MIND Research Institute
A neuroscience and education social benefit organization

GAME DESIGNER MANUAL

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Game Designer Letter

Dear Game Designers,

I am so happy that you have decided to create a math game for the MIND Research Institute's K-12 Game-a-thon Challenge. You have been working so hard all year to develop your math skills and the Game-a-thon gives you a great way to show off your problem-solving skills in a fun way. Remember to be creative as you design a game that focuses on mathematics. Think about everything you already know about games and conduct research to find out more information. Consider how strategy, logic, uniqueness, problem-solving opportunities, fun and creativity can be included in your design. You can invent card games, board games, apps, outdoor games or anything else that addresses a math concept. You can even adapt an existing game and turn it into a math game.

Here's what you need to do to get started:

- Complete Task #0 (two sessions)
- Complete Game-a-thon Intro
- Form a team
- Pick a team name
- Complete the entry form provided by your teacher and get a teacher to sign off

You are now ready for Task #1!

As a game designer, you will complete tasks and mini-challenges to help you develop your game. These tasks and mini-challenges will take you through the strategies in designing a game - including the steps of the engineering design process.
Good luck Game Designers!

I am excited to see your games!

— JiJi

TASK #0 (Session 1)

Play/Explore

When creating a new game it is important for game designers to experience playing a variety of games. As you play the games with your peers, start thinking about what you are learning, how the game makes you think, what strategies seem to help more than others, and so forth. You will use this experience in later tasks.

Your teacher will provide these two games for you to play.

TRAFFIC LIGHTS

TARUMBETA

Share your thoughts about the game(s) you played. What did you like and not like?

TASK #0 (Session 2)

Play/Explore

When creating a new game it is important for game designers to experience playing a variety of games. As you play the games with your peers, start thinking about what you are learning, how the game makes you think, what strategies seem to help more than others, and so forth. You will use this experience in later tasks.

Your teacher will provide these two games for you to play.

ACHI

DARA

Share your thoughts about the game(s) you played. What did you like and not like?

MINI-CHALLENGE #0

Due Date: _____

Compare the 4 games that you played in Task #0.

TRAFFIC LIGHTS
TARUMBETA
ACHI
DARA

Which was your favorite? Why?

How did the rules make the players use skill and/or strategy? Give examples.

How was mathematics involved in each of these games?

Think about ways other than computation that your game can include mathematics.

TASK #1
Ask

Game Designers, your first strategy is to define the problem and begin to think about math games in general. *The first step in the Engineering Design Process is: ASK*

What are you asked to do?

What is a game versus an activity?

What is the value in playing math games?

MINI-CHALLENGE #1

Due Date: _____

Good game designers think about their personal experiences with games to better understand the kind of game(s) they like and dislike. However, you don't want your past experiences to hinder your creativity. Instead, you want to use your past experiences as a foundation to make better games.

Think about games you have played.

What games do you like? Why?

What games do you not like? Why?

TASK #2
Investigate

Game Designers, your next strategy is to uncover the characteristics of a good game. Identify the circumstances/constraints around creating a math game. *The second step in the Engineering Design Process is: INVESTIGATE*

Based on Mini-Challenge #1, what do you think...

- **makes a good game?**

- **makes a good math game?**

What styles of games can you make?

MINI-CHALLENGE #2

Due Date: _____

Good game designers use information they gather from researching what has been done in the past to help them think through their game design.

Find 5 different math games. List them below. Include a brief description.

What are some things you like/dislike about the games you listed? Explain your reasoning.

Based on what you learned in Task #2, identify which characteristics of good math games are present in one or more of the games listed above? Which characteristics of good math games are missing (if any)? Explain your reasoning.

TASK #3
Imagine

Game Designers, your third strategy is to look at all the research and use it to help brainstorm game ideas. Begin to imagine what type of game you would like to create. *The third step in the Engineering Design Process is: IMAGINE*

Think about all the games you've explored up until now. What information will you take from your knowledge of these games to help you brainstorm your own game ideas?

What style of game are you interested in?

What math concept(s) will you incorporate into your game? Why?

How might you combine some of your game styles and math ideas to help people who struggle with the math concept(s)?

MINI-CHALLENGE #3

Due Date: _____

Good game designers look at all of their ideas and then come up with a solution. They imagine what their game will look like, how their audience will interact with the games, and much more. In creating a math game, it is important to think about how your audience will explore the math, problem solve and demonstrate their understanding.

Based on how you think you can help people interact with the math, share your game ideas with the rest of your team. Examine each other's ideas with fairness and utilize all the knowledge you've gained thus far to provide informative feedback to your team members.

Discuss with your team, and together, decide on which game idea your team would like to explore.

The name of our math game is_____.

We chose this game because

TASK #4
Plan

Game Designers, your fourth strategy is to begin planning how you will create your game. Think about the materials you will need and how you will include the characteristics of good games. *The fourth step in the Engineering Design Process is: PLAN*

Task #4 is intended to be discussed as a team.

As a team, think back to the characteristics of a good math game. How will your game incorporate these characteristics?

In what ways will game players explore the math concepts in the game?

What are the key math components that your game needs in order for it to be helpful for the game players?

MINI-CHALLENGE #4

Due Date: _____

Good game designers develop a plan before building a game. They use creativity and the information they gathered to write a “blueprint” for their game. This gives them the opportunity to see what the game will look like.

Mini-Challenge #4 is intended to be discussed as a team.

GAME BLUEPRINT

Target Audience	**Number of Players**

Game type (circle one):

board game **card game** **digital /APP** **other:** _____

What materials/tools might you need to build the game?
Continue to add/remove materials as you create your plan.

Game Goal: What does a player have to do to win? Is there a strategy involved in winning?

Learning Goal(s): By playing the game, what can a player expect to be experiencing and learning?

What math concepts are involved?

Game Mechanics: How does the player interact with the game?

Game Rules and Challenges: What are things a player can and cannot do in the game? What obstacles are in place to make the game more challenging and interesting?

NOTE: You will probably continue to adjust these rules until you have the final game. They may not be the final set of rules that govevrn your team's game at this point, and that is OK.

GAME SKETCH

In the space below, sketch your team's game.

GAME RULES BONUS CHALLENGE

Learning about Rules

All games have rules. They are an important part of playing the games. They help determine who may win the game.

What are some other reasons rules are important?

Below are some games that you might know. Write other games you think of that are not listed.

Memory	I SPY
Connect Four	UNO
Tic Tac Toe	Jenga
Checkers	Chutes and Ladders

Select one of these games and write down what the rules are for the game you choose.

Game we choose is _____

The rules of this game are:

GAME RULES BONUS CHALLENGE CONT.

Rewriting the Rules

Thinking about the rules that other games have can help prepare you to develop your own rules for your game.

Think of the game you selected. Write 2 new game-changing rules for this game.

1.

2.

Play the Game with the New Rules

Describe what it was like playing the game with the new rules. How did it change the game?

What worked?

What didn't work?

What did you like about the game that you didn't like before?

What did you not like about the game with these new rules?

How can this activity help you when creating your own rules?

What are some things that you have learned are important when determining rules for you game?

