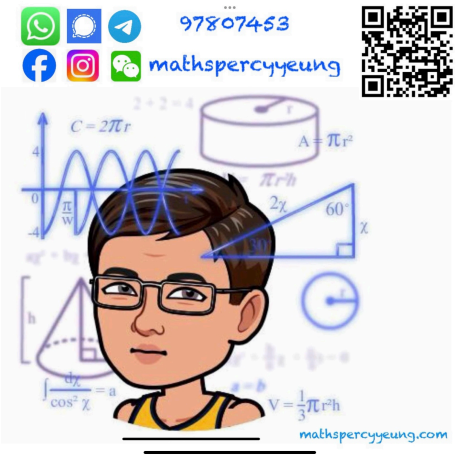
2018-19 F.5
MATH UT
M2



2018 - 2019
Form 5 1st Term Uniform Test

MATHEMATICS Extended Part
Module 2 (Algebra and Calculus)

Question–Answer Book

9th November, 2018. (Friday)

9:30 am – 10:30 am (1 hour)

This paper must be answered in English.

INSTRUCTIONS

1. After the announcement of the start of the examination, you should first write your name, class and class number in the spaces provided on this cover.
2. This paper consists of Section A and Section B.
3. Answer ALL questions. Write your answers in the spaces provided in this Question-Answer Book.
4. Graph paper and supplementary answer sheets will be supplied on request. Write your name, class, class number and mark the question number box on each sheet.
5. Unless otherwise specified, all working must be clearly shown.
6. Unless otherwise specified, numerical answers must be exact.
7. The diagrams in this paper are not necessarily drawn to scale.

Section A Question No.	Marks
1	
2	
3	
4	
5	
6	
7	
Section A Total	**/ 36**

Section B Question No.8	Marks
Section B Total	**/ 12**

Grand Total	**/ 48**

FORMULAS FOR REFERENCE

$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$	$\sin A + \sin B = 2\sin\frac{A+B}{2}\cos\frac{A-B}{2}$
$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$	$\sin A - \sin B = 2\cos\frac{A+B}{2}\sin\frac{A-B}{2}$
$\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$	$\cos A + \cos B = 2\cos\frac{A+B}{2}\cos\frac{A-B}{2}$
$2\sin A \cos B = \sin(A+B) + \sin(A-B)$	$\cos A - \cos B = -2\sin\frac{A+B}{2}\sin\frac{A-B}{2}$
$2\cos A \cos B = \cos(A+B) + \cos(A-B)$	
$2\sin A \sin B = \cos(A-B) - \cos(A+B)$	

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Section A (36 marks)

1. In the expansion of $(1-4x)^2(1+x)^n$, the coefficient of x is 1.

(a) Find the value of n.

(b) Find the coefficient of x^2.

(4 marks)

Answers written in the margins will not be marked.

2. (a) Find $\int \frac{1}{\sqrt{36+x}}\,dx$.

(b) Find $\int \frac{1}{36+x^2}\,dx$.

(5 marks)

Answers written in the margins will not be marked.

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3. Let $T_n = 1 - \dfrac{4}{(2n+3)^2}$, where n is a positive integer.

Prove, by mathematical induction, that $T_1 \bullet T_2 \bullet T_3 \bullet \cdots \bullet T_n = \dfrac{3(2n+5)}{5(2n+3)}$ for all positive integers n.

(6 marks)

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4. A curve $y = f(x)$ satisfies $f''(x) = \cos 6x \sin 2x$. It is known that $f'\left(\frac{\pi}{2}\right) = \frac{1}{16}$ and $f\left(\frac{\pi}{4}\right) = 1$.

(a) Find the equation of the curve.

(b) Find the equation of the tangent of the curve at $x = 0$.

(7 marks)

Answers written in the margins will not be marked.

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5. Using integration by parts, find $\int (x-4)\, e^{-x}\, dx$.

(4 marks)

Answers written in the margins will not be marked.

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6. Figure 1 shows a circle with centre O and radius 5 cm. P is a movable point on the circumference of the circle and PQ is a rod of length 5 cm. As P moves around the circle in the anti-clockwise direction, Q slides along a horizontal rail passing through O.

Let $\angle POQ = \theta$ and $0 < \theta < \pi$.

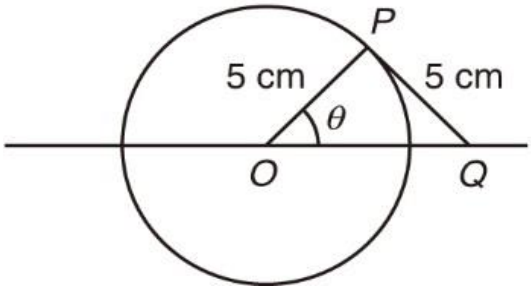

Figure 1

(a) Express OQ in terms of θ.

(b) If θ increases at a constant rate of $\frac{2}{5}$ rad/s, find the rate of change of OQ when $\theta = \frac{\pi}{2}$.

(5 marks)

Answers written in the margins will not be marked.

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7. Find $\int\left(\sin\frac{x}{8}\cos\frac{x}{8}\cos\frac{x}{4}\right)^2 dx$.

(5 marks)

Answers written in the margins will not be marked.

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Section B (12 marks)

8. (a) (i) Find $\frac{d}{d\theta}(\sec\theta + \tan\theta)$.

(ii) Hence, show that $\int \sec\theta \, d\theta = \ln|\sec\theta + \tan\theta| + C$.

(3 marks)

(b) Hence, find the following indefinite integrals:

(i) $\int \sec^3 x \, dx$

(ii) $\int \sec^5 x \, dx$

} [Hint: use integration by parts]

(iii) $\int \sqrt{1+x^2} \, dx$

(9 marks)

Answers written in the margins will not be marked.

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END OF PAPER

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