

**MODULE 6**  
**MATEMATIK SPM “ENRICHMENT”**  
**TOPIC : MATHEMATICAL REASONING**  
**TIME : 2 HOURS**

1. (a) Complete each statement in the answer space with the quantifier “all” or “some” so that it will become a true statement.  
(b) State the converse of the following statement and hence, determine whether its converse is true or false.

$$\text{If } x > 7, \text{ then } x > 4$$

- (c) Write down Premise 2 to complete the following argument :  
Premise 1 : If y is less than zero, then y is a negative number.

Premise 2 : \_\_\_\_\_

Conclusion : -2 is a negative number.

Answer :

- (a) (i) \_\_\_\_\_ of the multiples of 5 are even numbers.  
(ii) \_\_\_\_\_ hexagons have six sides.

(b) \_\_\_\_\_

(c) Premise 2 : \_\_\_\_\_

2. (a) State whether the sentence below a statement or non-statement ?

$$x + y = 2$$

- (b) Complete the following argument .  
Premise 1 : All factors of 12 are factors of 24.  
Premise 2 : 3 is a factor of 12.  
Conclusion : \_\_\_\_\_

- (c) Make a general conclusion by induction for the following number pattern:

$$\begin{aligned} 5 &= 3(2) - 1 \\ 10 &= 3(2^2) - 2 \\ 21 &= 3(2^3) - 3 \\ 60 &= 3(2^4) - 4 \\ &\dots\dots\dots \end{aligned}$$

Answer :

(a) \_\_\_\_\_

(b) Conclusion : \_\_\_\_\_

(c) Conclusion : \_\_\_\_\_

3. (a) State whether each of the following statements is true or false.

(i)  $2^3 = 6$  or  $\frac{7}{2} = 3.5$

(ii)  $(-4) \times (-5) = 20$  and  $-4 > -2$

(b) Complete the premise in the following argument:

Premise 1 : If the determinant of a matrix = 0, then the matrix does not have an inverse.

Premise 2 : \_\_\_\_\_

Conclusion : Matrix A does not have an inverse.

(c) Write down two implications based on the following sentence.

$$\mathbf{A} \subset \mathbf{B} \text{ if and only if } \mathbf{A} \cap \mathbf{B} = \mathbf{A}'$$

Answer :

(a) (i) \_\_\_\_\_

(ii) \_\_\_\_\_

(b) Premise 2 : \_\_\_\_\_

(c) Implication 1 : \_\_\_\_\_

Implication 2 : \_\_\_\_\_

4. (a) State whether the following statement is true or false.

$$-2(3) = 6 \text{ or } -4 > -5$$

(b) Write down two implications based on the following statement:

$$P^3 = 8 \text{ if and only if } p = 2$$

(c) Complete the premise in the following argument:

Premise 1 : \_\_\_\_\_

Premise 2 :  $\sqrt{x} \neq 3$

Conclusion :  $x \neq 9$

Answer :

(a) \_\_\_\_\_

(b) Implication 1 : \_\_\_\_\_

Implication 2 : \_\_\_\_\_

(c) Premise 1 : \_\_\_\_\_

5. (a) State whether each of the following statement is true or false.

(i)  $4^2 = 8$  or  $\sqrt[3]{-8} = -2$

(ii)  $a \subset \{ a, b, c \}$  and  $-3 > -7$

(b) Write down premise 1 to complete the following argument.

Premise 1 : \_\_\_\_\_

Premise 2 :  $6 \times p \neq 42$

Conclusion :  $p \neq 7$

(c) Form a general conclusion by induction for the number sequence

11, 23, 43, 71, ... which follow the pattern

$11 = 4(1^2) + 7$

$23 = 4(2^2) + 7$

$43 = 4(3^2) + 7$

$71 = 4(4^2) + 7$

.....

.....

Answer :

(a) (i) \_\_\_\_\_

(ii) \_\_\_\_\_

(b) Premise 1 : \_\_\_\_\_

(c) Conclusion: \_\_\_\_\_

6. (a) Determine whether each of the following sentences is a statement.

(i) 9 is a prime number.

(ii) Solve the equation  $2x(x - 2) = 0$

(b) Fill in the suitable quantifier to make the following statement become true.

..... Prime number are odd numbers

(c) Complete the following argument.

Premise 1 : If p is a positive integer, then 4p is a multiple of 2.

Premise 2 : \_\_\_\_\_

Conclusion : 4p is a multiple of 2.

