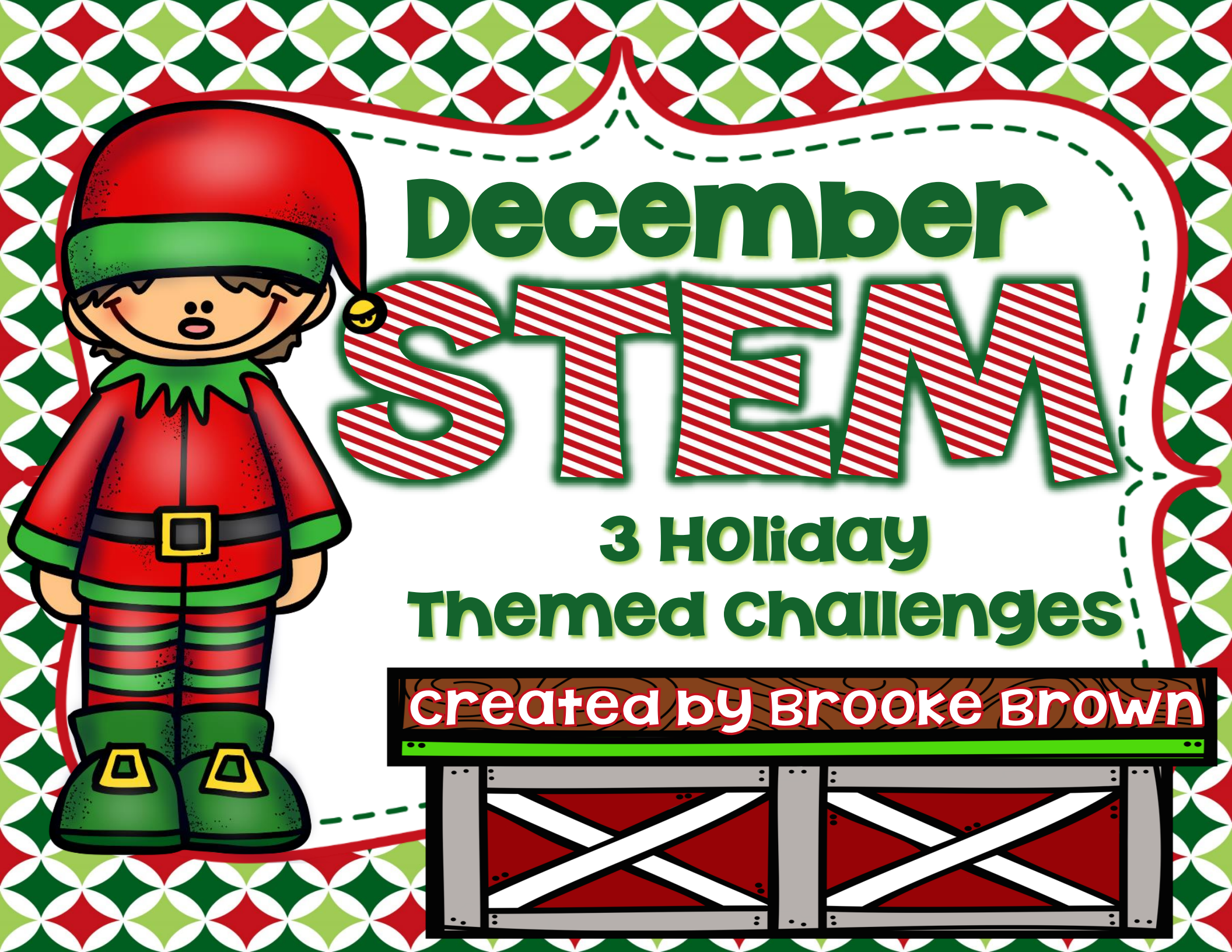

December
STEM
3 Holiday
Themed Challenges
Created by Brooke Brown

contents

The following STEM challenges are designed to be completed with partners or in small groups. You might choose to do activities on separate days or in the form of STEM stations that rotate, however, you will need to allow 45-60 minutes for each activity to be completed. Needed supplies are inexpensive can be found at most craft stores. I hope you and your students love them!

