Polynomials

Level: Key Stage 3

Dimension: Number and Algebra
Module: Observing Patterns and Expressing Generality
Unit: Manipulations of Simple Polynomials

Student ability: Average

Content Objectives:

After completing the activity, students should be able to have a better understanding of the key concepts and ideas about polynomials.

Language Objectives:

After completing the activity, students should be able to:

- understand the English terms related to polynomials (e.g., *polynomials, trinomial, terms, coefficient, like terms, degree 2, degree 1, degree 0, arrange, ascending powers, descending powers, variables, identify, simplify* and *create*);
- understand the English expressions for explaining the key concepts related to polynomials, for example,

- *There are 3 terms in* $5x^2 - 4x + 7$. *The coefficient of* x^2 *is 5. The coefficient of x is -4. The constant term is 7.*
- *We can simplify this polynomial,* $3k^2 + 2k – 1 – 5k + k^2 – 6$*, first by grouping the like terms together, and then by simplifying each group of the like terms:* $(3k^2 + k^2) + (2k -5k) + (-1-6) = 4k^2 -3k – 7$
- *In the polynomial* x^2+5*, the degree of* x^2 *is 2 and the degree of 5 is 0.*
- *This polynomial is arranged in ascending powers of a:* $1+2a-3a^2$.
- *This polynomial is arranged in descending powers of a:* $-3a^2+2a+1$.
- *In* $4b^3-3b +5$*, there is only one variable, which is b. The coefficient of* b^2 *in this polynomial is 0.*

- follow English instructions on solving problems concerning this topic and work on related problems written in English.

Prerequisite knowledge:

Students should have learned about like terms and unlike terms, degree of terms, and polynomials in one variable, through the medium of Chinese.

Time: 1 lesson (40 minutes)

Procedures:

1. Using Chinese as the medium of instruction, the teacher should revise the topic of polynomials with the students.
2. The teacher should distribute Worksheet A to the students and ask them to complete it.
3. The teacher should then check the answers with the students.
4. The teacher should then distribute Worksheet B to the students.
5. Using English as the medium of instruction, the teacher should then ask the students to answer the questions in Worksheet B in English.
6. The teacher should then ask 1-2 students to write their polynomials on the board.
7. Finally, the teacher should ask the students to do some calculations on the polynomials they have created.

Explanatory Notes for Teachers:

1. The first part of the lesson is conducted in Chinese and the second part of the lesson is conducted in English.
2. The students may refer to Worksheet A if they do not understand the meanings of the terms in Worksheet B.
3. If the students cannot answer the questions in English, they may give their answers in Chinese and the teacher should provide the appropriate English answers.

工作紙 3.2 – 多項式

1. 在 $3x + 1$ 中, 共有多少項? _____

   我們稱這種多項式做什麼? _____

   其中, x 的係數是什麼? _____

   1 稱為什麼? _____

2. 在下列各項中, 哪些是同類項?

   $10xyz$, y^2 mn, $5y^2$, xyz, $\frac{1}{2}mn$, $3m^2n$

   _____

3. 在多項式 $5x^2yz^2 + 10z^3 – 4xyz + 7$ 中,
   $5x^2yz^2$ 的次數是什麼? _____

   $10z^3$ 的次數是什麼? _____

   $– 4xyz$ 的次數是什麼? _____

   7 的次數是什麼? _____

   多項式 $5x^2yz^2 + 10z^3 – 4xyz + 7$ 的次數是什麼? _____

4. x^3+2x^2-x 的排列次序稱為什麼? _____

   $1-3x+5x^2-x^3$ 的排列次序稱為什麼? _____

   只有一個變數的多項式稱為什麼? _____

   把下列多項式以降冪的次序排列: $4x + 5x^3 + 6 – 7x^2$

   _____

   把上題多項式以升冪的次序排列.

