ST. STEPHEN'S GIRLS' COLLEGE Mid-Year Examination 2019 – 2020

Form 4

21 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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1	
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Total	/35

YLN

1. It is given that
$$C_2^n - 8C_1^n + 26C_0^n = 0$$
. Find the value(s) of *n*. (4 marks)

2. Evaluate
$$\sum_{r=0}^{200} [r^3 - 2(r-1)^3] + \sum_{r=101}^{201} (r-100)^3$$
. (4 marks)

3.	Con	sider	r the expansion of $\left(2x-\frac{1}{r^2}\right)^{25}$.	
	(a)	Fine	d the general term.	(2 marks)
	(b)	(i)	Find the constant term.	
		(ii)	Find the coefficient of x^{-38} .	
				(3 marks)

4. Let *n* be a positive integer. It is given that the coefficient of x^2 in the expansion of $\frac{(1-3x)^n}{e^{4x}}$ is 158. Find the value(s) of *n*. (4 marks)

5. (a) Expand $(1 + e^{-3x})^4$ in ascending powers of x as far as the term in x^2 . (4 marks)

(b) Find the coefficient of
$$x^2$$
 in the expansion of $(x-2)^2(1+e^{-3x})^4$. (2 marks)



6. During a certain year, the amount of water A (in million m^3) stored in a reservoir can be modelled by $A = \frac{6e^{kt}}{2e^{kt} + a}$, where a and k are positive constants and t is the time measured in months since the beginning of the year.

The values of A when t = 2, 4, 6, 8, 10 are as follows:

t	2	4	6	8	10
A	1.863	2.354	2.740	2.843	2.927

(a) Show that
$$\ln\left(\frac{6}{A}-2\right) = \ln a - kt$$
.

- (b) Suppose that there is a possible wrong datum in the table above. By plotting a suitable graph on the graph paper below,
 - (i) find out the possible wrong datum,
 - (ii) estimate the values of $\ln a$ and k.

(Give the answers correct to 1 significant figure.)

(4 marks)

(1 mark)

(c) Use the estimates in (b). Find the value of t such that the value of A is twice that of the beginning of the year? (2 marks)



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7. At the beginning of 2008, 10 thousand horses were found in a jungle. At the end of 2011, there were 20 thousand horses in the jungle. A scientist predicts that the number N (in thousands) of horses in the jungle *t* years after the beginning of 2008 is given by $N = N_0 e^{kt}$, where N_0 and *k* are constants.

(a)	Find the values of N_0 and k .	(3 marks)
(b)	Find the number of horses in the jungle at the end of 2023.	(2 marks)

End of Paper