

Manipulating Polygonal Numbers:

A. In working with polygonal numbers there are certain patterns that develop when using successive polygonal numbers:

1. The difference of 2 successive polygonal numbers is:

$$(x-2)n - (x-3), \text{ where } n \text{ is the largest } x\text{-agonal number}$$

2. In other words, to find the difference of two successive x -agonal numbers, subtract 2 from x and multiply by n and subtract $(x - 3)$.

Ex [1] The difference of the 6th and 7th octagonal numbers is ____.

- Since "octa" means 8, the formula is: $(8-2)n - (8-3)$ or $6n - 5$.
- Using the largest number 7, we get $6(7) - 5$ or 37.
- The answer is 37.

Ex [2] The difference of the 9th and 10th decagonal numbers is ____.

- Since "deca" means 10, the formula is: $(10-2)n - (10-3)$ or $8n - 7$.
- Using the largest number 10, we get $8(10) - 7$ or 73.
- The answer is 73.

B. We can use this above information to do a problem of another type:

Ex [3] If the 8th pentagonal number is 92, then the 9th pentagonal number is _____.

- First, find the expression for the difference.
- Since "penta" means 5, the formula is: $(5-2)n - (5-3)$ or $3n - 2$.
- Using the largest number 9, we get $3(9) - 2$ or 25.
- If the difference is 25, we can add 25 to 92 to get the 9th pentagonal number.
- $92 + 25 = 117$.
- The answer is 117.

Ex [4] If the 40th octagonal number is 4720, then the 39th octagonal number is

_____.

- a. The expression for the difference of octagonal numbers is: $6n - 5$.
- b. Using the largest number 40, we get $6(40) - 5$ or 235.
- c. If the difference is 235, we can subtract 235 from 4720 to find the 39th octagonal number.
- d. $4720 - 235 = 4485$.
- e. The answer is 4485.