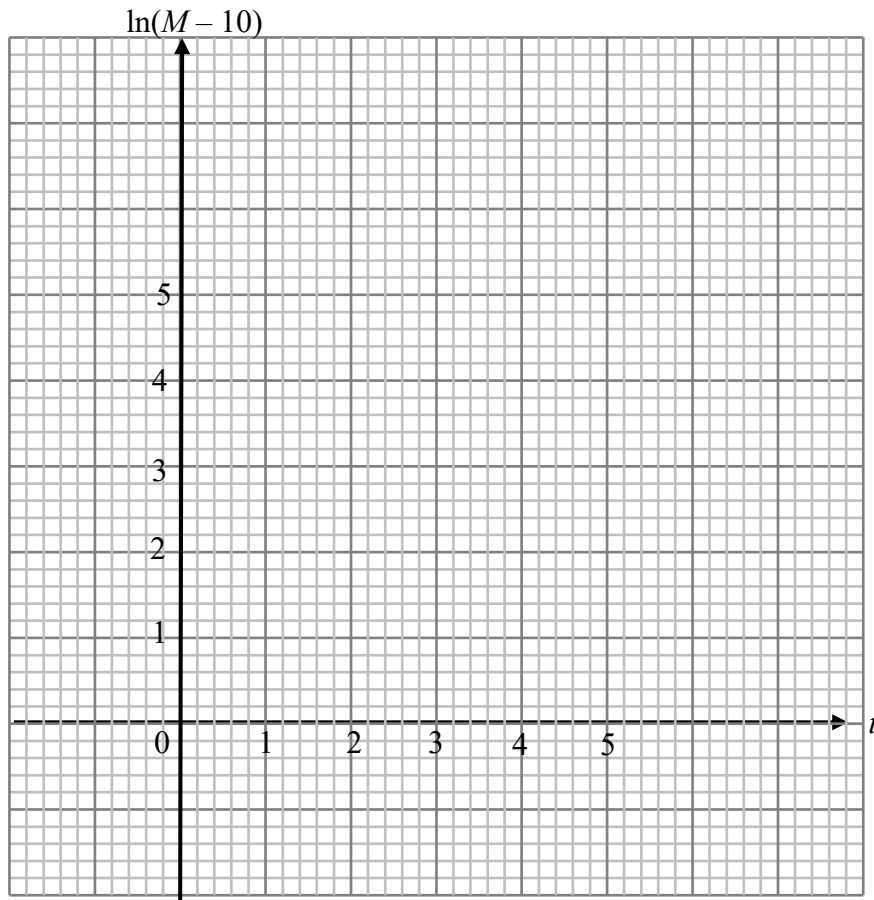
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7. The number of bacteria M (in thousands) can be modelled by $M = ae^{kt} + 10$, where a and k are constants and t is the number of hours after the first observation. The number of bacteria is recorded as follows.

t	1	2	3	4	5
M	15.44	24.78	50.17	119.08	306.83

- (a) Express $\ln(M - 10)$ as a linear function of t .
- (b) Draw the graph of $\ln(M - 10)$ against t , estimate the values of a and k correct to the nearest integer.
- (c) Using the values of a and k estimated in (b), find the time required to reach 10 times the number of bacteria in the first observation. (Correct your answer to the nearest integer.) (7 marks)



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