TASK #5
Create

Game Designers, your fifth strategy is to use the plan to create/construct your game. This first version of your game is what game designers call a prototype. After building your game you will test it out to see how it works. *The fifth step in the Engineering Design Process is: CREATE*

Task #5 is intended to be discussed as a team.

All members of the team will need to work together to create the game. In the space below identify the jobs that need to be done to create this game. Assign each team member to a role and include a due date and the materials needed.

Job	Team Member	Materials Needed	Due Date

GAME RULES

Every good game has clear rules. In the space below, formalize the rules for your game.

GAME RULES CONT.

MINI-CHALLENGE #5

Due Date: _____

Good game designers analyze their game as honestly as they can. Be sure to continually rethink aspects of your game and play it as often as you can, especially during development.

INITIAL REFLECTION

Analyze your team's game by answering the following questions.

1. What makes my game challenging and interesting?

2. What strategies do I need to use to win?

3. Can my rules by simplified? If so, how?

4. As I play my game, how is the length? Does it end too quickly? Does it take it too long? How might I shorten or extend the gameplay?

5. Where do I think players might get stuck in my game?

6. Do I think players have all the tools they need to play the game?

7. Did I learn/practice the math concept in the way we intended when we created this game?

8. Where did I find opportunities for problem solving?

TASK #6

Game Designers, your sixth strategy is to use your self-reflection on your game to make improvements.

Discuss your answers to Mini-Challenge #5, with your team.

What quick improvements should we make to our game before testing it with others?

What specific things do I want to learn from my game testers? (Write your questions here.)

MINI-CHALLENGE #6

Due Date: _____

Good game designers test their prototype and gather feedback. Have a group of people play your game and test it out. Provide them with the feedback form to share their experiences playing the game. Watch the gameplay and respond to the following questions based on what you observe.

PROTOTYPE TESTING

1. Do the game players find this game challenging and interesting?

2. What strategies are the players/teams using to win?

3. Were the directions clearly understood by the players?

4. How did the players interact with the game? Was it the way that you expected?

5. Was the math concept too easy? Too hard?

6. Did the players learn/practice the math concept in the way you intended?

7. In what ways did you observe opportunities for problem solving?

8. Include your own questions here from Task #6.

GAME TESTER FEEDBACK FORM

Game name:

Learning Outcomes:
What did you learn from this game?

Understanding of Rules:
How clear were the rules?

It was rough  I got it

Fun:
How fun was the game to play?

Boring  Awesome

Difficulty Level:
Would you like this game to be ...

☐ Less Challenging ☐ As is ☐ More Challenging

What did you like most about the game?

What did you like least about the game?

What suggestions do you have for the game?

TASK #7
Reflect

Game Designers, your seventh strategy is to use the feedback from testing your game to make additional improvements. It is important to always have a mindset for continual improvement when designing games.

As a team, look at all the feedback that you have collected. Summarize what you have learned.

What did I observe that surprised me or challenged me to think differently about our game design?

MINI-CHALLENGE #7

Due Date: _____

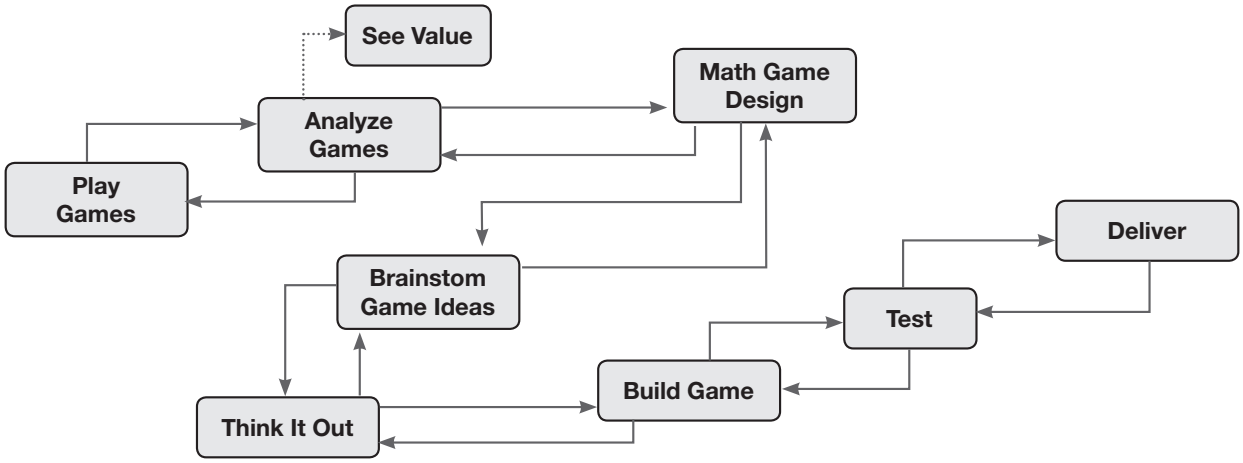
Good game designers make improvements to their games until they arrive at a final product.
The sixth step in the Engineering Design Process is: IMPROVE

As a team, determine any additional changes you will make to your game, and make those changes.

Based on the feedback, additional improvements we will make to my game will be...

Understanding the Game Design Process

The Game Designer Manual is specifically constructed and organized for students to navigate the cycles of effective game design. It is rare in any creative endeavor to advance to the next step of a process without revisiting prior steps. This is highlighted in the cyclical nature of the diagram below.



What is the Game Design Process?

The process above is a proprietary flow diagram created by MIND's game design experts to bring to life the critical aspects in designing a math game. The flow of the Game Designer Manual is devised to match each of the 7 main phases on the diagram: play games, analyze games, math game design, brainstorm game ideas, think it out, build game, and test.

Play Games
Get a feel for different games prior to making your own

Analyze Games
Understand what games are and see the value in playing math games

Math Game Design
Explore key characteristics of what makes good math games

Brainstorm Game Ideas
Incorporate your knowledge of and experience with games to brainstorm your math game ideas

Think It Out
Narrow down your math game ideas into a single game and think carefully about the components of the game

