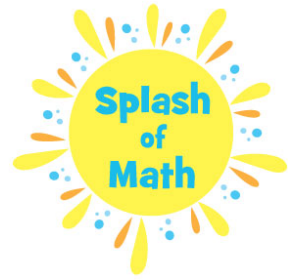


Ninjas on the Run

Grades 3-5



The Big Idea

Today you're going to be secret agents training to track down ninjas. Learn how to tiptoe sneakily through the shapes made by a maze of laser beams. Then see how many secret handshakes you can share with your fellow agents!

Supplies

In your kit:

- ★ Masking tape
- ★ Ribbon: 1 spool

You provide:

- ★ Crayons: 1 per kid
- ★ Scissors: 1 pair
- ★ Scrap paper: 3 sheets
- ★ Sturdy chairs and/or tables: 8-10

Key Prep

- ★ You'll need 1 crayon per kid. Try to get multiple colors so each kid in a group of 4-6 kids has a different color crayon.

Room Set-up

- ★ Clear an 8-foot-by-10-foot space in the middle of the room. Place 8-10 chairs and tables in 2 parallel rows along the sides of the open space.

What's the Math?

- ★ Geometric shapes
- ★ Math facts: addition, multiplication
- ★ Patterns and series

Kickoff

"Ninjas were agents for hire who lived hundreds of years ago in Japan. They would climb buildings, swing through trees, and sneak through small spaces, all in total silence. Let's train to be just as stealthy and agile so we can track these agents!"

Build the Laser Maze (10-15 minutes)

"Do you know how motion sensors work? One type shoots a laser beam that sets off an alarm when an object crosses its path. We're going to build a maze of laser beams out of ribbon, then use geometry to sneak through it without setting off the alarm!"

1. Tie the ribbon around 1 chair leg about 6 inches above the floor.
2. Hand the spool to a volunteer, who walks it across the aisle to a chair in the other row and wraps it around a leg.
3. Kids take turns wrapping the ribbon around chair legs, staying 6 inches above the floor. Encourage them to run new lines that divide existing shapes.
4. Use masking tape to keep the ribbon from sliding down the chair legs. Once you're finished assembling the maze, snip the end of the ribbon so it doesn't get tangled.
5. Once you have about 10-12 lines stretching across, ask the kids:
 - ? "Which chair leg has the most lines coming to it?" **Discuss.**
 - ? "Which new shape has the most sides?" **Discuss.**



Extra Challenge (optional)

- ? "If every chair leg on the left was connected to every chair leg on the right, how many ribbon lines would we have?" **Discuss.** See if the kids figure out that they need to multiply the number of legs on the left x number of legs on the right; for example, 4 legs x 6 legs = 24 lines!

Laser Maze Stealth Training (15-20 minutes)

"Now let's start the game! Each ninja must cross the maze without touching the laser beams."

1. Have everyone line up to take turns crossing the maze. With each turn, give the ninjas a challenge for crossing the maze. For example:
 - ★ Step in as few shapes as possible.
 - ★ Step in triangles only, quadrilaterals only (4-sided shapes), pentagons only (5-sided shapes), etc.
 - ★ Step in shapes that don't touch any shape you've already stepped in.
 - ★ Make up your own challenges and see who makes it through!



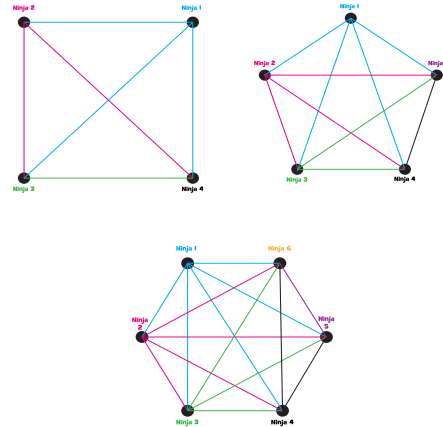
Extra Challenge (optional)

- ? "When a triangle and quadrilateral are side by side sharing one edge, how many small segments of ribbon do they use in total?" **Discuss.** See if the kids figure out that normally the triangle would use 3 and the quadrilateral would use 4 for a total of 7 sides, but since the 2 shapes are sharing a side, only 6 sections of ribbon are needed.
- ★ Pick sets of 3-4 adjacent shapes, predict how many segments they should have based on shared sides, then count to see if your guesses are right!

Secret Handshakes (15-20 minutes)

"Ninjas used secret handshakes to identify each other. That's a lot of handshakes for all of us. Let's see how many times we'll shake hands with each other only once!"

1. Divide the kids into 3 groups of 4, 5 or 6. It's okay to have different numbers in each group.
2. Give each group 1 sheet of paper.
3. Give each kid 1 crayon. Try to give a different color to each kid in the same group.
4. Each kid draws a large dot on the edge of the group's paper then writes his/her name or initials next to the dot.
5. Each group makes up its own "secret" handshake.
6. In each group, the first ninja shakes hands with every other ninja in the group. That ninja draws a line from his/her dot to all the other dots on the paper.
7. The second ninja shakes hands with any ninjas in the group with whom he/she hasn't already shaken hands. That ninja draws lines from his/her dot to those ninjas.
8. The third ninja shakes hands with any other ninjas left in the group and draw lines to those dots.
9. Continue until all ninjas in the group have shaken hands only once.
10. Groups count their total number of handshakes by counting the lines on their sheet.



- ? "How many handshakes did your group have?" **Discuss.** Groups of 4 have 6, groups of 5 have 10, and groups of 6 have 15.
- ? "Do you see a pattern?" **Discuss.** Wait to see if the kids figure out that within each group, we add all the numbers that are less than the number of ninjas. For example, 5 ninjas added $4+3+2+1$, and 6 ninjas added $5+4+3+2+1$.
- ? "How many handshakes would a group of 7 have?" **Discuss.** Answer: 21

Extra Challenge (optional)

- ? "How many handshakes would 10 ninjas share?" **Discuss.** Answer:
 $9+8+7+6+5+4+3+2+1=45$

Wrap Up

"When you learn about shapes in math class, it's called geometry. Think of all the shapes you maneuvered through today and patterns you identified when you made your handshake maps!!"