

# BBMP 1103

## Matematik Pengurusan

### Chapter:1 – Real Numbers

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### 1. Introduction to Real Numbers

- ❖ Natural Numbers  $N$  – numbers used for counting  
Example:  $N = \{1, 2, 3, 4, 5 \dots\}$
- ❖ Integer  $Z$  - consist of positive and negative whole numbers and zero  
Example:  $Z = \{ \dots -3, -2, -1, 0, 1, 2, 3, \dots\}$
- ❖ Positive Integers  $Z^+ = \{1, 2, 3, \dots\} = \text{Natural numbers } N$
- ❖ Negative Integers  $Z^- = \{\dots, -4, -3, -2, -1\}$
- ❖ Hence  $N \subset Z$  or  $N$  subset of  $Z$
- ❖ Rational numbers  $Q =$  numbers that can be expressed in the form  $\frac{a}{b}$  where  $a$  and  $b$  are integers

- ❖ Example of rational numbers  $Q = \left\{ \frac{2}{3}, \frac{1}{4}, -\frac{5}{8}, \frac{3}{3}, -\frac{2}{-2}, \dots \right\}$
- ❖ Hence  $N$  is a subset of  $Z$  which in turn is a subset of  $Q$
- ❖ Irrational numbers are numbers which cannot be expressed as  $\frac{a}{b}$  for example  $\{ \sqrt{3}, \sqrt{7}, \dots \}$
- ❖ Rational Numbers + Irrational Numbers = Real Numbers  $R$
- ❖ Hence real numbers  $R$  are all numbers which can be defined. These include Natural numbers  $N$ , Integers  $Z$ , Rational numbers  $Q$  and Irrational Numbers except:
 
$$\frac{1}{0} \text{ or } \frac{n}{0} \text{ or } \sqrt{-n}$$

## 2. Properties of Real Numbers

If  $a$ ,  $b$  and  $c$  are real numbers then:

- ❖ **Closed Properties:**
  - $a + b =$  Real numbers
  - $a \times b =$  Real numbers

**Example:**

- $2 + 3 = 5$
- $3.5 + 2.8 = 6.3$
- $4 \times 8 = 32$

- ❖ **Commutative Properties:**
  - $a + b = b + a$
  - $a \times b = b \times a$

**Example:**

- $2 + 3 = 3 + 2 = 5$
- $3.5 + 2.8 = 2.8 + 3.5 = 6.3$
- $2 \times 5 = 5 \times 2 = 10$

❖ **Associative Properties:**

- $(a + b) + c = a + (b + c)$
- $a \times (b \times c) = (a \times b) \times c$

**Example :**

- $(2 + 3) + 5 = 2 + (3 + 5) = 10$
- $(2 \times 3) \times 5 = 2 \times (3 \times 5) = 30$

❖ **Distributive Properties:**

- $a(b + c) = ab + ac$
- $a(b - c) = ab - ac$

**Example:**

- $2(3 + 5) = 2(3) + 2(5) = 16$
- $2(3 - 5) = 2(3) - 2(5) = -4$

❖ **Identity Properties:**

- $a + 0 = 0 + a = a$
- $a \times 1 = 1 \times a = a$

**Example:**

- $3 + 0 = 3$
- $3 \times 1 = 3$

❖ **Inverse Properties:**

- $a + (-a) = 0$
- $a \times (1/a) = 1$

**Example:**

- $2 + (-2) = 0$
- $5 \times (1/5) = 1$

**❖ Elimination Properties:**

- If  $a + \cancel{c} = b + \cancel{c}$ , then  $c$  on the left hand and right hand side can be eliminated and hence  $a = b$
- If  $a \times \cancel{c} = b \times \cancel{c}$ , then  $c$  on the left hand and right hand side can be eliminated and hence  $a = b$

**Example:**

- If  $x + \cancel{2} = y + \cancel{2}$ , hence  $x = y$
- If  $x(\cancel{2}) = y(\cancel{2})$ , hence  $x = y$

**❖ Zero Properties:**

- Any real numbers multiplied by zero will produce a zero

**Example:**

- $2(0) = 0$
- $-3.5(0) = 0$

**❖ Properties of Positive and Negative numbers:**

- $(+ve) \times (+ve) = (+ve)$
- $(+ve) \times (-ve) = (-ve)$
- $(-ve) \times (+ve) = (-ve)$
- $(-ve) \times (-ve) = (+ve)$