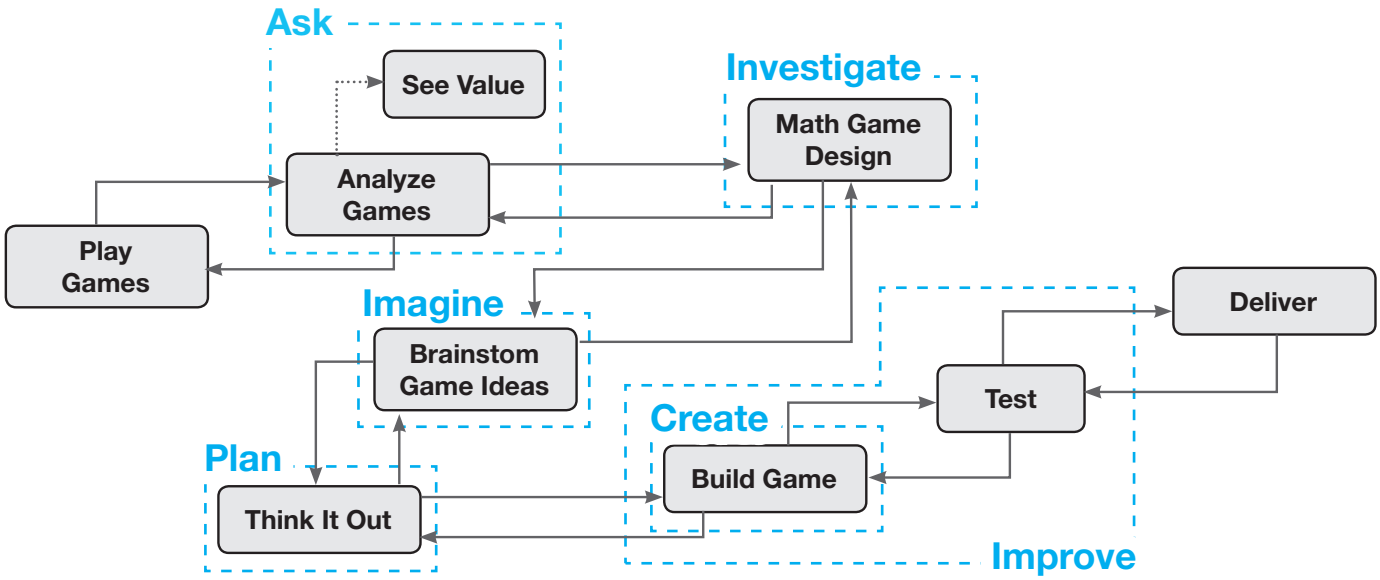
Build a Game
Execute your game idea and make improvements as you go

Test
Pilot your game with others and continuously improve until the desired game is obtained

Deliver
Enter your game into the National K-12 Game-a-thon Challenge

MIND's Game Design Process is distinct from the Engineering Design Process, but aligns well with the Engineering Design Process which is described on the next page.

Understanding Game Design
with the Engineering Design Process



What is the Engineering Design Process?

The Engineering Design Process is a series of steps used to guide engineers through different design challenges, and can easily be adapted by students participating in the Game-a-thon Challenge. Modified from the *Museum of Science Boston* "Engineering Is Elementary" program, this is a cyclical process as students may need to repeat one or more phases to produce the final version of their game, similar to MIND's Game Design Process.

Ask
Define a problem or need

Investigate
Research what has been done and identify the circumstances/constraints around the problem

Imagine
Brainstorm potential ways to solve the problem; choose a solution

Plan
Plan how the solution will be carried out/created; determine materials; draw a diagram/picture

Create
Use the plan to construct the solution/model/prototype; test it out

Improve
Evaluate the product and make improvements

K-12 Game-a-thon
Entry Form

School _____

Teacher _____ Grade Level _____

Team Name _____

Team Mentor _____

Student Names

_____

_____

_____

_____

_____

_____

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Important Notes To Enter the National K-12 Game-a-thon:
(Keep for your information)

1. For information on the Game-a-thon challenge visit:
   http://www.mindresearch.org/gameathon/#participate
2. Complete the Game Designer Manual to help you think through your game design.
3. Create your game video presentation and complete the Video Permission Form.
4. Upload your video to YouTube with the help of your team mentor.
5. Complete the submission form by visiting http://mindresearch.org/gameathon/submission to enter your game into the National K - 12 Game-a-thon Challenge for a chance to win.

Graphic Organizers

Tools to help stimulate conversation and organize student thinking

Game Brainstorming Sheet

The purpose of this sheet is to help you collect the ideas you have for your game as you complete Tasks #0, #1 and #2.

Ideas from Task #0

Ways to make my game challenging:

Ideas from Task #1

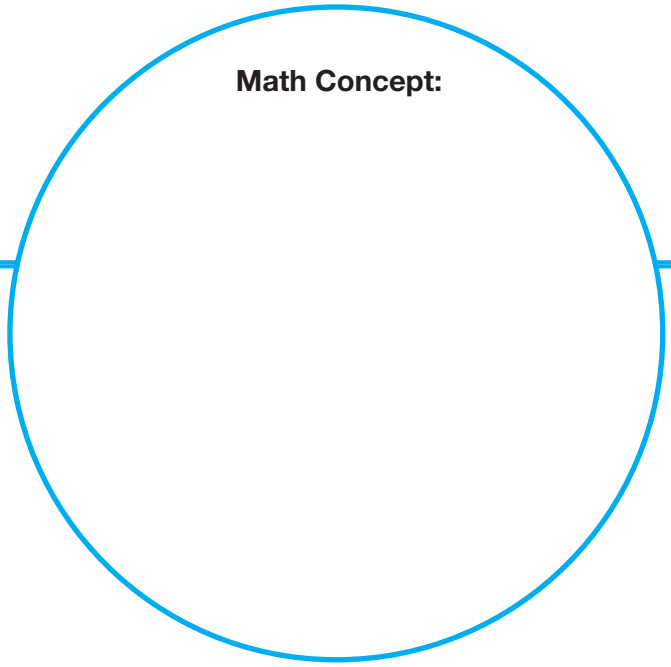
Reasons why someone would want to play my game:

Ideas from Task #2

Things I like in games that I might want to include in my game:

Math Concept Web

How have you used/experienced this concept? Give examples.



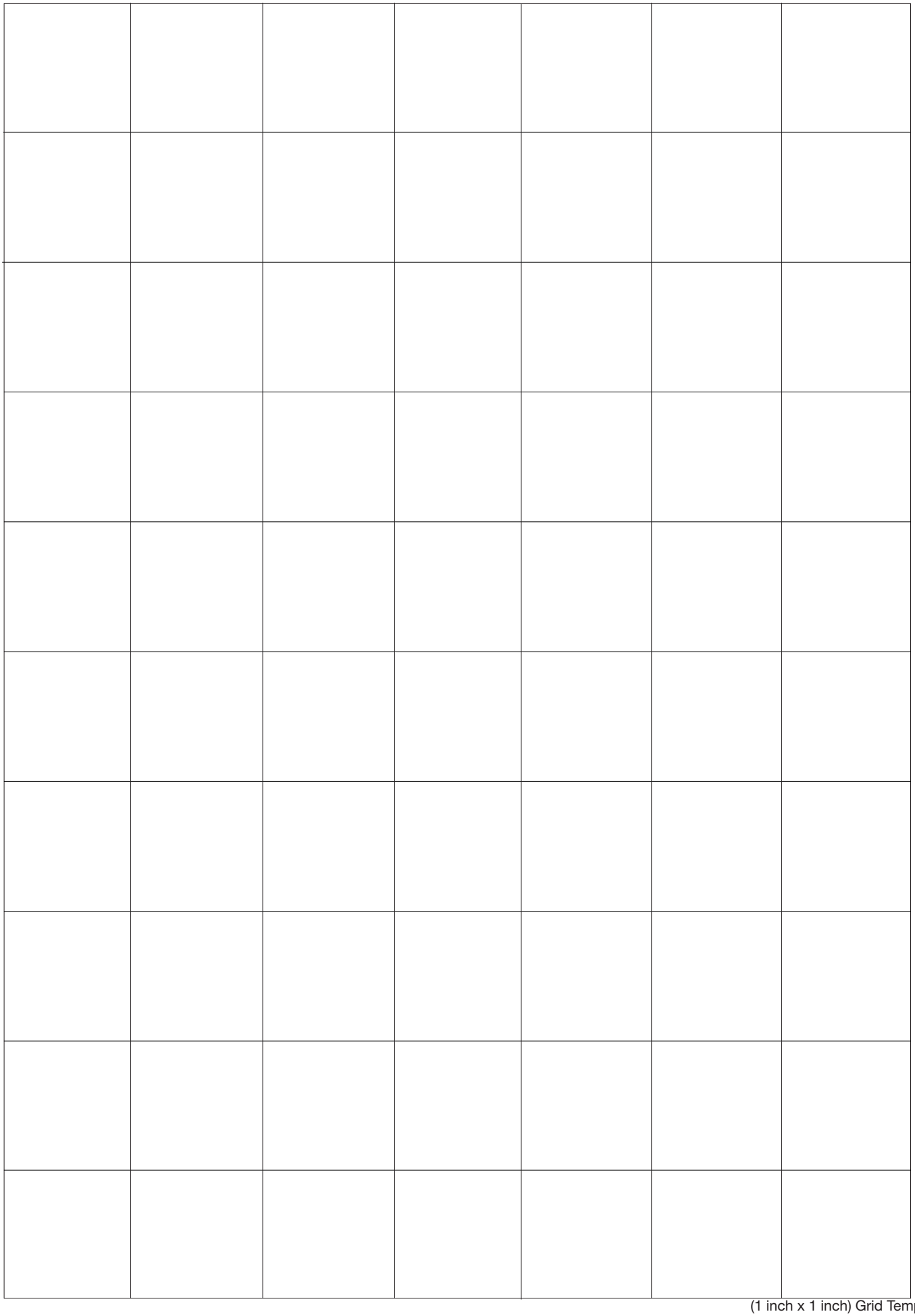
Visualize the concept.

