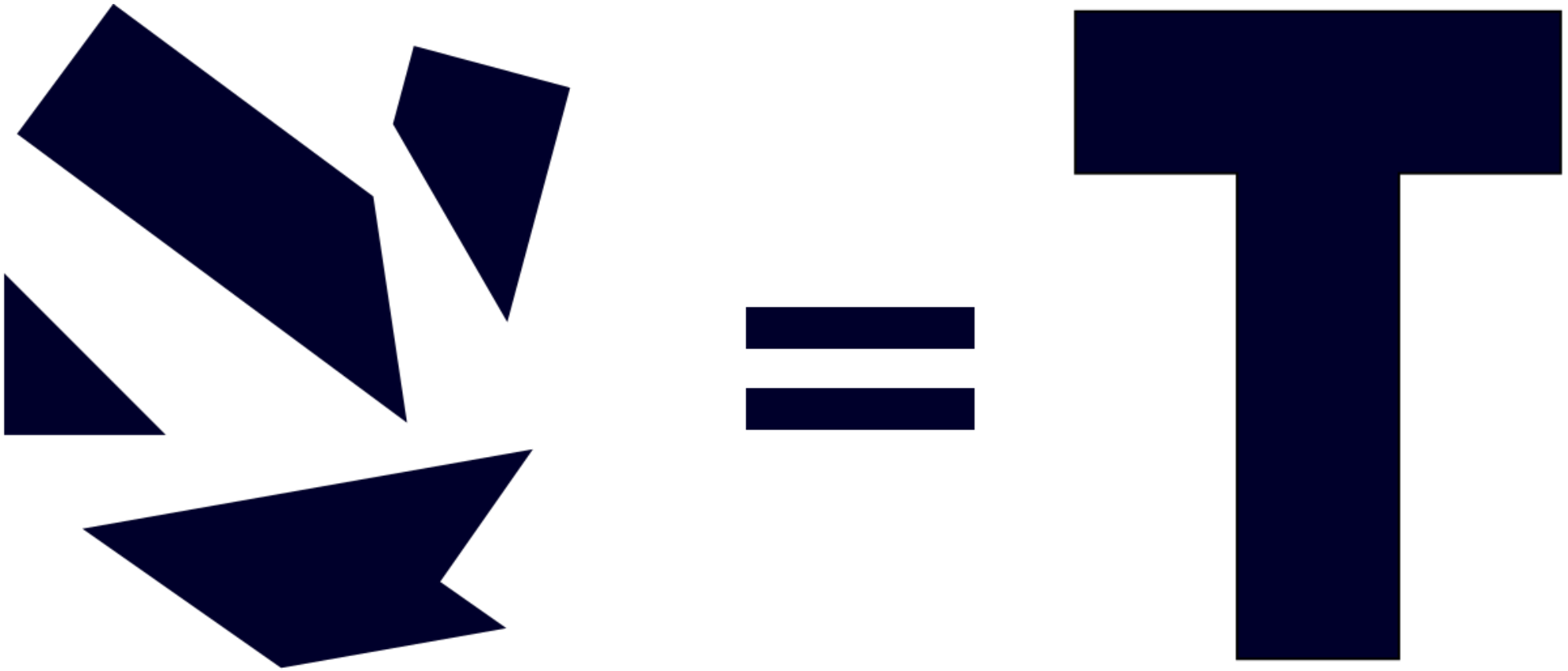
EXPLORING THE T-SHAPED PUZZLE

Marika Fowler and Aries Wu

Created by Marika Fowler and Tianxingjian (Aries) Wu for MATH 3P41 at Brock University in collaboration with the Niagara Catholic DSB under the Math Knowledge Network. Coordinated by Laura Cronshaw and Dr. Chantal Buteau. August 2018.

