



# MATHEMATICS PRACTICE

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# SEM 1

423

$$\log 15^a - \log 15^b = \log 5^a - \log 3^a$$
$$\log \frac{15^a}{45} = (\log 5^a - \log 3^a)$$



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*SEM 1*

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ABANG MOHAMMAD HUDZAIFAH ABANG SHAKAWI**

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## PREFACE

Mathematics Practice Semester 1 is specially written for foundation students level taking Mathematics at Centre for Pre-University, Universiti Malaysia Sarawak or local matriculation centres.

The objective of this book is to provide a comprehensive discourse of the basic concepts and foundation in Mathematics. This book contains ten chapters. Each chapter starts with a page of notes and formulae for easy reference. In each chapter, the concepts are explained clearly with real practice questions. Question and answer for each chapter provide a wide range of examination type question based on the concepts and theories learnt. Answers are also provided for all questions on each chapter.

To optimize the effectiveness of this books, students are advised not to simply read the notes and formulae but instead to work out the solution and method on the space provided below the questions. All mathematical concepts are presented clearly in simple English for easy understanding. Practical questions have been incorporated to the chapters to enhance better understanding of the concepts. The book is also suitable for first year undergraduate Mathematics course for a degree or diploma programme.

We would like to express our thanks to the members of the staffs who have contributed directly or indirectly to the successful publication of this book. Many thanks to our dean, Assoc. Prof Dr. Ramlah Zainudin and deputy dean, Assoc. Prof Dr. Muna Sabri for their encouragement and support.

We hope this book will assist the students in mastering mathematical knowledge as well as preparing them for their examinations.

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# CHAPTER 1

## NUMBER SYSTEMS

### 1.1 Real Numbers

1. Natural numbers,  $\mathbf{N} = \{1, 2, 3, 4, \dots\}$
2. Whole numbers,  $\mathbf{W} = \{0, 1, 2, 3, 4, \dots\}$
3. Integers,  $\mathbf{Z} = \{\dots, -3, -2, -1, 0, 1, 2, 3, \dots\}$
4. Negative integers,  $\mathbf{Z}^- = \{-1, -2, -3, \dots\}$
5. Positive integers,  $\mathbf{Z}^+ = \{1, 2, 3, \dots\}$
6. Rational numbers,  $\mathbf{Q} = \left\{x : x = \frac{a}{b}, a, b \in \mathbf{Z}, b \neq 0\right\}$
7. Irrational numbers,  $\overline{\mathbf{Q}} = \{\dots, \pi, e, \sqrt{5}, \sqrt{2}, \dots\}$

### 1.1.1 Real Number Line

1. Intervals:





Given two real numbers  $a$  and  $b$ , the possibilities are

- (a)  $a$  is equal to  $b$ ,  $a = b$
- (b)  $a$  is greater than  $b$ ,  $a > b$
- (c)  $a$  is less than  $b$ ,  $a < b$
- (d)  $a$  is greater than or equal to  $b$ ,  $a \geq b$
- (e)  $a$  is less than or equal to  $b$ ,  $a \leq b$

2. Finite intervals

If  $a$  and  $b$  are real numbers such that  $a < b$ , then the set of all real numbers  $x$  in the following finite interval:

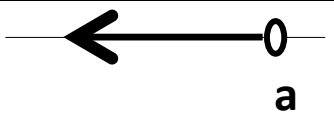
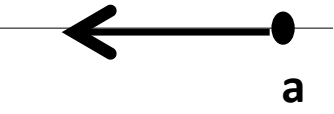
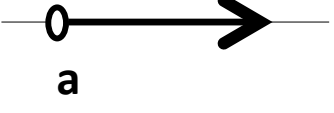

**Table 1.1**

	<b>Inequalities</b>	<b>Interval notation</b>	<b>Real number line</b>
Open interval	$a < x < b$	$(a, b)$	
Closed interval	$a \leq x \leq b$	$[a, b]$	
Half-open or half-closed	$a \leq x < b$	$[a, b)$	
Half-open or half-closed	$a < x \leq b$	$(a, b]$	

## 3. Infinite intervals

If  $a$  is a real number, then the set of all real numbers  $x$  satisfying the conditions  $x < a$ ,  $x \leq a$ ,  $x > a$  or  $x \geq a$  is called an infinite interval.

Table 1.2

Inequalities	Interval notation	Real number line
$x < a$	$(-\infty, a)$	
$x \leq a$	$(-\infty, a]$	
$x > a$	$(a, \infty)$	
$x \geq a$	$[a, \infty)$	

## 4. Union and intersection

- (a) The union of sets  $A$  and  $B$  denoted by  $A \cup B$  is the set of all elements which belong to  $A$  or to  $B$ .
- (b) The intersection of two sets  $A$  and  $B$  denoted by  $A \cap B$  is the set of elements which belong to both  $A$  and  $B$ .