# NEW ELEMENTARY MATHEMATICS TEACHER'S MANUAL 2 SYLLABUS D (NEW EDITION)

## Scheme of Work

***Legend***

| | | | |
|---|---|---|---|
| Asse | Assessment | Misc Ex | Miscellaneous Exercise |
| C | Challenger | PS | Problem Solving |
| CA | Class Activity | Rev Ex | Revision Exercise |
| Ex | Exercise | I | Investigation |

| Week | Topic | Specific Instructional Objectives | | Activities | Exercises |
|---|---|---|---|---|---|
| 1-2 | **Chapter 1**<br>Indices<br>*p* 1-22 | 1.1 | • Use the following laws of indices: $a^m \times a^n = a^{m+n}$, $a^m/a^n = a^{m-n}$ $(m > n)$ and $(a^m)^n = a^{mn}$, where $a$, $m$ and $n$ are positive integers. | CA 1, *p* 3<br>Q1, 2 | Ex 1.1, *p* 6<br>Q1, 2 |
| | | | • Show awareness that the laws of indices apply to negative and fractional bases. | CA 1, *p* 3<br>Q3 | Ex 1.1, *p* 6<br>Q3, 4 |
| | | 1.2 | • Use zero and negative indices, including the laws of indices, with integral indices (zero, positive and negative). | | Ex 1.2, *p* 11 |
| | | 1.3 | • Simplify indices involving variable bases. | | Ex 1.3, *p* 13 |
| | | 1.4 | • Demonstrate an understanding of the definition of standard form. | CA 2, *p* 15 | Ex 1.4, *p* 18<br>Q1-3 |
| | | | • Use and compute numbers in standard form. | | Ex 1.4, *p* 18<br>Q4-5 |
| | | Challenger 1 (optional) | | | C 1, *p* 20 |
| | | Problem Solving 1 | | | PS 1, *p* 20 |
| 3-4 | **Chapter 2**<br>Algebraic Manipulations<br>*p* 23-49 | 2.1 | • Use the following special algebraic rules: $(a + b)^2 = a^2 + 2ab + b^2$, $(a - b)^2 = a^2 - 2ab + b^2$ and $a^2 - b^2 = (a + b)(a - b)$ for calculating and expanding products of algebraic expressions. | CA 1, *p* 24<br>CA 2, *p* 25 | Ex 2.1, *p* 28 |
| | | 2.2 | • Use the distributive rule to establish the rules: $a(b + c + d) = ab + ac + ad$, $(a + b)(c + d) = ac + ad + bc + bd$ and the special algebraic rules.<br>• Expand products of algebraic expressions. | CA 3, *p* 30 | Ex 2.2, *p* 31 |
| | | 2.3 | • Use the distributive rule to factorize algebraic expressions, including the use of brackets for grouping. | | Ex 2.3, *p* 33<br>Q1-3 |
| | | | • Factorize algebraic expressions of the forms $a^2 + 2ab + b^2$, $a^2 - 2ab + b^2$ and $a^2 - b^2$. | | Ex 2.3, *p* 33<br>Q4-6 |

# Answers and Notes to Class Activity

## Chapter 1

### Class Activity 1 *(p 3)*

Indices are also called exponents.

| | | |
|---|---|---|
| **1.** **(a)** T | **(b)** F | **(c)** F |
| **(d)** T | **(e)** F | **(f)** F |
| **(g)** F | **(h)** T | **(i)** T |
| **(j)** T | **(k)** F | **(l)** F |
| **(m)** T | **(n)** T | **(o)** F |
| **(p)** T | **(q)** F | **(r)** F |
| **(s)** T | **(t)** T | |

*Note:* • After students have answered the questions, conduct a class discussion to lead to conclusions that
(1) sentences of the form of each of the five Laws of Indices are true,
(2) sentences not of the form of any of the five Laws of Indices are not necessarily false. For example, the sentence in (d) and (n) are true by chance.

• Encourage students to check all sentences of Q1 by evaluating the values of both sides of each sentence.

• Use compare and contrast technique to show the difference between (c) $5^2 \times 5^3$ and (e) $5^2 + 5^3$. Focus on the different meanings of these expressions.