Math Concept Web

What are some common misconceptions about the concept?	Why do you think the misconceptions are happening?

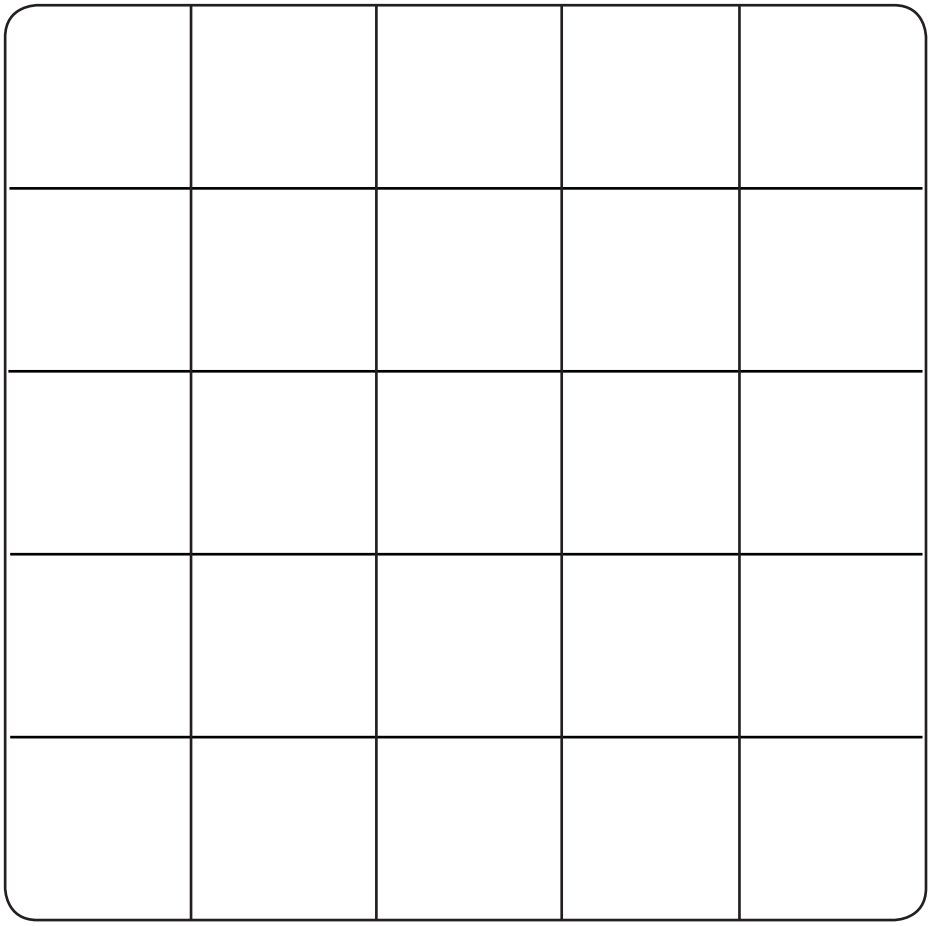
How would you create a game to address the math concept?