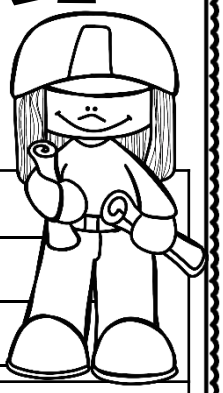
Created by Brooke Brown

Alignment to NGSS: December STEM

Challenge	Engineering	Science	Math
Santa's Parachute	K-2-ETSI Engineering Design: K-2-ETSI-1, 3-5 ETSI-2, 3-5 ETSI-3 3-5-ETSI Engineering Design: 3-5-ETSI-1, 3-5 ETSI-2, 3-5 ETSI-3	K-PS2 Motion and Stability: Forces and interactions 3-PS2 Motion and Stability: Forces and Interactions 5-PS2 Motion and Stability: Forces and Interactions	MP1: Make sense of problems and persevere in solving them MP.2: Reason abstractly and quantitatively MP.4: Model with mathematics MP.5: Use appropriate tools strategically
Tree Tower	K-2-ETSI Engineering Design: K-2-ETSI-1, 3-5 ETSI-2, 3-5 ETSI-3 3-5-ETSI Engineering Design: 3-5-ETSI-1, 3-5 ETSI-2, 3-5 ETSI-3	*Action/Reaction forces, tension and compression forces, weight, balance, stability	MP1: Make sense of problems and persevere in solving them MP.2: Reason abstractly and quantitatively MP.4: Model with mathematics MP.5: Use appropriate tools strategically
Shelf for the Elf	K-2-ETSI Engineering Design: K-2-ETSI-1, 3-5 ETSI-2, 3-5 ETSI-3 3-5-ETSI Engineering Design: 3-5-ETSI-1, 3-5 ETSI-2, 3-5 ETSI-3	*Action/Reaction forces, tension and compression forces, weight, balance, stability	MP1: Make sense of problems and persevere in solving them MP.2: Reason abstractly and quantitatively MP.4: Model with mathematics MP.5: Use appropriate tools strategically

STEM in a SNAP

Lesson Plan for any STEM Challenge



Challenge: _____

Date/Time: _____

Grade Level(s): _____

STANDARDS & CONCEPTS	S	T
	E	M
SHARE (Teacher Guided, whole class)	• Share the challenge, objectives, rules, and time limit. • Ask students to identify the problem and purpose for the challenge. • Share permitted materials and review safety expectations. • Brainstorm tips and tricks for how materials might work and fit together. • Have students model how to use materials appropriately.	
SPARK (Teacher Guided, whole class)	• Trigger background knowledge by asking students to share what they already know about the structure. • Display or project real world Google images or video clips of the structure. • Discuss similarities and differences between the structures. • Discuss what might be important about specific parts of the structures.	
IMAGINE (Student-driven, partners or groups)	• Students discuss design ideas with partners or groups. • Students plan and sketch initial blueprints on notebook paper or dry erase boards, then label possible parts.	
CREATE TEST IMPROVE (Student-driven, partners or groups)	• Students build and create with materials, test designs and functions, and improve models. • Students record test results, final blueprints, and reflective questions. • Teacher guides, prompts, questions, and models as necessary.	
REFLECT (Teacher Guided, whole class)	• Students share and discuss creations with the class. • Students share successes and struggles that they experienced. • Teacher and students refer back to STEM processes and skills utilized during challenge.	

Teacher Tips

Santa's Parachute: Students will choose from a variety of materials to construct a working parachute with attached basket. They will discover that parachute designs with the least amount of air resistance, or drag, will drop the slowest. The hole punchers may be used to punch holes around the bottom perimeter of the parachute (tissue paper, coffee filter, or napkin) to allow for strings to be attached more easily. Students may choose to use the Dixie cup as Santa's basket or construct their own basket out of an index card. The Santa cutout should fit inside the basket. Pennies may also be used to adjust the weight and balance of the basket. Encourage students to explore and test designs as much as possible, with their goal to help Santa to land as safely (upright) and slowly as possible. You might also choose to have students time their drops with a timer for each test to determine the slowest fall. **DISCUSSION QUESTIONS: What are parachutes used for and how might they be useful? What is gravity and how does it affect your parachute and basket? Which materials were most effective for your parachute? What factors affected your parachute's drop? (friction/drag or air resistance) What factors do not affect your parachute's drop? (mass and weight) What are some features of real parachutes that are important for them to function effectively?**

Shelf for the Elf: The shelf is best constructed in phases, with playdough used at the joints to connect sticks together. Students build one level for a shelf, "sit" the elf on top, and measure the height. Then, they may attempt to add a second level, add the elf on top, and measure the height. It is possible to build three levels, however, most students will build 1-2 levels in a variety of styles. Smaller popsicle sticks work best, and most groups will require 1-2 cans of Play Dough. **DISCUSSION QUESTIONS: How is your shelf similar to and different from the shelves in our classroom? How is your shelf designed to make it as sturdy and balanced as possible? What horizontal and vertical lines are used in your shelf design? What are some different styles of shelves and how are they useful? What materials would you use to build real shelves?**

Tallest Tree: Students work together to stack cups and construct the tallest tree possible. Allow creativity, as some groups may choose to build linear "pyramid style" trees while others might choose to build circular-based or triangular-based trees. Cups can also be flipped and stacked on both ends. Optional ornament cutouts are provided for students to tape to the cups and "decorate" their trees. Students may use measuring tape or yardsticks to measure the height of their tree designs. **DISCUSSION QUESTIONS: How does the design of your tree affect its balance and stability? How are buildings designed using these same concepts? What three-dimensional shapes are represented in your tree tower?**