THE T-SHAPED PUZZLE



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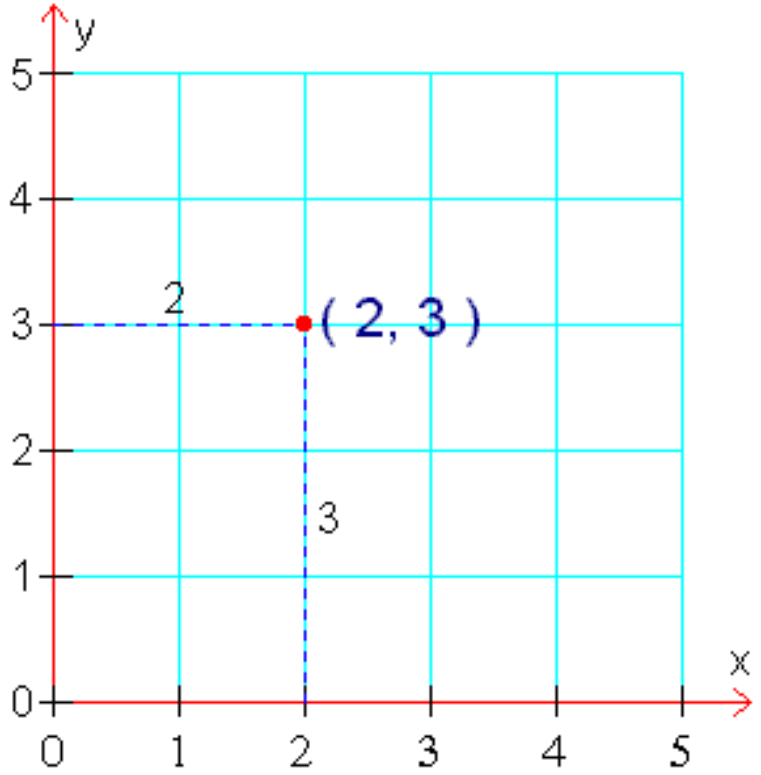
WORKING WITH COORDINATES

- A coordinate pair is written as (x, y)
- The first coordinate "x" reads how far you move across the x-axis
- The second coordinate "y" reads how far you move up/down the y-axis
- The pair represents a point within the Cartesian plane
- The example to the left represents the point (2,3) in the positive quadrant of the Cartesian plane



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WORKING WITH THE CNC MACHINE

- The CNC machine plasma cuts objects starting from the origin (0,0) and measures in imperial units
- We will need to determine the coordinates that the CNC machine will use to create the T-shaped puzzle
- The coordinates can be determined by measuring the to scale diagrams that will be provided
- However, the CNC machine needs the coordinate to be in decimal form, so we need to convert from imperial units to decimal form!

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THE CNC CODE

- The CNC code has several components that we will need to know before coding

- N tells us the line number of the code

- Z tells us when the machine is cutting
  - If Z is positive – the machines not cutting (z0.200)
  - If Z is negative - the machine is cutting (z-0.100)

- G1 tells us that the machine is undergoing a movement in the Cartesian plane
  - The movement code starts with the x-coordinate and then the y-coordinate

  Lets check out a code!

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THE CNC CODE – MAKING A SQUARE

N200G00X0.0000Y0.0000Z0.2000	-no movement in plane, the laser is lifted
N210G1X0.0000Y0.0000Z-0.1000F30.0	-laser moves to (0,0), the laser is put down
N220G1X0.0000Y4.0000Z-0.1000F100.0	-laser moves to (0,4), the laser is still down
N230G1X4.0000Y4.0000Z-0.1000	-laser moves to (4,4), the laser is still down
N240G1X4.0000Y0.0000Z-0.1000	-laser moves to (4,0), the laser is still down
N250G1X0.0000Y0.0000Z-0.1000	-laser moves to (0,0), the laser is still down
N260G00X0.0000Y0.0000Z0.2000	-no movement in plane, the laser is lifted

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GROUP ACTIVITY

- In groups of four, you and your group members will be determining the code that will be used by the CNC machine to cut the T-shaped puzzle

- Each group member will be responsible for 1 puzzle piece

- Once you have determined the coordinates, you and your group members can complete the missing code

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PUZZLE PIECE – THE MISSING CODE

```
N200G  X      Y      Z
N210G  X      Y      Z      F30.0
N220G  X      Y      Z      F100.0
N230G  X      Y      Z
N240G  X      Y      Z
N250G  X      Y      Z
N260G  X      Y      Z
```

YOU AND YOUR GROUP MEMBERS WILL BE FILLING IN THE MISSING BLANKS!