Answer :

(a) (i) \_\_\_\_\_

(ii) \_\_\_\_\_

(b) \_\_\_\_\_

(c) Premise 2 : \_\_\_\_\_

7. (a) State whether the following statements is true or false.  
(i)  $8 + 2 = 10$  and  $2 < -3$   
(ii) All square numbers are even numbers.
- (b) Complete the following argument.  
Premise 1 : If  $3t = 0$ , then  $t = 0$ .  
Premise 2 : \_\_\_\_\_  
Conclusion :  $3t \neq 0$
- (c) State the converse of the following statement and hence, determine whether its converse is true or false.

$$x^3 = 64 \text{ if and only if } x = 4$$

Answer :

- (a) (i) \_\_\_\_\_  
(ii) \_\_\_\_\_
- (b) Premise 2 : \_\_\_\_\_
- (c) \_\_\_\_\_

8. (a) Is the sentence below a statement or non-statement?

$$3 \text{ and } 4 \text{ are factors of } 8$$

- (b) Write down two implications based on the following sentence:

$$x \text{ is an even number if and only if } x \text{ can be divided by } 2$$

- (c) Make a general conclusion by induction for the following number pattern :

$$\begin{aligned} 2 &= (0)^2 + 2 \\ 3 &= (1)^2 + 2 \\ 6 &= (2)^2 + 2 \\ 11 &= (3)^2 + 2 \end{aligned}$$

Answer :

- (a) \_\_\_\_\_
- (b) Implication 1 : \_\_\_\_\_  
Implication 2 : \_\_\_\_\_
- (c) \_\_\_\_\_

9. (a) State whether each of the following statement is true or false

(i)  $-2^2 = -4$  or  $(-3)^3 = -9$

(ii)  $16^{\frac{1}{2}} = 8$  and  $25^{\frac{-1}{2}} = \frac{1}{5}$

(b) Complete the following argument.

Premise 1 : \_\_\_\_\_

Premise 2 :  $x^n + x$  is not a quadratic expressions.

Conclusion :  $n \neq 2$ .

(c) Write down two implications based on the following sentence.

$1 - m > 2$ if and only if $m < -1$
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Answer :

(a) (i) \_\_\_\_\_

(ii) \_\_\_\_\_

(b) Premise 1 : \_\_\_\_\_

(c) Implication 1 : \_\_\_\_\_

Implication 2 : \_\_\_\_\_

10. (a) State whether the following sentence is a statement or a non-statement. Give a reason for your answer.

$2 + 7 = 1 + 6$
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(b) State whether each of the following statements is true or false.

(i)  $\{0\}$  is an empty set or  $\phi$  is an empty set.

(ii)  $\{ \}$  is an empty set and  $\phi$  is also an empty set.

(c) Complete the following argument.

Premise 1 : if  $y > 3$ , then  $5y > 15$ .

Premise 2 :  $5y > 15$ .

Conclusion : \_\_\_\_\_

Answer :

(a) \_\_\_\_\_

(b) (i) \_\_\_\_\_

(ii) \_\_\_\_\_

(c) Conclusion : \_\_\_\_\_

**MODULE 6**  
**TOPIC : MATHEMATICAL REASONING**

1. (a) (i) some 1m  
(ii) all 1m  
(b) If  $x > 4$  then  $x > 7$  1m  
False. 1m  
(c)  $P \cap Q \neq P$  1m
2. (a) Non-statement 1m  
(b) 3 is a factor of 24 2m  
(c)  $3(2^n) - n$  and  $n = 1, 2, 3, \dots$  2m
3. (a) (i) True 1m  
(ii) False 1m  
(b) The determinant of matrix  $a = 0$  1m  
(c) If  $A \subset B$  then  $A \cap B = A$  1m  
If  $A \cap B = 0$  then  $A \subset B$  1m
4. (a) True 1m  
(b) If  $p^3 = 8$  then  $p = 2$  1m  
If  $p = 2$  then  $p^3 = 8$  1m  
(c) If  $x = 9$  then  $x = 3$  2m
5. (a) (i) True 1m  
(ii) False 1m  
(b) Premise 1 : If  $p = 7$ , then  $6 \times p = 42$  1m  
(c)  $4n^2 + 7$ ,  $n = 1, 2, 3, 4, \dots$  2m
6. (a) (i) Statement. 1m  
(ii) Non-statement 1m  
(b) Some 1m  
(c) Premise 2 :  $p$  is a positive integer 2m
7. (a) (i) False 1m  
(ii) False 1m  
(b)  $t \neq 0$  1m  
(c) If  $x \pm 3$ , then  $x^2 = 9$  1m  
True 1m
8. (a) Statement 1m  
(b) If  $x$  is an even number then  $x$  can be divided by 2. 1m  
If  $x$  can be divided by 2 then  $x$  is an even number. 1m  
(c)  $n^2 + 2$ ,  $n = 0, 1, 2, \dots$  2m
9. (a) (i) True 1m  
(ii) False 1m  
(b) If  $n = 2$ , then  $x^2 + x$  is a quadratic expressions. 1m  
(c) If  $1 - m > 2$  then  $m < -1$  1m  
If  $m < -1$  then  $1 - m > 2$  1m

10. (a) It is a statement because it has a truth value which is false. 2m  
(b) (i) True 1m  
(ii) False 1m  
(c)  $y > 3$  1m