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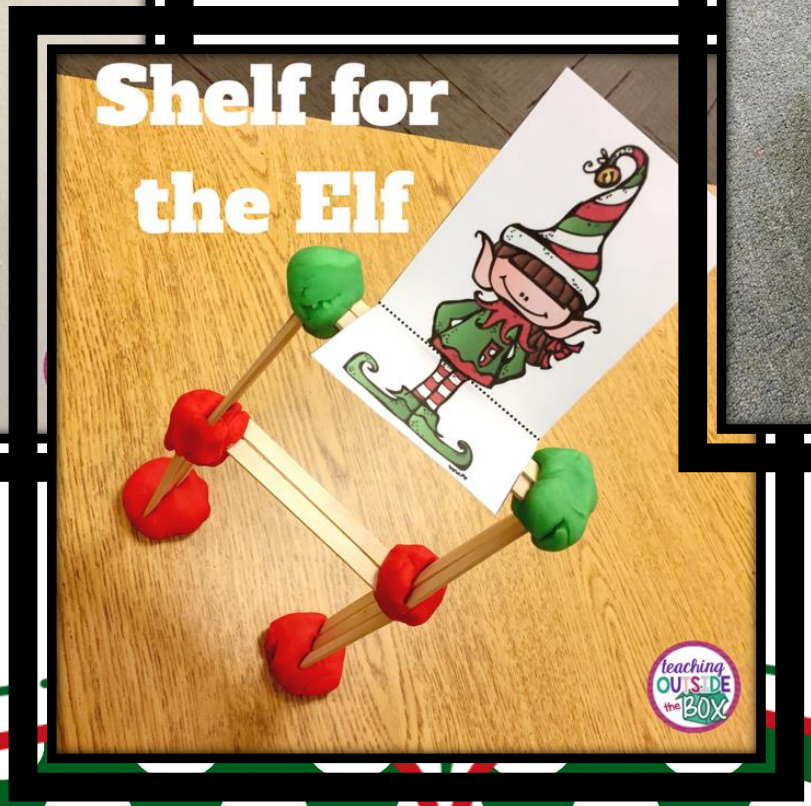
Possible Finished Projects



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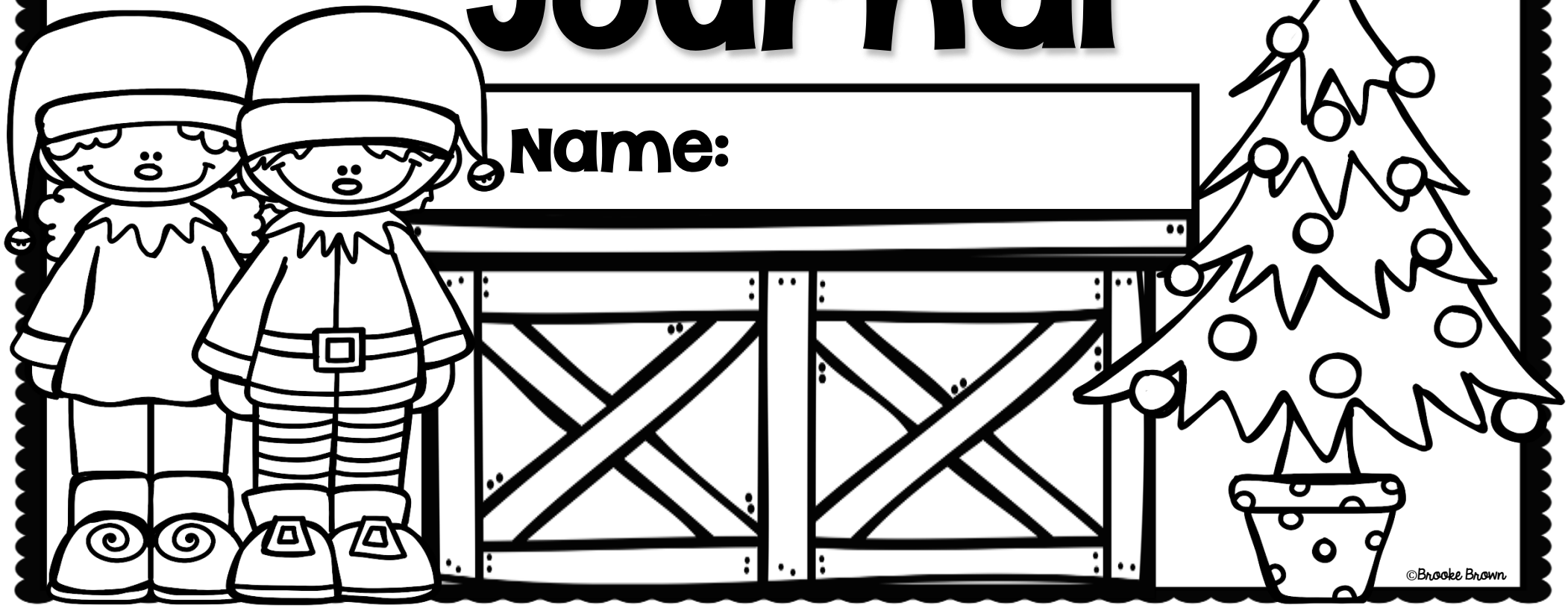
DECEMBER

