 **BALDIVIS SECONDARY COLLEGE**

**YEAR 11 SPECIALIST 2020**

**RELATIONSHIPS IN PASCAL’S TRIANGLE**

**Combinatorics and Pascals Triangle (Topics: 1.1.1 – 1.1.9)**

**INVESTIGATION 1: TAKE HOME SECTION**

**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date due and test : Friday 6/3/20**

Consider Pascal’s triangle

****

**Question 1**

Investigate the sums of the terms in each of the rows of Pascal’s Triangle.

Determine a rule for the sum of the terms of row *n*. Show that your rule is valid.

**Question 2**

To obtain any term in Pascal’s triangle the two terms in the row above and on either side of the proposed term are added.

For example, 4 + 6 (from the fifth row) = 10 (a term in the sixth row).

i.e. *n+1Cr = n Cr − 1 + n Cr* .

Show that the rule is valid.

**Question 3**

If the first *n* triangular numbers are added, the *n* *th* tetrahedral number is produced.

The triangular numbers are located on the third diagonal and are 1, 3, 6, 10, …

The tetrahedral numbers are the numbers 1, 4, 10, 20, 35…. and the name is linked to the construction of tetrahedrons.

For example 4 = 1 + 3, 10 has 3 layers, 6 + 3 + 1 to form a tetrahedron.



Determine a rule for the number of units required to make a tetrahedron with *n* layers. Show your rule is valid when *n* = 6.

**Question 4**

Prove the identity



Hint:*nCr = n− 1Cr + n− 1Cr − 1*

[NB: This is sometimes known as the hockey stick pattern where 1 + 3 + 6 + 10 = 20.]

****

**Question 5**

Prove the identity

