14 – 15 F.4
1st Term Exam
MATH EP
M1

2014 – 2015
Form 4 First Term Examination

MATHEMATICS Extended Part

Module 1 (Calculus and Statistics)
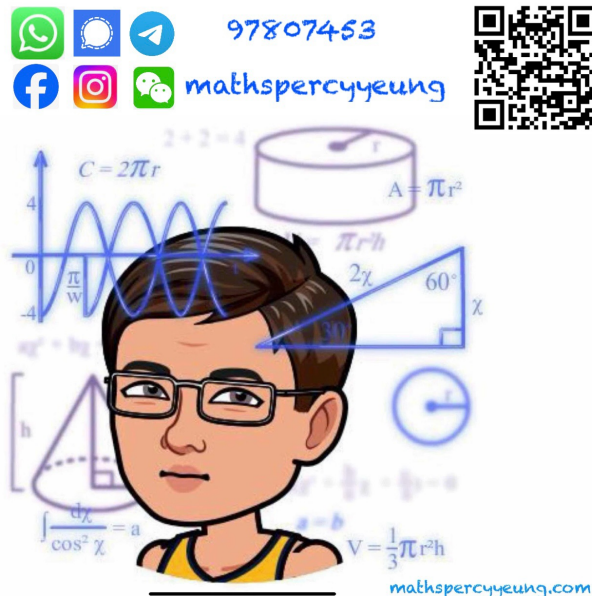
Question–Answer Book

14th January, 2015
8:15 am – 9:30 am
Time Allowed: 1 hour 15 minutes
This paper must be answered in English

INSTRUCTIONS

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

2. Answer **ALL** questions in this paper. Write your answers in the spaces provided in this Question–Answer Book. Do not write in the margins. Answers written in the margins will not be marked.

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

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

5. The diagrams in this paper are not necessarily drawn to scale.

Section A Total	**/32**
Section B Total	**/18**
Grand Total	**/50**

97807453
mathspercyyeung

$C = 2\pi r$
$A = \pi r^2$
$\pi r^2 h$
$60°$
$\int \dfrac{d\chi}{\cos^2 \chi} = a$
$V = \dfrac{1}{3}\pi r^2 h$
mathspercyyeung.com

1. (a) Expand $(2x+1)^3$.

   (b) Expand e^{-ax} in ascending powers of x as far as the term in x^2, where a is a constant.

   (c) If the coefficient of x^2 in the expansion of $\dfrac{(2x+1)^3}{e^{ax}}$ is -4, find the value(s) of a.

   (5 marks)

2. Find $\dfrac{dy}{dx}$ if (6 marks)

   (a) $y = (3x^2 - 2x)(6x + 1)$

   (b) $y = \dfrac{2x^2 - 1}{x^2 + 3}$

3. Let $f(x) = \sqrt{x - \sqrt{2x+1}}$. Find $f'(4)$. (4 marks)

4. Find the following limits. (9 marks)

(a) $\lim\limits_{x \to 3} \dfrac{x^3 - 27}{2x^2 - 3x - 9}$

(b) $\lim\limits_{x \to 9} \dfrac{x(x-9)}{\sqrt{x} - 3}$

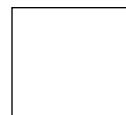(c) $\lim\limits_{x \to \infty} \dfrac{3x^3 - 2x^2 + x - 1}{2x^3 - 3x + 4}$