STEM Challenge Supplies

Challenge	Item	Number PER GROUP	I Have It
Santa's Parachute	coffee filters and/or thin plastic tablecloth cut into squares	1-2	
	string, yarn, or fishing line	2-3 yards	
	Scotch tape OR hole punchers	1 roll or 1 hole puncher	
	Dixie cups and/or index cards	2 cups or 3-4 index cards	
	pennies	5	
	Santa cutouts	1	
Shelf for the Elf	playdough	1-2 containers	
	popsicle sticks	20-24	
	elf cutouts	1	
	rulers	1	
Tallest Tree	large plastic green cups	24-30	
	yardsticks	1	
	ornament cutouts with scotch tape (OPTIONAL)	1 set/1 roll	

My December STEM Journal

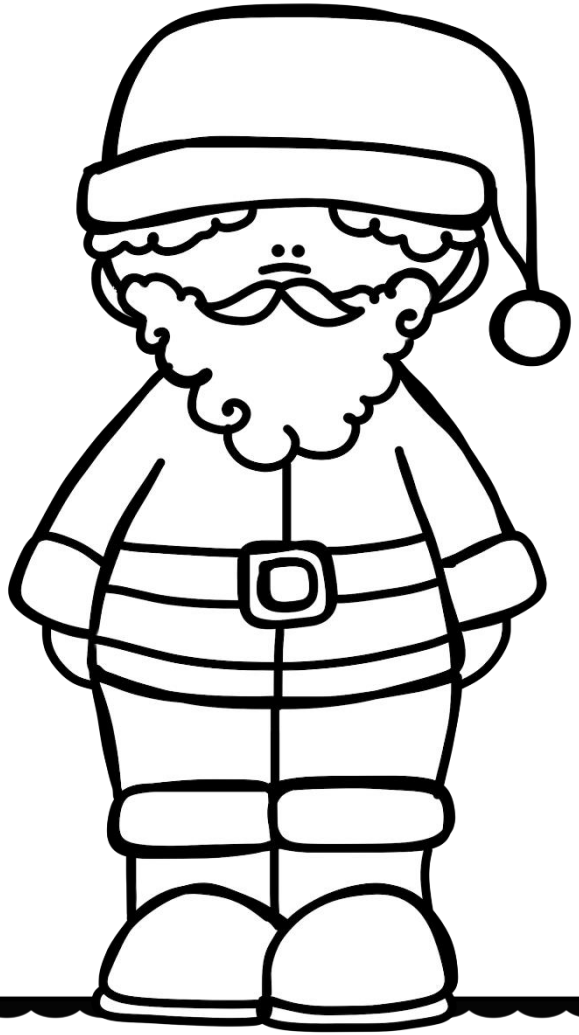
Name:



Santa's parachute

Santa's sleigh broke down!

Construct a parachute with basket that will help him land safely and gently on the ground.

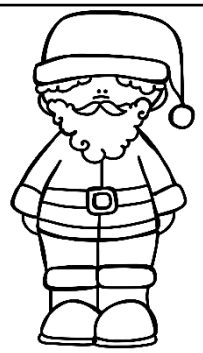


Materials:

* Coffee filters, plastic table cloths cut into 1 ft. x 1 ft. squares, napkins, tissue paper
  (allows for different testing materials)
* Yarn or fishing line
* Single hole punchers (one per group)
* Scotch tape
* Dixie cups, index cards (choices for basket materials)
* Santa cutouts printed on cardstock
* Pennies (for adjusting weight/balance of basket)
* Stopwatches/timers (optional for timing drops)

Santa's Parachute

Vocabulary Cards

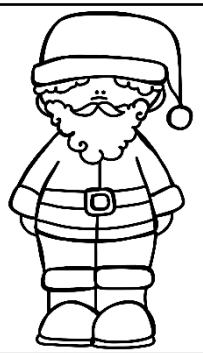


gravity

force of attraction of objects to the center of the Earth

drag

force on an object in the air that reduces forward motion

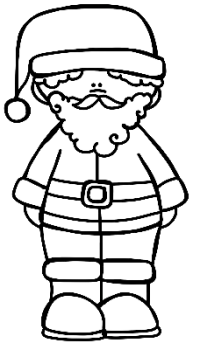


mass

the amount of matter in an object

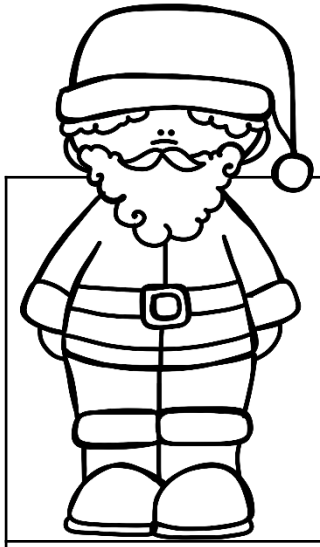
friction

surface resistance to motion



Name:_____

Santa's Parachute



Can you construct a parachute with basket that will help Santa land safely and upright on the ground?