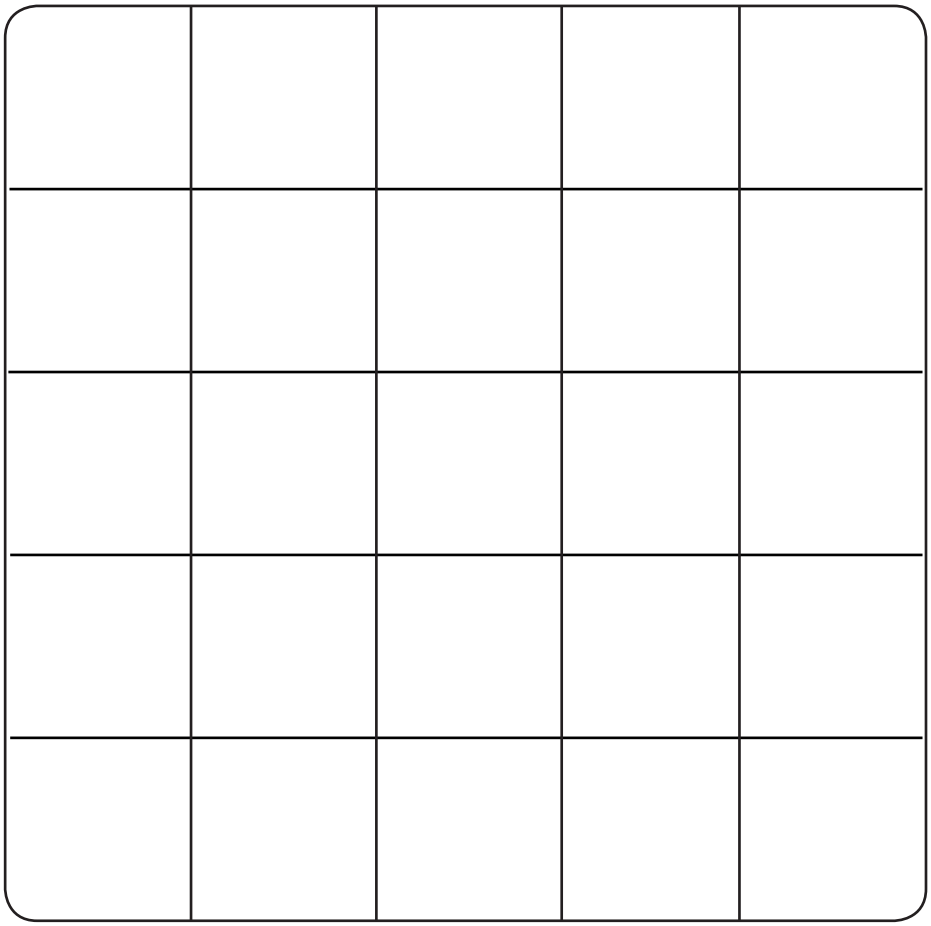
Printable Templates



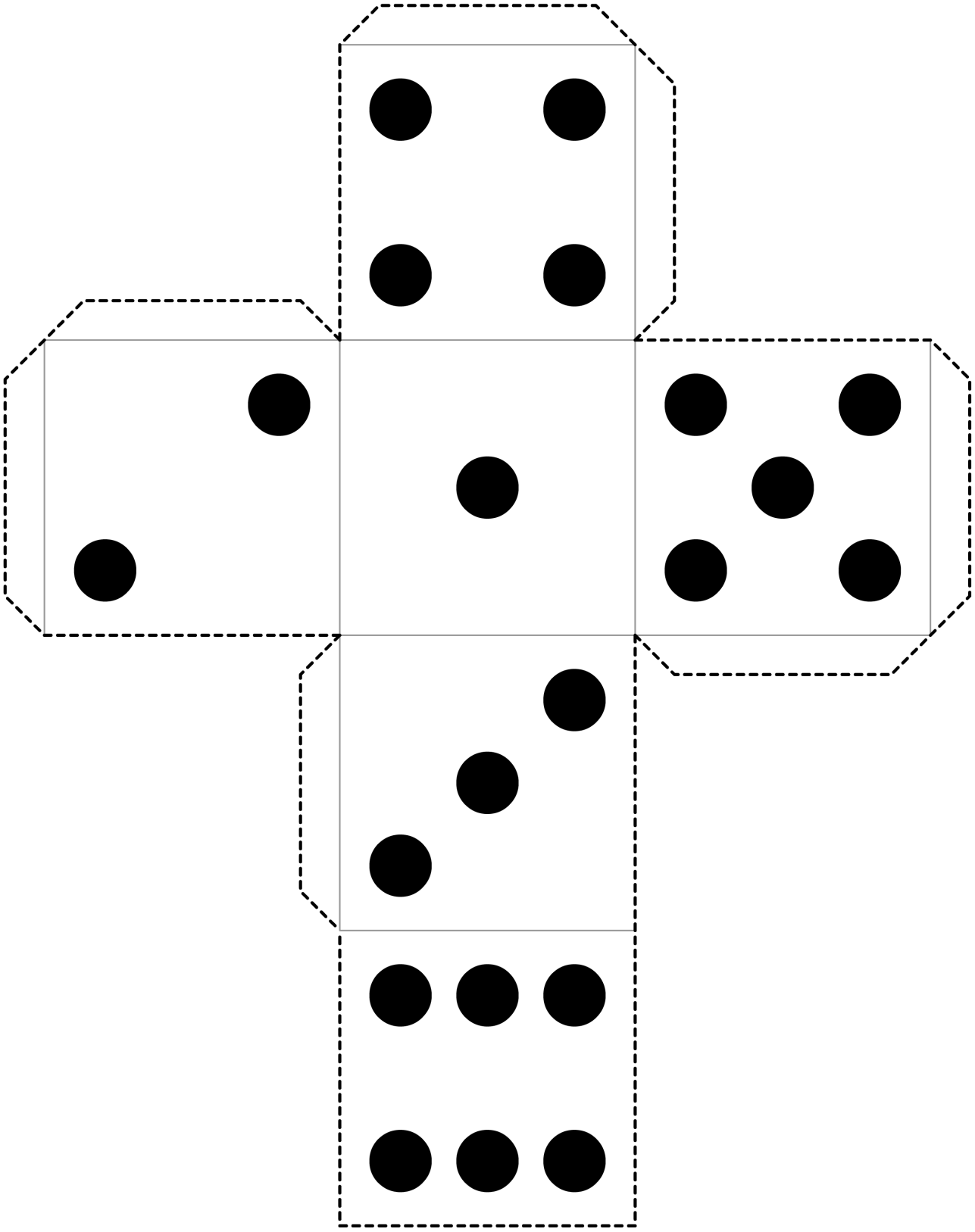
(1 inch x 1 inch) Grid Template

(0.5 inch x 0.5 inch) Grid Template

