

## Dominoes@Douglas: a PIP Family Math Night

By Janice M. Ward and Karen Herther

Enthusiasm rippled through the audience of 70 students, parents, and educators who played domino math games at Douglas School on the evening of February 15, 2005. The mainly 5<sup>th</sup> and 6<sup>th</sup> audience eagerly fell for the domino games and picked up some math skills along the way.

The goal of Family Math Night was to demonstrate how families could use domino games to reinforce problem solving, promote logical reasoning and encourage number sense—without opening a math book or writing a number on a piece of paper. The Domino Math game inventors, Acton residents Dr. Judith Collison (an author of the Massachusetts Math Frameworks) and Dr. George Collison (from the Concord Math Consortium), developed the games so students could learn their math tables “without filling in blanks on worksheets.”

This pilot program was presented by the Collisons in conjunction with Acton PIP (Parent Involvement Project) which supplied 20 sets of dominoes along with event volunteers, and the Douglas School PTO. Karen Herther, PIP co-chair, and Dr. Whitbeck, Douglas School principal, introduced Dr. George Collison at the start of the evening.



Dr. Whitbeck and Dr. Collison

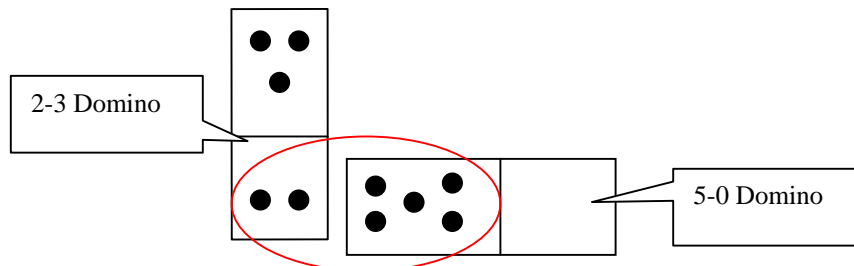


Game Players at Family Math Night

Dr. Collison addressed an audience seated around tables set up for a family game night and told a few stories about his colleagues from that little engineering school near the Charles. According to George, “some very good mathematicians are bad at their times tables... but they have a very strong number sense.” Dr. Collison said that these same mathematicians think about numbers in a different way—by estimating (not exacting) a product, comparing products, building number sense, and thinking about the size and relationships with other numbers.” The Collisons used this “different way of thinking about numbers” to create Domino Math games.

To start the games, Dr. Collison asked volunteers from each table to empty their box of domino tiles into the center of their table and turn them face down. He called that center pile, the “boneyard.” Then he asked each player to take 20 dominoes. The youngest player at the table was asked to draw one more domino from the boneyard and turn it face up for the game called *Domino Target*.

Using an overhead projector, George drew a 2-3 domino. He suggested the audience try a target number of 7. Then he asked the audience what numbers could I add to 2 or 3 to get 7?



Domino Target Using the Number 7

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The audience responded and Dr. Collison drew a 5-0 domino beside the 2-3 domino. Then Dr. Collison asked about other combinations. Could we use subtraction instead of addition? Could we continue until all the dominoes are gone? Then the games began.

After playing *Domino Target*, Dr. Collison demonstrated *Domino Maze*, which used ranges of numbers as targets and multiplication as the operation. "What domino pairs can you make with multiplication and a target range of 10 to 25?" asked Dr. Collison. The groups tackled the problem and almost covered the tables with domino pairs (number facts) that multiplied to products between 10 and 25. Dr. Collison asked participants to share the different strategies they used when looking for dominos that fit in the number range. One strategy was to select lower numbers to allow the product to fit into the target range.

Although Dr. Collison gave instructions for the games, he encouraged experimentation. "What becomes very exciting is when kids make up their own domino math games, create their own rules, and design their own strategies," noted Dr. Collison. On cue, Benjamin Wright, a Douglas 5th grader, made up a domino math game that involved putting dominos in random order in a "train" then looked at domino patterns based on the target range.