Materials:

Tests:

TEST	Did Santa land upright?	Time (seconds)
1		
2		
3		

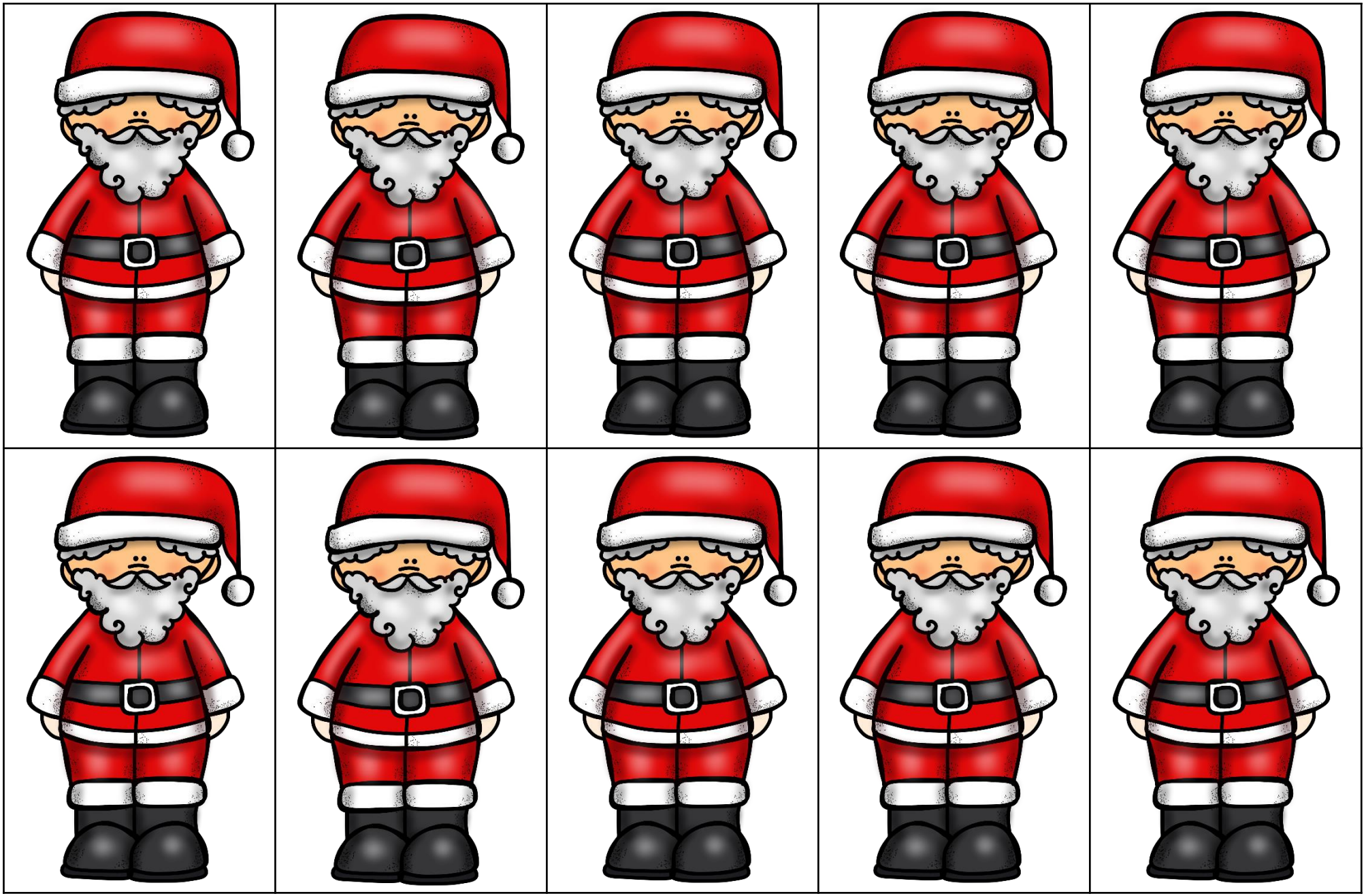
Blueprint:

Which part of your design worked well and WHY?