5. Differentiate the following functions with respect to x. (8 marks)

    (a) $f(x) = \left(2x^5 - x^3 + 1\right)^{10}$

    (b) $g(x) = \left(x^2 - 2\right)^{\frac{5}{2}} \left(3x + 4\right)^{\frac{1}{3}}$
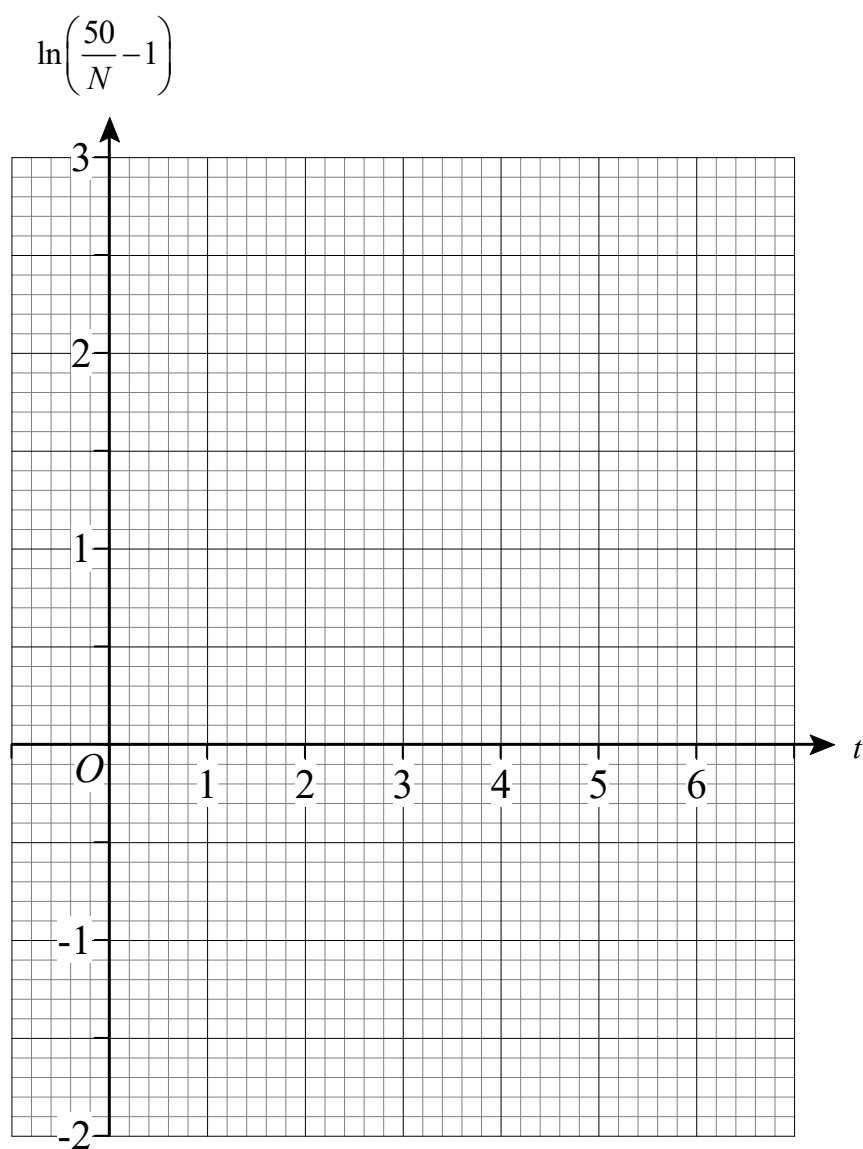
Section B (18 marks)

6. The ratings $R\%$ of a television series after the broadcasting of the nth episode can be modelled by $R = \alpha - \beta e^{-0.07n}$ $(1 \le n \le 30)$. It is given that the television series has the ratings of 16.0% and 20.8% after the broadcasting of the 1st episode and the 7th episode respectively.

   (a) Find the values of α and β. (4 marks)

   (b) What ratings does the series have after the broadcasting of the 20th episode? (1 mark)

   (c) Yvonne claims that after the broadcasting of the 16th episode, the ratings will start to exceed 25%. Do you agree? Justify your answer. (4 marks)

   (Give your answers correct to 3 significant figures if necessary.)

7. After the implementation of a new policy to fight against organized crime for t months, the number N of organized crime can be modelled by

$$N = \frac{50}{1 + ae^{kt}} \quad,$$

where a, k are positive constants.

The values of N when $t = 1, 2, 3, 4, 5$ are as follows:

t	1	2	3	4	5
N	33	25	16	10	5

(a) Express $\ln\left(\dfrac{50}{N} - 1\right)$ as a linear function of t. (1 mark)

(b) Using the graph paper on **Page 9**, estimate the values of a and k.
(Give your answers correct to 2 significant figures.) (6 marks)

(c) Using the estimates in (b), predict the number of organized crime when $t = 6$.
(Give your answer correct to the nearest integer.) (2 marks)

$$\ln\left(\frac{50}{N}-1\right)$$

End of Paper