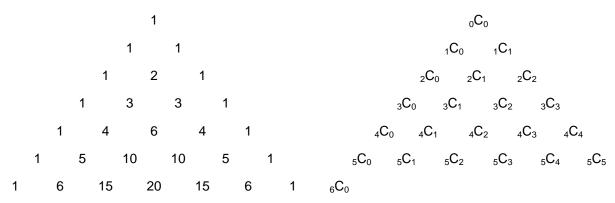
In this activity, a number pattern described in a paper written in 1653 by French mathematician Blaise Pascal will be used to simplify the process of expanding binomials.

On the left below, the first 7 rows of Pascal's Triangle are given. On the right, the same pattern is shown using combination notation. Letting n represent the row number, the top row is n = 0.

**1.** Complete the last row on the right.



#### Problem 1 – Exploring $(x + b)^n$

On the Home screen, use the **Expand** command from the Algebra (F2) menu to expand the following binomials.

**2.** 
$$(x+1)^0 =$$

$$(x+1)^1 =$$

$$(x+1)^2 =$$

$$(x+1)^3 =$$

**3.** What do you notice about the coefficients? The exponents? How do the expansions above seem to relate to Pascal's Triangle?

# 🤣 Expanding Binomials

Expand the following. The letter *b* represents any integer value.

- **4.**  $(x+b)^0 =$ 
  - $(x+b)^1 =$
  - $(x+b)^2 =$
  - $(x+b)^3 =$
- **5.** What effect does *b* have on the expanded binomial?

**6.** Rewrite  $1 \cdot x^3 + 3 \cdot b \cdot x^2 + 3 \cdot b^2 \cdot x + 1 \cdot b^3$  using combination notation.

### Problem 2 – Exploring $(ax + 1)^n$

**7.** Expand the following binomials. The letter *a* represents any integer value.

$$(2x+1)^0 =$$

$$(ax+1)^0 =$$

$$(2x+1)^1 =$$

$$(ax+1)^1 =$$

$$(2x+1)^2 =$$

$$(ax+1)^2 =$$

$$(2x+1)^3 =$$

$$(ax+1)^3 =$$

- **8.** What effect does a have on the expanded binomial?
- **9.** Write  $(ax+1)^4$  in expanded form using Pascal's triangle. Do not use the calculator.
- **10.** Rewrite  $(ax+1)^4$  in expanded form using combination notation.

## Problem 3 – Exploring $(ax + b)^n$

**11.** Expand the following binomials. Remember, *a* and *b* represent integer values.

$$(3x+2)^0 =$$

$$(ax+b)^{0} =$$

$$(3x+2)^1 =$$

$$(ax+b)^{1} =$$

$$(3x+2)^2 =$$

$$(ax+b)^2 =$$

$$(3x+2)^3 =$$

$$(ax+b)^3 =$$

**12.** What is the pattern involving a and b in  $(ax + b)^n$ ?

**13.** Write expansion of the following binomials using combination notation. Remember that the first and last term have coefficients of 1.

$$(ax + b)^0 =$$

$$(ax + b)^1 =$$

$$(ax+b)^2 =$$

$$(ax+b)^3=$$

14. The pattern established in this problem can be generalized as the Binomial Theorem. State the Binomial Theorem by writing the first two and last two terms of the expanded binomial  $(ax + b)^n$  using combination notation.

$$(ax+b)^n =$$

#### **Extra Problems**

Use the Binomial Theorem to expand the following binomials.

- 1.  $(6x + 1)^5$
- **2.**  $(x+7)^6$
- 3.  $(3x + 5)^4$
- **4.**  $(7x + 4)^8$