**2.** (i) and (a) – 2nd Law
(ii) and (e) – 5th Law
(iii) and (d) – 1st Law
(iv) and (c) – 1st Law
(v) and (k) – 3rd Law
(vi) and (g) – 3rd Law
(vii) and (m) – 4th Law
(viii) and (i) – 4th Law
(ix) and (h) – 2nd Law
(x) and (b) – 1st Law
(xi) and (f) – 3rd Law
(xii) and (l) – 4th Law
(xiii) and (j) – 5th Law
(xiv) and (n) – 5th Law
(xv) and (o) – 2nd Law

**3.** Yes

*Note:* • Get students to use their own examples to show that the five Laws of Indices are all true for negative bases. For example,

$$(-5)^2 \times (-5)^3 = [(-5) \times (-5)] \times [(-5) \times (-5) \times (-5)]$$
$$= (-5)^5$$
$$= (-5)^{2+3}$$

• Alert students to the difference between $(-3)^4$ and $-3^4$. Use similar examples to show the importance of parentheses.

### Class Activity 2 *(p 15)*

| | | | |
|---|---|---|---|
| **1.** **(e)** | | | T |
| **(f)** | | | T |
| **(g)** | | T | |
| **(h)** | | F | |
| **(i)** | T | | |
| **(j)** | T | | |
| **(k)** | | T | F |
| **(l)** | T | F | F |
| **(m)** | T | T | T |
| **(n)** | T | T | T |

| | | |
|---|---|---|
| **2.** **(a)** $10^0$ | **(b)** $10^{-1}$ | **(c)** $10^{-13}$ |
| **(d)** $10^{10}$ | **(d)** $10^{27}$ | **(f)** $10^3$ |
| **(g)** $10^3$ | **(h)** $10^{-11}$ | **(i)** $10^4$ |
| **(j)** $10^3$ | **(k)** $10^{13}$ | **(l)** $10^2$ |

| | | |
|---|---|---|
| **3.** **(a)** ✓ | **(b)** ✗ | **(c)** ✓ |
| **(d)** ✓ | **(e)** ✗ | **(f)** ✗ |
| **(g)** ✓ | **(h)** ✓ | **(i)** ✓ |

## Chapter 2

### Class Activity 1 *(p 24)*

The approach in this activity is called geometric algebra. It was the method used by a Muslim mathematician in the 8th century to solve algebraic equations. This method helps students to develop visual imagery of the algebraic expressions.

Opportunity is given here for teaching mathematical communication. For example, students may be asked to explain why they say yes for Q1(e), Q2(a), (c), (d), etc.

| | | |
|---|---|---|
| **1.** **(a)** Yes | **(b)** Yes | **(c)** Yes |
| **(d)** Yes | **(e)** Yes | **(f)** Yes |

| | | |
|---|---|---|
| **2.** **(a)** Yes | **(b)** Yes | **(c)** Yes |
| **(d)** Yes | **(e)** Yes | |

### Class Activity 2 *(p 25)*

| | | |
|---|---|---|
| **1.** **(a)** (i) | **(b)** (ii) | **(c)** (iii) |
| **(d)** (i) | **(d)** (ii) | **(f)** (iii) |
| **(g)** (iii) | **(h)** (i) | **(i)** (i) |
| **(j)** (iii) | **(k)** (i) | **(l)** (ii) |
| **(m)** (i) | **(n)** (i) | **(o)** (ii) |
| **(p)** (iii) | **(q)** (i) | **(r)** (ii) |
| **(s)** (iii) | **(t)** (ii) | **(u)** (iii) |

# Answers and Notes to Problem Solving

## Problem Solving 1 *(p 22)*

1. | Strategy: **Guess and check** <br> Thinking skill: **Inferring** |
   |---|

We draw the following inference:
$C = 1$, $T = 5$ to 9.
Take $C = 1$, $T = 5$, $R = 0$, $N = 2$

$$\begin{array}{r} THINK \\ +\ THINK \\ \hline CREATE \end{array}$$

$$\begin{array}{r} 5\,H\,I\,2\,K \\ +\ 5\,H\,I\,2\,K \\ \hline 5\,0\,E\,A\,5\,E \end{array}$$