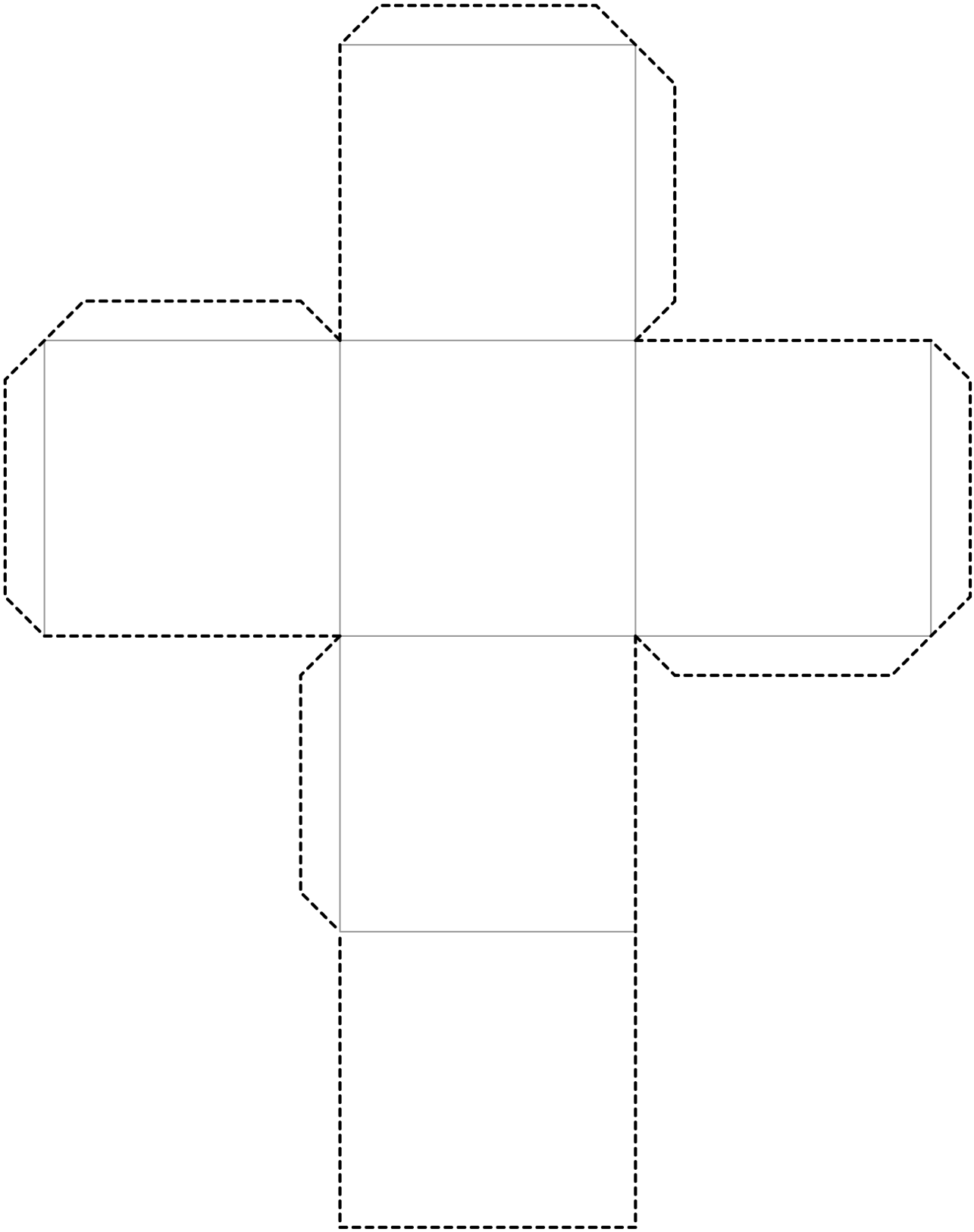




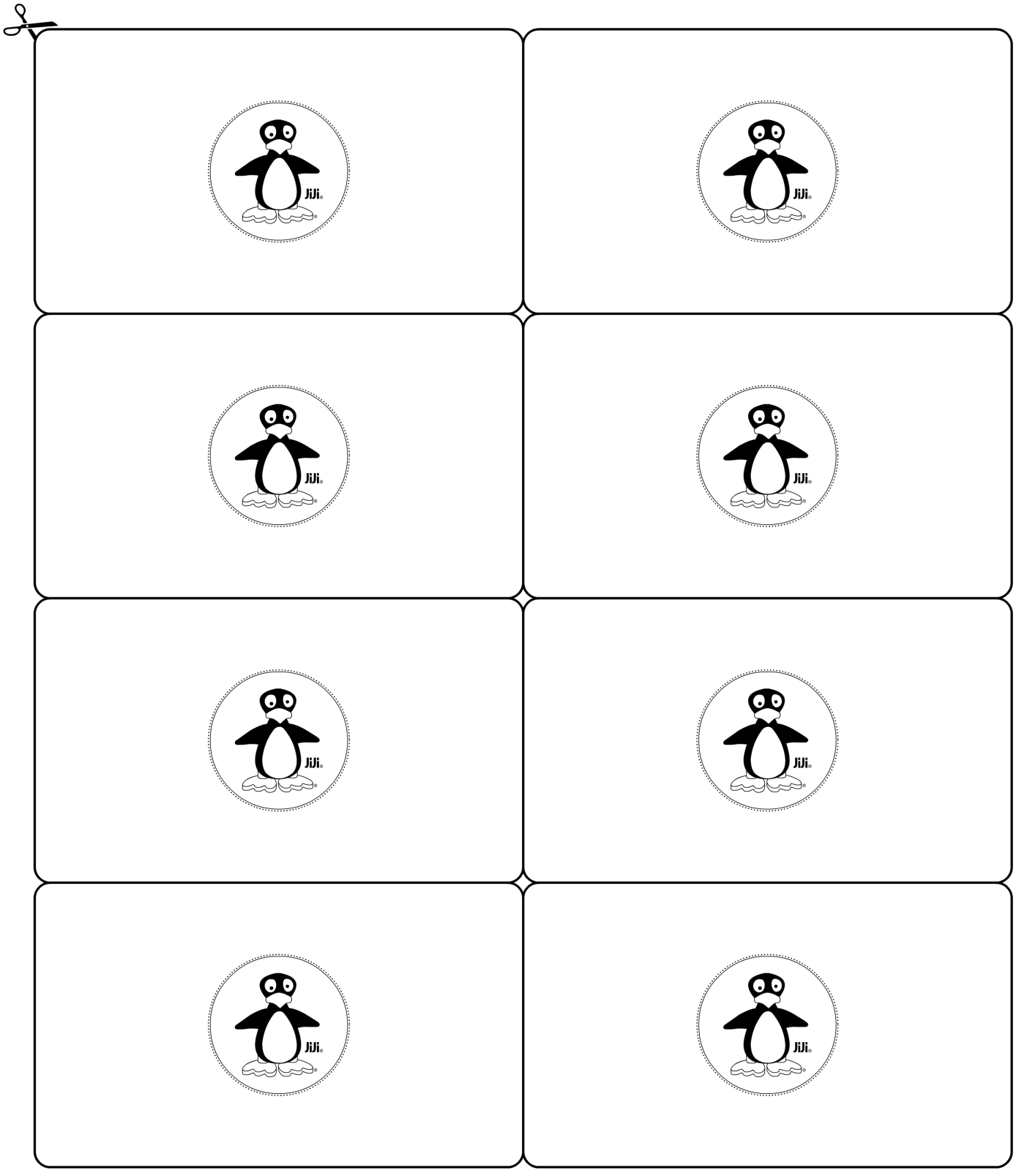
5 x 5 Grid Template



Die Template



Blank Die Net Template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