"Domino math spurs algebraic thinking because players make a number and then take it apart or decompose it. For example, to reach a target of 15-25 in a game called Roman Road— students use a process which is very algebraic in nature," said Dr. Collison. "If the seed numbers are 3 and 4, players can use 4 and 2 to make  $3 \times 4 + 4 \times 2 = 12 + 8 = 20$ . Since Roman Road players get 5 points for each multiplication, this move yields 10 points. Another student could employ factoring knowledge and play on the 3 and 4—an 8 and a 4 yields  $3 \times 4 \times 8 \div 4 = 12 \times 2 = 24$ . The student effectively factored 24 into  $2 \times 3 \times 4$ . This gives 20 points because there are four operations (three multiplication and a division). Players can get very creative using zeros in Roman Road as well.

Domino math games provide a simple, inexpensive and fun way for students from first grade through high school to practice estimation skills and number facts. In addition, the games are particularly valuable for students approaching middle school to hone their math skills and "math sense." According to Tina Bloom, a 6<sup>th</sup> grade teacher at Douglas, middle and junior high school teachers identified two important areas of competency for incoming students: (1) computational efficiency and (2) having math facts down pat.

In fact, "Computational Efficiency" was the title of the May 2003 paper the Collisons published at the Concord Consortium. According to the Collisons, "Computational efficiency and number sense take prominent space in the NCTM (National Council of Teachers of Mathematics) standards and link directly to many items in current state and national examinations. Traditional approaches to these topics commonly employed drill, either written or verbal. Manipulative games like dominoes offer a much needed and efficient alternative."

Acton PIP co-chairs Karen Herther and Lorrie Jacobsohn hope that the successful Domino Math Pilot will spur other community and school family domino math events! Special thanks to the Collisons for sharing the family domino math games with PIP and to PIP veterans Janice Ward and Mark Buxbaum for creating PIP domino game sheets (all games are available on the Acton PIP Web site). See the sidebar for a primer on domino basics. For more information about PIP community math and science events or to be added to the e-mail loop, please visit the PIP website at [douglas.ab.mec.edu/pip](http://douglas.ab.mec.edu/pip) or e-mail us at [actonpip@yahoo.com](mailto:actonpip@yahoo.com).

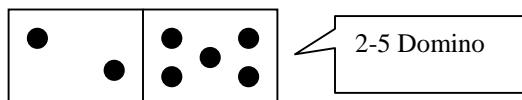
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### Domino Basics

A domino game includes a set of tiles called dominoes. Dominoes are small, flat, rectangular-shaped game pieces made of plastic or wood. In the past, dominoes have been made of ivory, stone, or bone. Hence, the name “boneyard.”

Like playing cards, a set of domino pieces is called a *deck*. Each domino in the deck has a back and a front called a *face*. The back is blank and a line in the middle divides the face. On each side of the divide, you’ll see dots or spots called *pips*. The absence of spots represents zero.



Like dice, you count the dots on a domino. So a domino with 2 pips on one half and 5 pips on the other is called a 2-5 domino. A domino with a different number of pips on each side is called a *combination*. Dominoes with the same number of pips on each half are called *doubles*.

The most common domino sets are the double-6, double-9, double-12, and double-15 sets. They are named after the domino with the highest number of pips. For Domino Math games, Dr. Collison recommends sets of double-9s or double-12s for advanced domino game play.

Every set of dominoes includes all possible combinations of two numbers, from zero (blank) to the highest number of pips in the set (for example, 12 in a double-12 set). Each combination of pips occurs only once in a set. A standard double-6 domino set consists of 28 tiles, 7 doubles and 21 singles. In a double-6 set, each number appears eight times, once each on six tiles and twice on the double tile.

Domino sets are sold at most major toy and department stores. High quality but inexpensive sets are available at Building 19-1/2, Marshalls, and ToysRUs.