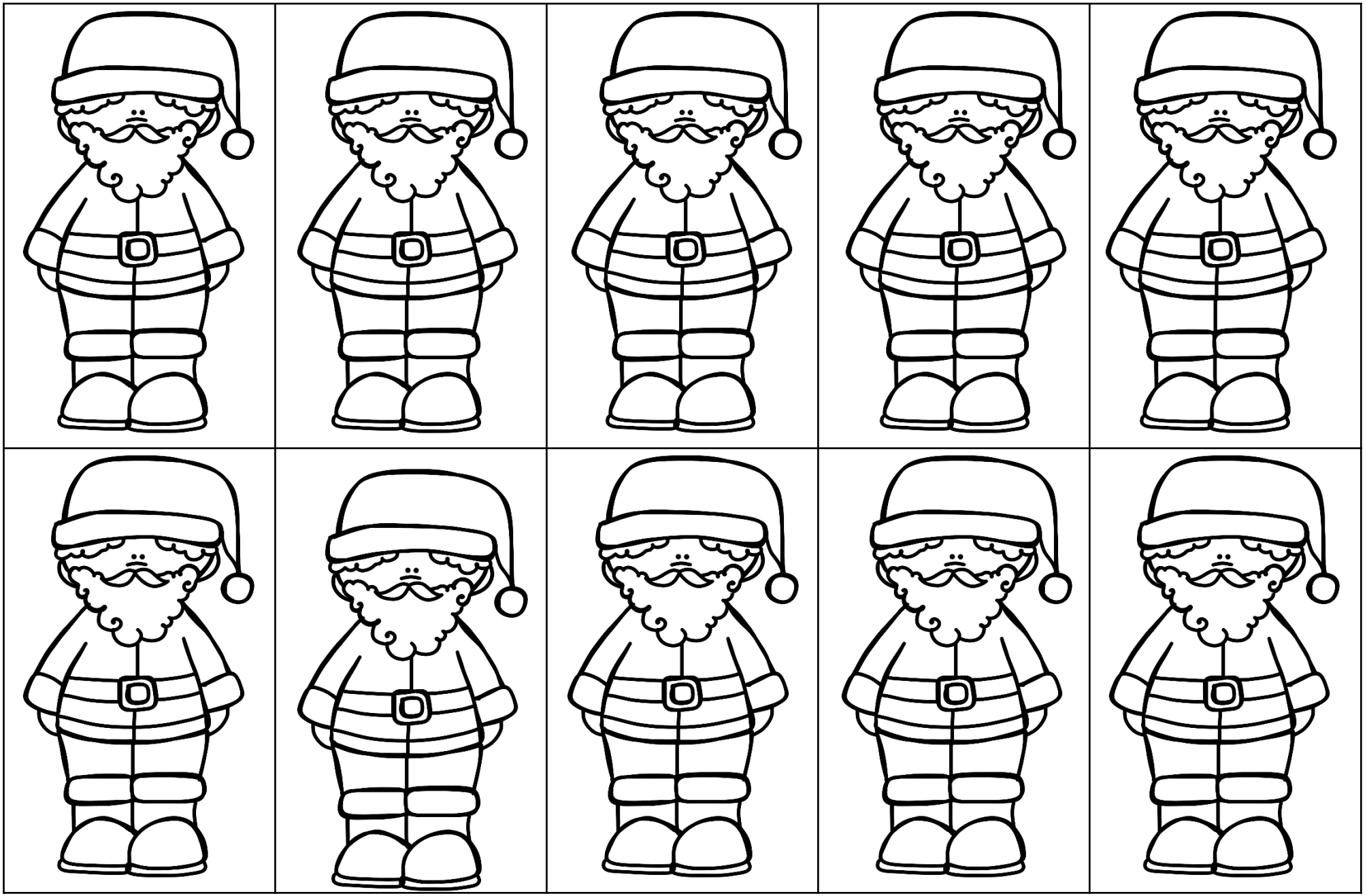
Which part of your design did not work well and WHY?

How did you IMPROVE your design?

Santa's Parachute Challenge



Santa's Parachute Challenge



Shelf for the Elf

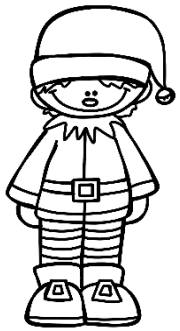
The elf needs a safe and high place to sit that cannot be reached by children. Construct the tallest shelf possible that will hold the elf.

