Quiz 02, #8 Determine the $n$-th term.

- **Solution**
  - $a_n = 11^{(n-1)/2} = (11^{1/2})^{n-1} = \left(\sqrt{11}\right)^{n-1}$
  - $\sqrt[11]{n} = 11^{1/11} = 11^{1/2}$

3. Another idea $r = \frac{a_2}{a_1} = \frac{30}{1} = r = \sqrt{11}$

$$a_n = a \cdot r^{n-1} = 1 \cdot (\sqrt{11})^{n-1}$$

II. 51.6: p. 865: Binomial Theorem:

$$\textbf{A} \quad (a+b)^n = \binom{n}{0}a^n b^0 + \binom{n}{1}a^{n-1} b^1 + \binom{n}{2}a^{n-2} b^2 + \ldots + \binom{n}{n}a^0 b^n$$

**Example**: $(2x+y)^5$ Expand using B.T. (p. 866)

$$(2x+y)^5 = \binom{5}{0} (2x)^5 y^0 + \binom{5}{1} (2x)^4 y^1 + \binom{5}{2} (2x)^3 y^2 + \binom{5}{3} (2x)^2 y^3 + \binom{5}{4} (2x)^1 y^4 + \binom{5}{5} (2x)^0 y^5$$

$$= \frac{5!}{0!(5-0)!} (2x)^5 + \frac{5!}{1!(4)!} (2x)^4 y^1 + \frac{5!}{2!(3)!} (2x)^3 y^2 + \frac{5!}{3!(2)!} (2x)^2 y^3 + \frac{5!}{4!(1)!} (2x)^1 y^4 + \frac{5!}{5!(0)!} (2x)^0 y^5$$

$$= (2x)^5 + 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 (2x)^4 y^1 + \frac{5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{1 \cdot 4 \cdot 3 \cdot 2 \cdot 1} (2x)^3 y^2 + 10 (2x)^2 y^3 + 5 (2x)^1 y^4 + y^5$$

$$(2x+y)^5 = 32x^5 + 80x^4 y + 80x^3 y^2 + 40x^2 y^3 + 10xy^4 + y^5$$

$n=5$

**III. Review of General Term of Binomial Expansion**

The TERM that contains $a^r$ in the expansion of $(a+b)^n$ is $\binom{n}{r} a^r b^{n-r}$

**B.** How do we use this?
Example 1: Find the 12th term in the expansion of \((x + 2y)^8\)

Solution: "Build" the answer

\[ \binom{8}{11} (x)^{11} \binom{1}{11} (2y)^{11} \]

\[ = 31824 \times 2048 \times 7y^{11} = 65,175,552 \times 7y^{11} \]

Example 2: The 12th term in the expansion of \((x + 2y)^8\)

is \(65,175,552 \times 7y^{11}\).

Example 3: 

9.6.1: p.869: #30: Find the 5th term in the expansion of \((ab-1)^{20}\) = \((ab+1)^{20}\)

Solution: Work.

\[ \binom{20}{4} (ab)^{16} (-1)^4 \]

\[ = \frac{5 \times 3 \times 2 \times 1}{20 \times 19 \times 18 \times 17} \times 16 \times 15 \times a^{16} b^{16} \]

\[ = 48,45 \times a^{16} b^{16} = 48,45 (ab)^{16} \]

The 5th term in the expansion of \((ab-1)^{20}\) is \(48,45 \times a^{16} b^{16}\).