



**UNIVERSITI KUALA LUMPUR**  
**MALAYSIAN INSTITUTE OF MARINE ENGINEERING TECHNOLOGY**

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**FINAL EXAMINATION**  
**JANUARY 2017 SEMESTER**

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<b>COURSE CODE</b>	<b>: LGB11903</b>
<b>COURSE NAME</b>	<b>: ENGINEERING MATHEMATICS 1</b>
<b>PROGRAMME NAME</b> (FOR MPU: PROGRAMME LEVEL)	<b>: BACHELOR OF ENGINEERING TECHNOLOGY (HONS) IN NAVAL ARCHITECTURE &amp; SHIPBUILDING</b>
<b>DATE</b>	<b>: 14/07/2017 FRI</b>
<b>TIME</b>	<b>: 9.00 AM - 12.00 PM</b>
<b>DURATION</b>	<b>: 3 HOURS</b>

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**INSTRUCTIONS TO CANDIDATES**

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1. Please read **CAREFULLY** the instructions given in the question paper.
  2. This question paper has information printed on both sides.
  3. This question paper consists of **TWO (2)** sections; Section A and Section B. Answer **ALL** questions in Section A and **THREE (3)** questions from Section B.
  4. Please write your answers on the answer booklet provided.
  5. Write your answers only in **BLACK** or **BLUE** ink.
  6. Answer all questions in English.
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**THERE ARE 6 PAGES OF QUESTIONS, INCLUDING THIS PAGE.**

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**SECTION A (Total: 40 marks)****INSTRUCTION: Answer ALL questions.****Please use the answer sheet provided.****QUESTION 1**

- (a) Sarah extremely excited about starting her first job as a dietation. Her gross annual salary is \$40,000. Susan contributes 10% of her salary before taxes to a retirement account. Then she pays 25% of her remaining salary in state and federal taxes. Finally she pays \$30 per month for health insurances. Determine susan's annual take-home pay.

(8 marks)

**QUESTION 2**

- (a) Simplify  $i^{12789}$ .

(4 marks)

- (b) Express  $\frac{6-9i}{5+2i}$  in the form  $a+ib$ .

(4 marks)

**QUESTION 3**

- (a) If the zeroes of the quadratic polynomial  $x^2 + (a+1)x + b$  are 2 and -3, find the values of  $a$  and  $b$ .

(4 marks)

- (b) Find value of  $m$  if  $x^3 - 2mx^2 + 16$  is divisible by  $x + 2$ .

(4 marks)

#### QUESTION 4

- (a) Given that  $125(5^{3m-1}) = 25^m$ , find the value of  $m$ .

(4 marks)

- (b) Solve the following equation,  $\log_{\sqrt{7}}(4x+1) = 2$ .

(4 marks)

#### QUESTION 5

- (a) Calculate the volume and total surface area of the solid prism shown in Figure 1.

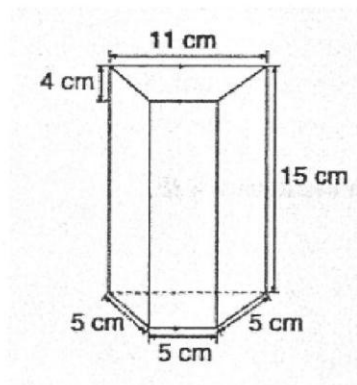


Figure 1: Solid prism

(5 marks)

- (b) Simplify the following expression,

$$\frac{1 + \tan x}{1 + \cot x}$$

(3 marks)

## SECTION B (Total: 60 marks)

**INSTRUCTION: Answer only THREE(3) questions.**

**Please use the answer sheet provided.**

## QUESTION 6

(a) Find  $z^{\frac{1}{3}}$  if  $z = -2 + 2i$ .

(10 marks)

(b) Use De Moivre's Theorem to find the indicated power of the complex number  $4(1 - \sqrt{3}i)^3$  and write the result in the form of  $a + ib$ .

(10 marks)

## QUESTION 7

(a) Find all the roots of  $h(x) = x^5 - 6x^4 + 20x^3 - 60x^2 + 99x - 54$ .