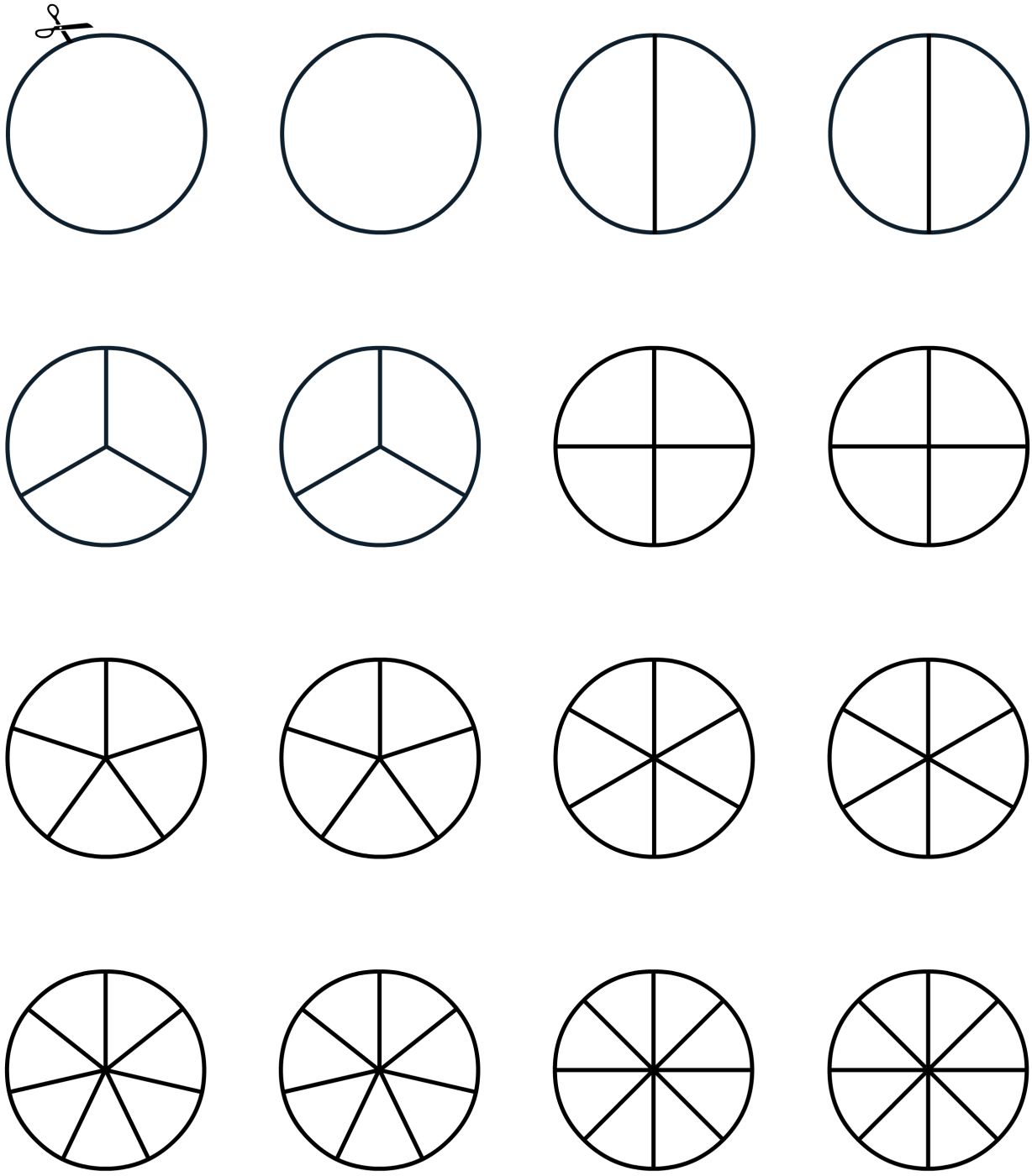
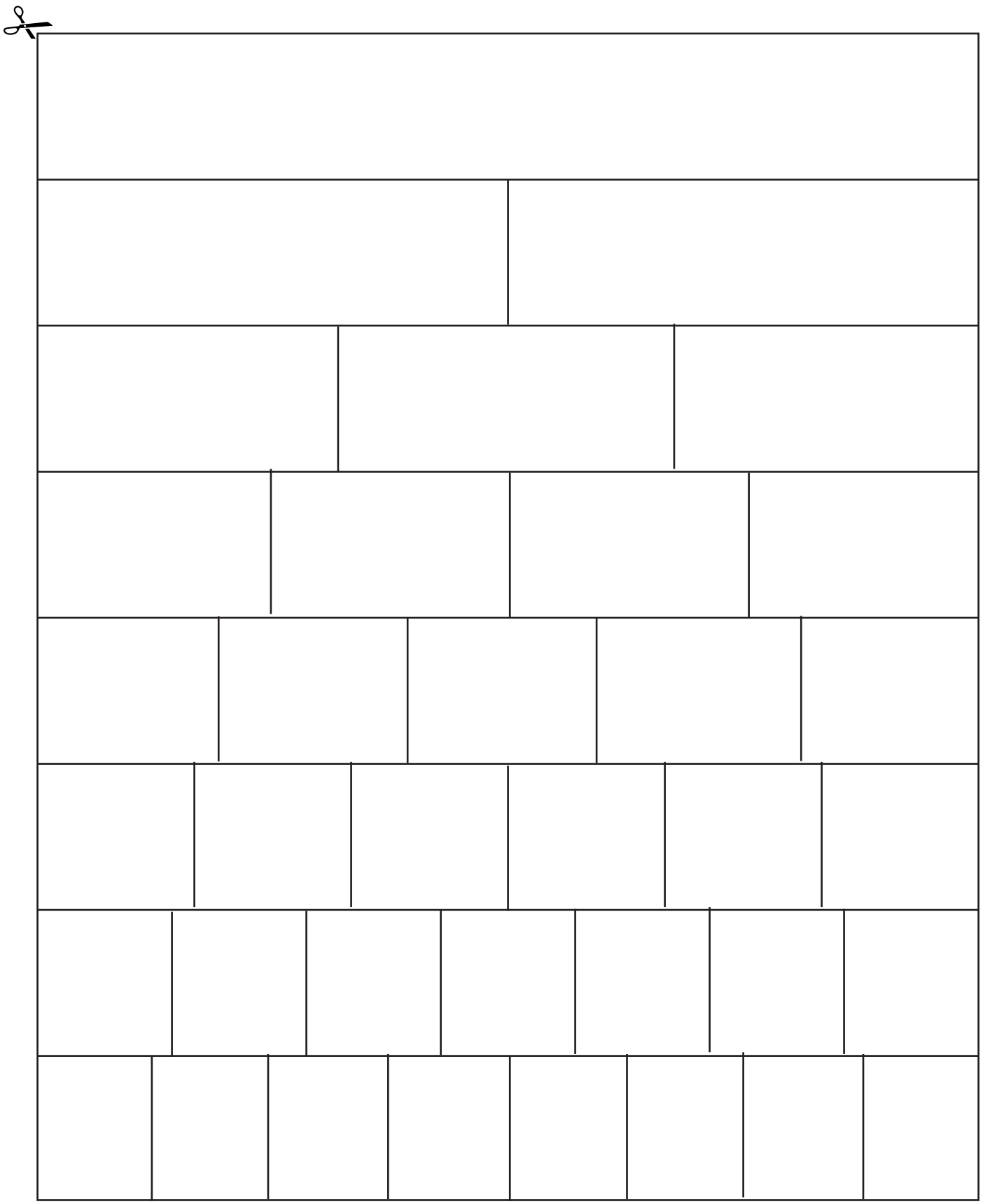
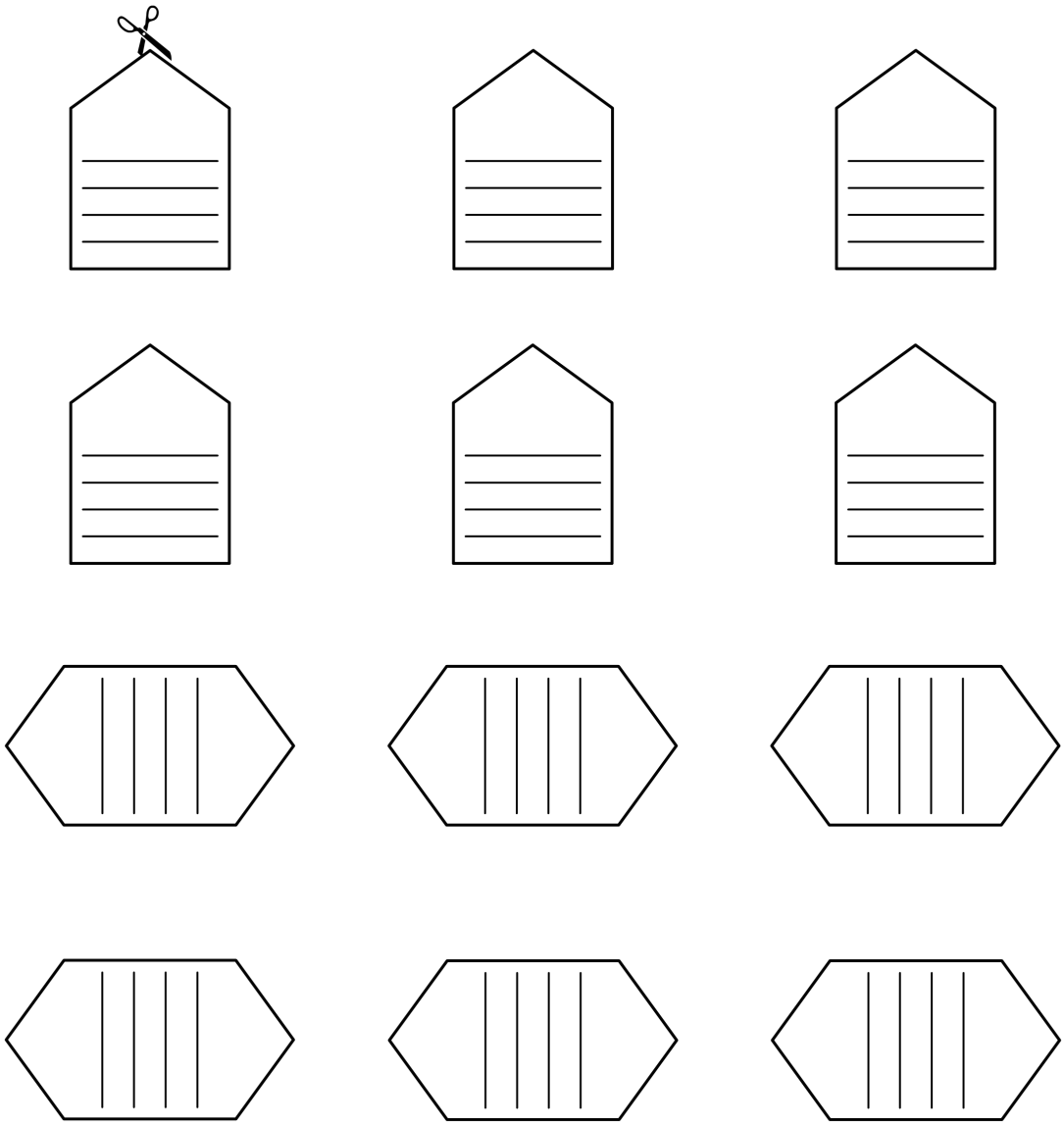
Blank Playing Card Template