Can we replace $H, E, I, A, K$ by 3, 4, 6, 7, 8, 9 such that $H + H = E$, $K + K = 10 + E$?
Try $H = 4$, $E = 8$, $K = 9$. Yes

**Solution**

$$\begin{array}{r} 5\,4\,3\,2\,9 \\ +\ 5\,4\,3\,2\,9 \\ \hline 1\,0\,8\,6\,5\,8 \end{array}$$

Take $C = 1$, $T = 5$, $R = 0$, $N = 7$

$$\begin{array}{r} 5\,H\,I\,7\,K \\ +\ 5\,H\,I\,7\,K \\ \hline 1\,0\,E\,A\,5\,E \end{array}$$

Can we replace $H, E, I, A, K$ by 2, 3, 4, 6, 8, 9 such that $H + H = E$, $K + K = 10 + E$?
Try $H = 3$, $E = 6$, $K = 8$. Yes

**Another Solution**

$$\begin{array}{r} 5\,3\,4\,7\,8 \\ +\ 5\,3\,4\,7\,8 \\ \hline 1\,0\,6\,9\,5\,6 \end{array}$$

***Looking back***

Are there other solutions?
We further draw the following inferences:
If $R$ is even, then $H + H = E$, $K + K = 10 + E$ and $T$ is odd.
If $R$ is odd, then $H + H = 10 + E$, $K + K = E$ and $T$ is even.
In short, if one of $R$ and $T$ is even, the other is odd.
Take $C = 1$, $T = 6$, $R = 3$ ($R \neq 2$ since $T$ is even), $N = 8$

$$\begin{array}{r} 6\,H\,I\,8\,K \\ +\ 6\,H\,I\,8\,K \\ \hline 1\,3\,E\,A\,6\,E \end{array}$$

Can we replace $H, E, I, A, K$ by 0, 2, 4, 5, 7, 9 such that $H + H = 10 + E$, $K + K = E$?
Try $K = 2$, $E = 4$, $H = 7$. No

Take $C = 1$, $T = 7$, $R = 4$ ($R \neq 5$ since $T$ is odd), $N = 3$

$$\begin{array}{r} 7\,H\,I\,3\,K \\ +\ 7\,H\,I\,3\,K \\ \hline 1\,4\,E\,A\,7\,E \end{array}$$

Can we replace $H, E, I, A, K$ by 0, 2, 5, 6, 8, 9 such that $H + H = E$, $K + K = 10 + E$? No

Take $C = 1$, $T = 7$, $R = 4$, $N = 8$

$$\begin{array}{r} 7\,H\,I\,8\,K \\ +\ 7\,H\,I\,8\,K \\ \hline 1\,4\,E\,A\,7\,E \end{array}$$

Can we replace $H, E, I, A, K$ by 0, 2, 3, 5, 6, 9 such that $H + H = E$, $K + K = 10 + E$? No

Take $C = 1$, $T = 8$, $R = 7$ ($R \neq 6$ since $T$ is even), $N = 4$

$$\begin{array}{r} 8\,H\,I\,4\,K \\ +\ 8\,H\,I\,4\,K \\ \hline 1\,7\,E\,A\,8\,E \end{array}$$

Can we replace $H, E, I, A, K$ by 0, 2, 3, 5, 6, 9 such that $H + H = 10 + E$, $K + K = E$? No

Take $C = 1$, $T = 8$, $R = 7$, $N = 9$

$$\begin{array}{r} 8\,H\,I\,9\,K \\ +\ 8\,H\,I\,9\,K \\ \hline 1\,7\,E\,A\,8\,E \end{array}$$

Can we replace $H, E, I, A, K$ by 0, 2, 3, 4, 5, 6 such that $H + H = 10 + E$, $K + K = E$? No

Take $C = 1$, $T = 9$, $R = 8$, $N = 4$

$$\begin{array}{r} 9\,H\,I\,4\,K \\ +\ 9\,H\,I\,4\,K \\ \hline 1\,8\,E\,A\,9\,E \end{array}$$

Can we replace $H, E, I, A, K$ by 0, 2, 3, 5, 6, 7 such that $H + H = E$, $K + K = 10 + E$? No