(10 marks)

(b) Consider the polynomial  $p(x) = x^3 - 4x^2 + ax - 3$

i. Find  $a$  if, when  $p(x)$  is divided by  $x + 1$ , the remainder is  $-12$ .

ii. Thus, find all the factors of  $p(x)$ .

(10 marks)

## Question 8

- (a) Given  $Ae^x + Be^{-x} = 4 \cosh x - 5 \sinh x$ , determine the values of  $A$  and  $B$ .  
(5 marks)
- (b) If  $4e^x - 3e^{-x} = P \sinh x + Q \cosh x$ , find values of  $P$  and  $Q$ .  
(5 marks)
- (c) Solve the equation  $5 \cosh 2x + 7 \sinh 2x = 1$ .  
(10 marks)

## Question 9

- (a) Show that  
$$\frac{1 + \cot x}{1 + \tan x} = \cot x$$
  
(3 marks)
- (b) Given that  $y = 2 \sin(2x - \pi)$
- State the amplitude, period and phase shift.  
(3 marks)
  - Sketch the graph for one cycle beginning with  $x = 0$ .  
(6 marks)
- (c) Solve the equation  $3 \sin^2 x + 4 \cos x = 4$  for angles in the range  $0 \leq x \leq 360^\circ$ .  
(8 marks)

## Question 10

- (a) Suppose you can save RM10 one week and that each week thereafter you can save 50 cents more than the preceeding week. Determine total money that can be saved by the end of the year.

(6 marks)

- (b) Show that  $\frac{1}{\sqrt{1-x^2}} = 1 + \frac{1}{2}x^2 + \frac{1 \cdot 3}{2^2 2!}x^4 + \frac{1 \cdot 3 \cdot 5}{2^3 3!}x^6 + \dots$

(14 marks)

END OF EXAMINATION PAPER

### COMPLEX FORMULA

**De Moivre's Theorem**  $Z^n = r^n(\cos nx + i \sin nx)$

### VOLUME AND SURFACE AREA

Volume	Surface area
<b>Prism</b> $v = l \times b \times h$ <i>l = length, b = base, h = height</i>	<i>Surface area = <math>2(bh + hl + lb)</math></i>
<b>Cylinder</b> $v = \pi r^2 h$ <i>r = radius, h = height</i>	<i>Surface area = <math>2\pi r h</math></i>
<b>Sphere</b> $v = \frac{4}{3}\pi r^3$	<i>Surface area = <math>4\pi r^2</math></i>
<b>Cone</b> $v = \frac{1}{3}\pi r^2 h$ <i>r = radius, h = height, l = length,</i>	<i>Surface area = <math>\pi r l + \pi r^2</math></i>

### HYPERBOLIC FUNCTION

$$\cosh x = \frac{e^x + e^{-x}}{2}$$

$$\sinh x = \frac{e^x - e^{-x}}{2}$$

$$\tanh x = \frac{e^x - e^{-x}}{e^x + e^{-x}}$$

### TRIGONOMETRIC FUNCTION

$$\tan x = \frac{\sin x}{\cos x}$$

$$\sec x = \frac{1}{\cos x}$$

$$\csc x = \frac{1}{\sin x}$$

$$\sin^2 x + \cos^2 x = 1$$

$$1 + \tan^2 x = \sec^2 x$$

$$1 + \cot^2 x = \csc^2 x$$

## PROGRESSION

### ARITHMETIC

$$T_n = a + (n-1)d$$

$$S_n = \frac{n(a_1 + a_n)}{2}$$
$$= \frac{n(2a_1 + (n-1)d)}{2}$$

### GEOMETRIC

$$T_n = ar^{n-1}$$

$$S_n = \frac{a(r^n - 1)}{r - 1} \text{ when } |r| > 1$$
$$= \frac{a(1 - r^n)}{1 - r} \text{ when } |r| < 1$$

$$S_\infty = \frac{a}{1 - r}$$

## BINOMIAL THEOREM

$$(a + b)^n = \sum_{r=0}^n \binom{n}{r} a^{n-r} b^r$$
$$= \frac{n(n-1)(n-2) \times \dots \times (n-r+1) a^{n-r} b^r}{r!}$$

$$T_{r+1} = \binom{n}{r} a^{n-r} b^r$$