



**FINAL EXAMINATION  
SEMESTER I, ACADEMIC SESSION 2019/2020**

**DATE : JANUARY 2020**

**DURATION : 3 HOURS**

**SMS1013  
ALGEBRA  
(ALJABAR)**

**INSTRUCTIONS TO CANDIDATES:**

1. This paper contains **six (6)** questions.
2. Answer **all** questions in the **answer booklet** provided.
3. All answers must be written in English.
4. All answers must be clearly written and readable.
5. Candidates are **not allowed** to take the question papers out of the examination hall.
6. Please complete your particulars in **Borang H**

**DO NOT OPEN THIS QUESTION PAPER UNTIL YOU ARE INSTRUCTED TO DO SO**

This question paper has **four (4)** printed pages excluding this cover page



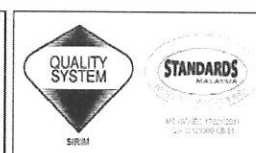
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[100 MARKS]

ANSWER ALL QUESTIONS IN THE ANSWER BOOKLET PROVIDED

1. a ) Given a conditional statement  $p \rightarrow q$ , find the converse of its inverse, the converse of its converse, and the converse of its contrapositive. (6 marks)
- b ) Let  $P(x)$  be the statement  $x$  spends more than five hours every week-day in class, where the domain for  $x$  consists of all students. Express each of these quantifications in English.
- i.  $\exists xP(x)$ . (2 marks)
  - ii.  $\forall xP(x)$ . (2 marks)
  - iii.  $\exists \neg P(x)$ . (2 marks)
  - iv.  $\forall x\neg P(x)$ . (2 marks)
- c ) Show that the premises “If you send me an e-mail message, then I will finish writing the program,” “If you do not send me an e-mail message, then I will go to sleep early,” and “If I go to sleep early, then I will wake up feeling refreshed” lead to the conclusion “If I do not finish writing the program, then I will wake up feeling refreshed.” (8 marks)

[Total : 22 marks]

2. a ) Represent the following sets with a Venn diagram:
- i)  $(B \cup C) \cap A'$ . (3 marks)
  - ii)  $(A \cap B) \cup C$ . (3 marks)
- b ) Let  $\Omega$  be the set of integers. Let  $A = \{3, 6\}$ ,  $B = \{3, 8, 10, 12\}$  and  $C = \{6, 8, 10\}$ . Find the elements of the indicated sets operations.
- i)  $C - B$ . (3 marks)

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ii)  $(A \cup C) \cap B$ . (3 marks)

iii)  $C \times A$ . (3 marks)

**[Total : 15 marks]**

3. a) Find the solution for each of the following :

i)  $|x - 2| + |x - 5| = 9$ . (6 marks)

ii)  $\left| x + \frac{1}{x} \right| < 4$ . (6 marks)

b) Let  $a, b, c, d \in \mathbb{R}$ , show that

i) if  $a < b$ , then  $a + c < b + c$ . (6 marks)

ii) if  $\frac{a}{b} = \frac{c}{d}$ , then  $ad = bc$ . (6 marks)

**[Total : 24 marks]**

4. Given  $i = \sqrt{-1}$ ,  $z = x + iy$  and  $z \neq 0$ .

(a) If  $z_1 + z_2$  and  $z_1 z_2$  are both real then show that either  $z_1$  &  $z_2$  are both real or  $z_1 = \bar{z}_2$ . (8 marks)

(b) Show that  $\operatorname{Re}(iz) = -\operatorname{Im}(z)$  and  $\operatorname{Im}(iz) = \operatorname{Re}(z)$ . Evaluate  $\operatorname{Re}(1/z)$  and  $\operatorname{Im}(1/z)$ . (7 marks)

**[Total : 15 marks]**

5. (a) A polynomial  $P$  is given as

$$x + xy + (x + xy)y + [x + xy + (x + xy)y]y.$$

Rewrite  $P$  completely into the linear form. (6 marks)

(b) Perform indicate operations :

a)  $(x - h)^2 + (y - k)^2$ . (4 marks)

b)  $(x + h)^4 - x^4$ . (4 marks)

**[Total : 14 marks]**

6. Apply Cramer's rule to solve the system of equations of

$$\begin{aligned}x_1 - 2x_2 - 5x_3 &= -28, \\2x_1 + 6x_2 + 5x_3 &= 44, \\-3x_1 + 3x_2 - 4x_3 &= 25.\end{aligned}$$

**[Total : 10 marks]**

**END OF QUESTIONS**

**APPENDIX**  
**LIST OF MATHEMATICAL FORMULAE**

Rule of Inference			
Modus Ponens	$p \implies q$ $p$ $\therefore q$	Modus Tollens	$p \implies q$ $\neg q$ $\therefore \neg p$
Disjunctive syllogism	$p \vee q$ $\neg q$ $\therefore p$	Hypothetical syllogism	$p \implies q$ $q \implies r$ $\therefore p \implies r$
Addition	$p \implies p \vee q$ $q \implies p \vee q$	Simplification	$p \wedge q \implies p$ $p \wedge q \implies q$
Conjunction	$p$ $q$ $\therefore p \wedge q$	Resolution	$p \vee q$ $\neg q \vee r$ $\therefore q \vee r$

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