Materials:

* Playdough (2 cans per group)
* Popsicle sticks
* Elf cutouts printed on cardstock and each folded into a "sitting" position.
* Rulers

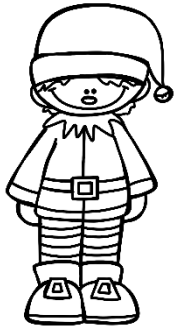
Shelf for the Elf

Vocabulary Cards



horizontal

being in a side to side direction, parallel to the ground

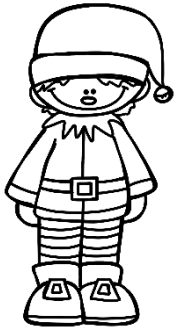


vertical

being in an up and down direction, perpendicular to the ground

joint

a place at which two things are joined

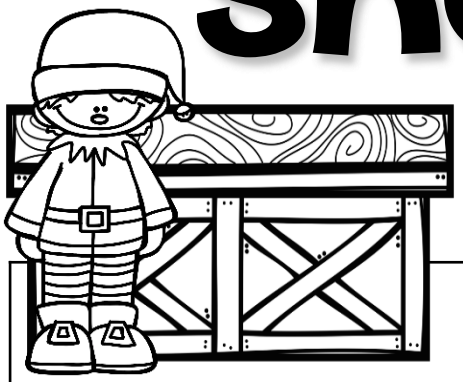


balance

equal distribution of weight

Name:_____

Shelf for the Elf



Can you construct the tallest possible shelf that will hold the elf?

Materials:

Tests:

TEST	Height in Centimeters
1	
2	
3	

Blueprint:

Which part of your design worked well and WHY?

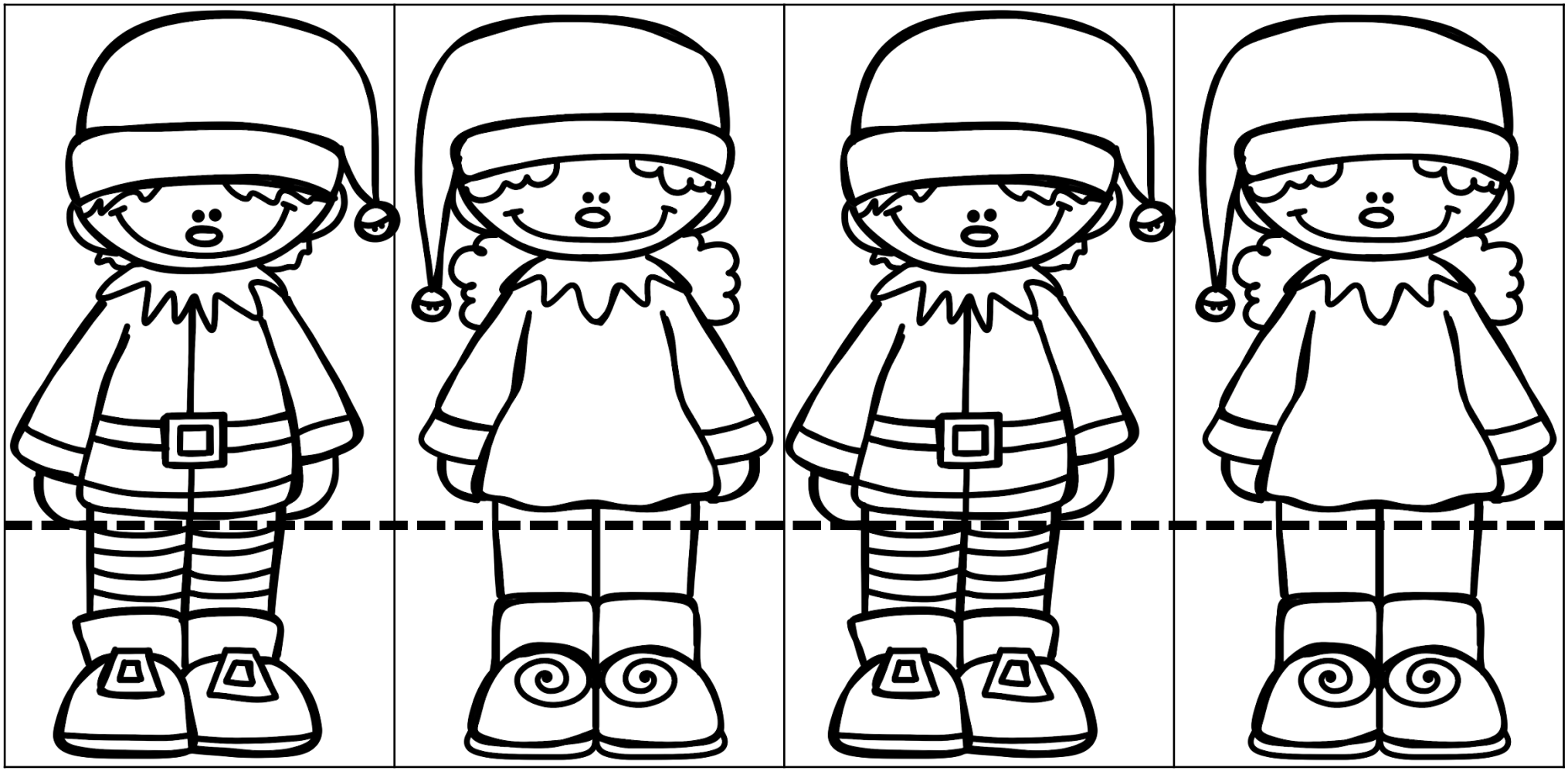
Which part of your design did not work well and WHY?