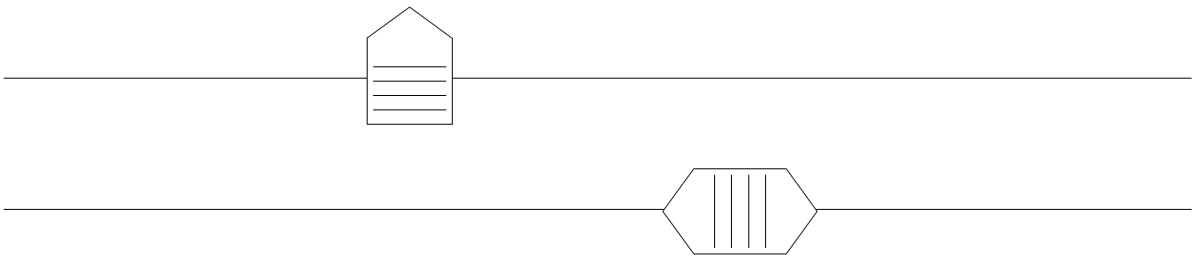


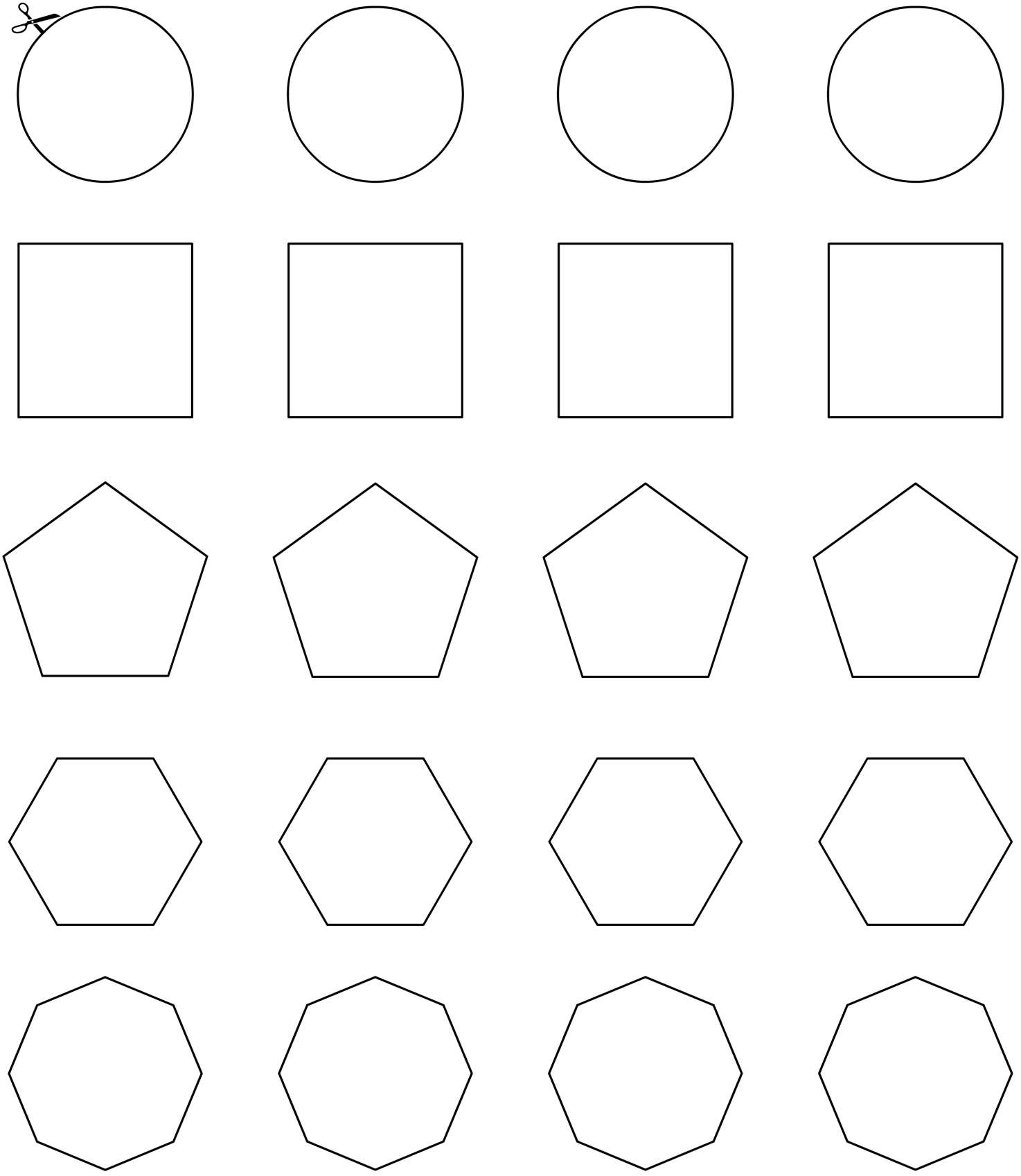
Fraction Pie Template





Examples:





Shapes Template