   _____

5. 化簡下列各式.
   $6a + 5a – a =$ _____

   $4m + 3k – 2m + k =$ _____

   $6xy – 3x – 4xy + 6x =$ _____

Worksheet 3.2 – Polynomials

1. There are 3 terms in $5x^2 - 4x + 7$. This kind of polynomial is called *trinomial*.
   The *coefficient* of x^2 is 5.
   The *coefficient* of x is -4.
   The *constant term* is 7.

   a) How many terms are there in $6x^2 + 8x - 9$? _____
   What is the coefficient of x^2? _____
   What is the coefficient of x? _____
   What is the constant term? _____

   b) The type of polynomials as $11x^2 - x - 12$ is called_____.
   The _____ of x^2 is 11.
   The _____ term is -12.
   _____ is the coefficient of x.

2. a) Identify the *like terms* in the following.

   2a, 3b, $\frac{bc}{4}$, $5a^2$, 6bc, $7b^{2,}$ $-a^2$,

   _____

   b) Find the sum of the *like terms* in the previous question.

   _____

   _____

   c) Simplify the following polynomial:
   $3k^2 + 2k - 1 - 5k + k^2 - 6$

   _____

   _____

3. In the polynomial x^2+5, the degree of x^2 is 2 and the degree of 5 is 0.
   a) In $6abc^2 - 7a^2b^2 + 8c^3 - 1$,
   what is the degree of the term $8c^3$? _____

   what is the degree of -1? _____

   which terms have degree 4? _____

   what is the degree of the polynomial? _____

b) In $5mn^2 - 10mn + 3m - 6$,

which term has degree 1? _____

which term has degree 2? _____

which term has degree 0? _____

4. a) Arrange $2a + 1 - 3a^2$ in ascending powers of a.

_____

Arrange $2a + 1 - 3a^2$ in descending powers of a.

_____

b) What do we call the kind of arrangement of powers of x in $10 - 11x + 9x^2$?

_____

What do we call this kind of arrangement in $7x^3 - 8x - 3$?

_____

Arrange the following polynomial in descending powers of x:

$13x^2 + 14x^5 - 15x - 16 + 17x^3$

_____

Arrange the previous polynomial in ascending powers of x.

_____

c) How many variables are there in $-3b + 4b^3 + 5$? _____

Which one is the variable? _____

Arrange the terms in descending powers. _____

Arrange the terms in ascending powers. _____

What is the coefficient of b^2? _____

5. Simplify the following polynomials.

$x - 2xy + xy - y =$ _____

$3x + 6x^2 - x + 5x^3 - 3x^2 =$ _____

6. Create one polynomial with 4 terms in descending powers.

_____

Suggested Answers

工作紙 3.2

1. 2, 二項式, 3, 常數項

2. $10xyz$ 和 xyz, y^2 和 $5y^2$, mn 和 $\frac{1}{2}mn$

3. 5, 3, 3, 0, 5

4. 降冪, 升冪, 一元多項式, $5x^3 - 7x^2 + 4x + 6$, $6 + 4x - 7x^2 + 5x^3$

5. 10a, 4k + 2m, 2xy + 3x

Worksheet 3.2

1. a) 3, 6, 8, -9

   b) Trinomial, coefficient, constant, -1

2. a) $\frac{bc}{4}$ and 6bc, $5a^2$ and $-a^2$

   b) $\frac{bc}{4} + 6bc = \frac{25}{4}bc$

   $5a^2 + (-a^2) = 4a^2$

   c) $(3k^2 + k^2) + (2k - 5k) + (-1-6)$
   $= 4k^2 - 3k - 7$

3. a) 3, 0, $6abc^2$ and $-7a^2b^2$, 4

   b) $3m$, $-10mn$, -6

4. a) $1+2a-3a^2$, $-3a^2+2a+1$

   b) Ascending powers, Descending powers,
   $14x^5 + 17x^3 + 13x^2 - 15x - 16$, $-16 - 15x + 13x^2 + 17x^3 + 14x^5$

   c) One, b, $4b^3-3b+5$, $5-3b+4b^3$, 0

5. $x - xy - y$, $5x^3 + 3x^2 + 3x$

6. Any polynomial with 4 terms in descending powers