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NOW THAT WE CREATED A SMALL T-SHAPED PUZZLE...

- With a ratio, we can create a bigger t-shaped puzzle!
- By multiplying each length of the puzzle pieces by the same factor we can cut bigger puzzle pieces

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HOW COMPLEX CAN THE CNC CODE GET?

- Now that we looked at creating basic shapes with the CNC code, lets check out a more complex CNC creation

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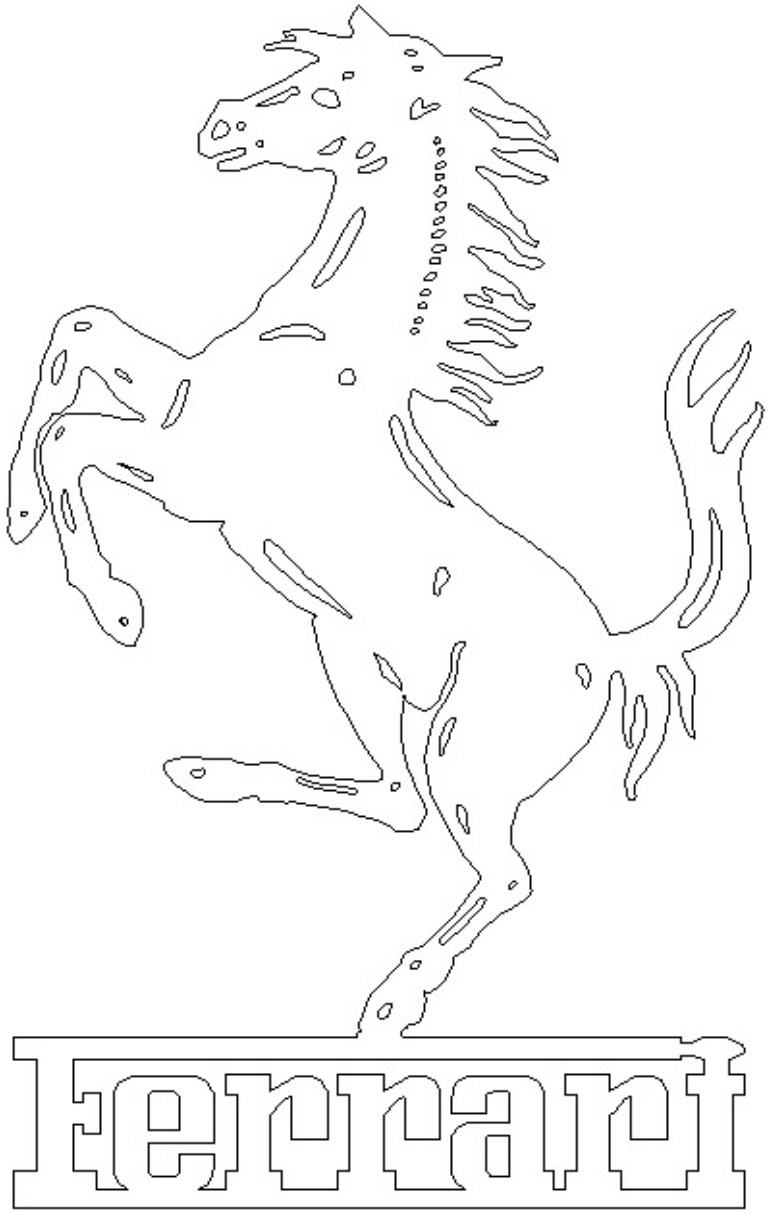
LOOK AT HOW COMPLEX THE DESIGN CAN GET!

DO YOU THINK THE CODE WILL BE JUST AS COMPLEX?



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