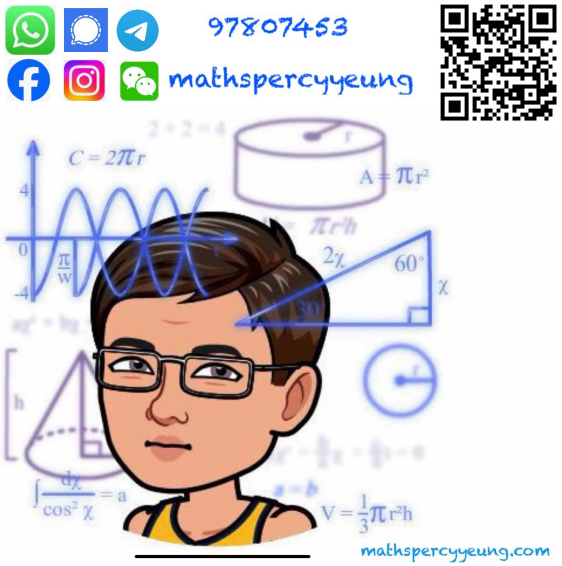
2021-2022 S4
2nd TERM UT
MATH EP
M1



2021 – 2022
S4 Second Term Uniform Test

MATHEMATICS Extended Part

Module 1 (Calculus and Statistics)

Question–Answer Book

16th May, 2022
10:15 am – 11:15 am (1 hour)
This paper must be answered in English

INSTRUCTIONS

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

2. This paper consists of TWO sections, A and B.

3. Attempt 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.

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

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

Sections	Marks
A Total	**/33**
B Total	**/9**
TOTAL	**/42**

Section A (33 marks)

1. Differentiate the following functions with respect to x.

(a) $y = \dfrac{\sqrt{x+1}}{(x+1)^3}$

(b) $y = 9^{x^3+4x-1}$

(c) $y = \ln(\ln 2x^2 + 8))$

(8 marks)

2. Find the equation of the tangent to the curve $y = \dfrac{2x+6}{2x-3}$ at $x = 2$. (4 marks)

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3. Find the local extrema of the function $f(x)=\dfrac{x^2-2x+4}{x^2+4}$. (6 marks)

4. A particle moves along a straight rail. Its displacement s m after t s is given by $s=4t^3-2t^2+2$.

(a) Find the velocity of the particle at $t=2$.

(b) Find the range of values of t such that the acceleration is positive.

(4 marks)

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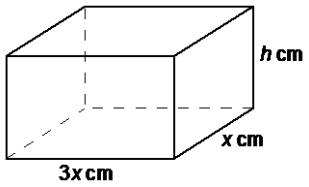
5. In the figure, the length, width and height of a cuboid are $3x$ cm, x cm and h cm respectively. Its total surface area is 3 000 cm^2. Denote V cm^3 be the volume of the cuboid.



(a) Express h and V in terms of x.

(b) Find the maximum volume of the cuboid and the corresponding value of x. (Leave your answer in surd form.)

(7 marks)

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6. The initial temperature of a can of soft drink is 6 °C after taking it out from the refrigerator. Its temperature T °C after t minutes can be modelled by $T = 28 - Ae^{kt}$, where A and k are constants. It is given that the temperature of the can of soft drink is 10 °C after 2 minutes.

(a) Find the values of A and k.

(b) Find the rate of change of the temperature of the can of soft drink after 2 minutes. (Give your answer correct to 2 significant figures.)

(4 marks)

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Section B (9 marks)

7. Originally, there were 650 chickens on a farm. Then, avian influenza broke out. By the end of the 10th day of the outbreak, 253 chickens had died. A zoologist studies the case and models the number of chickens N on the farm by

$$N = \frac{Ae^{kt}}{t+10} \qquad (t \geq 0),$$

where A and k are constants and t is the number of days elapsed since the outbreak of the influenza.

(a) Find the values of A and k. (Give your answers correct to 2 decimal places if necessary.)

(2 marks)

(b) The government announces that if more than 50% of the chickens on a farm die, all the chickens on the farm must be killed.

(i) Using the values of A and k obtained in (a), find the rate of change of the number of chickens on the farm.

(ii) Will all the chickens be killed? Explain your answer.

(7 marks)

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END OF PAPER

Answers written in the margins will not be marked