### 3. Introduction to Exponential

❖ Properties of exponential:

$$1. a^m \times a^n = a^{m+n}$$

$$2. a^m \div a^n = a^{m-n}$$

$$3. a^m \times b^m = (ab)^m$$

$$4. (a^m)^n = a^{mn}$$

$$5. a^{\frac{m}{n}} = (\sqrt[n]{a})^m$$

$$6. a^{-m} = \frac{1}{a^m}$$

$$7. a^0 = 1$$

**Example:**

$$1. a^m \times a^n = a^{m+n} \quad \rightarrow \quad 2^3 \times 2^5 = 2^{3+5} = 2^8$$

$$2. a^m \div a^n = a^{m-n} \quad \rightarrow \quad 3^7 \div 3^2 = 3^{7-2} = 3^5$$

$$3. a^m \times b^m = (ab)^m \quad \rightarrow \quad 2^5 \times 3^5 = (2 \times 3)^5 = 6^5$$

$$4. (a^m)^n = a^{mn} \quad \rightarrow \quad (3^5)^2 = 3^{5 \times 2} = 3^{10}$$

$$5. a^{\frac{m}{n}} = (\sqrt[n]{a})^m \quad \rightarrow \quad 64^{\frac{2}{3}} = (\sqrt[3]{64})^2 = (4)^2 = 16$$

## Soalan Latihan Tambahan

1. Nyatakan berikut Betul atau Salah:

- a. -6 adalah nombor integer: **Betul**
- b. -2 adalah nombor asli: **Salah**
- c. 5 adalah nombor nisbah: **Betul**
- d.  $\frac{4}{2}$  bukan nombor integer positif: **Salah**

2. Jika a, b dan c adalah nombor-nombor nyata, berikan sifat-sifat bagi setiap ungkapan berikut:

- i.  $a + b = b + a$  **Sifat Kalis Tukar Tertib**
- ii.  $(a + b) + c = a + (b + c)$  **Sifat Kalis Sekutuan**
- iii.  $a(b + c) = ab + ac$  **Sifat Kalis Agihan**
- iv.  $a + 0 = 0 + a = a$  **Sifat Identiti**

3. Nyatakan sama ada persamaan yang berikut BETUL atau SALAH. Jika persamaan adalah SALAH, buat pindaan supaya ianya betul

- a.  $a^m a^n = a^{mn}$  **Salah**  $\Rightarrow a^m a^n = a^{m+n}$
- b.  $(ab)^n = a^n b^n$  **Betul**
- c.  $(a - b)^2 = a^2 - 2ab + b^2$  **Betul**

4. Ringkaskan yang berikut:

- a)  $3 + (-2) - 1(-2)(4) - 5 = 3 - 2 + 8 - 5 = 4$
- b)  $(64x^3)^{\frac{2}{3}} = [(64)^{\frac{2}{3}}][x^3]^{\frac{2}{3}} = 16x^2$

$$c. \frac{2 - \frac{3}{5}}{3 + \frac{2}{5}} = \frac{10 - 3}{15 + 2} = \frac{7}{17} = \frac{7}{5} \times \frac{5}{17} = \frac{7}{17}$$

5. a) Tukarkan eksponen berikut ke bentuk radikal :

$$i. x^{\frac{2}{5}} \left[ y^{\frac{1}{2}} + 2x^{\frac{6}{5}} \right] = \left[ x^{\frac{2}{5}} \right] \left[ y^{\frac{1}{2}} \right] + \left[ x^{\frac{2}{5}} \right] \left[ 2x^{\frac{6}{5}} \right]$$

$$= \left[ \sqrt[5]{x^2} \right] \left[ \sqrt{y} \right] + \left[ (2) \left( \sqrt[5]{x^8} \right) \right]$$

$$ii. (ab^2c^3)^{\frac{3}{4}} = (a^{\frac{3}{4}})(b^2)^{\frac{3}{4}}(c^3)^{\frac{3}{4}}$$

$$= (a^{\frac{3}{4}})(b^{\frac{3}{2}})(c^{\frac{9}{4}})$$

$$= (\sqrt[4]{a^3})(\sqrt[2]{b^3})(\sqrt[4]{c^9})$$

5. b) Tukarkan radikal berikut ke bentuk eksponen :

$$i. \left( \sqrt[5]{x^2 y} \right)^{\frac{2}{5}} = \left( (x^{\frac{2}{5}})(y^{\frac{1}{5}}) \right)^{\frac{2}{5}} = \left( (x^{\frac{2}{5}}) \right)^{\frac{2}{5}} \left( (y^{\frac{1}{5}}) \right)^{\frac{2}{5}} = \left( x^{\frac{4}{25}} \right) \left( y^{\frac{2}{25}} \right)$$

$$ii. \sqrt[3]{ab^5} = \left( a^{\frac{1}{3}} \right) \left( b^{\frac{5}{3}} \right)$$

# Any Question?

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