How did you IMPROVE your design?

Shelf for the Elf Challenge

Cut out the elves and fold on dotted lines so that each elf is "sitting."

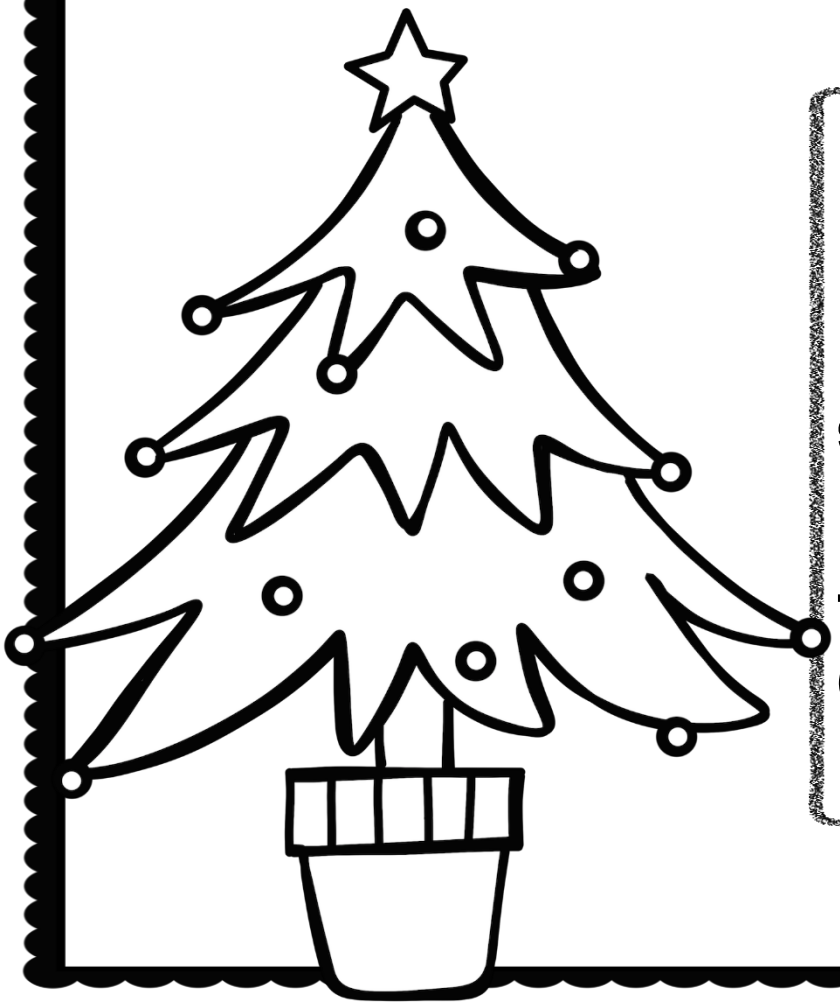
Shelf for the Elf Challenge



Cut out the elves and fold on dotted lines so that each elf is "sitting."

Tallest Tree

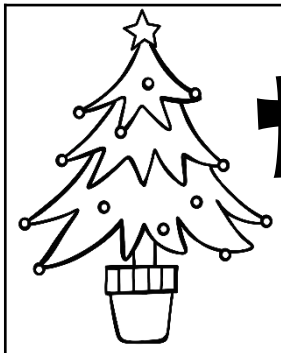
You have been asked to create a decorative tree for the holiday parade. Use the cups to construct the tallest tree possible.



Materials:

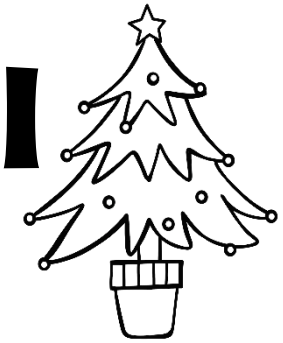
* Plastic cups (green found at party supply stores)
* Printed ornaments and Scotch tape for students to decorate cups (OPTIONAL)
* Measuring tape or yard sticks

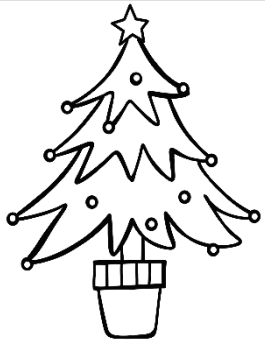
TALLEST TREE
Vocabulary Cards



three-dimensional

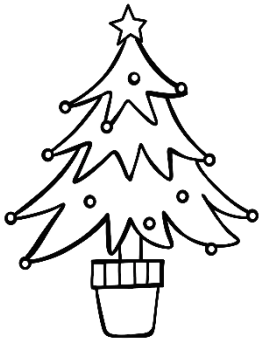
a solid shape that has depth, width, and height

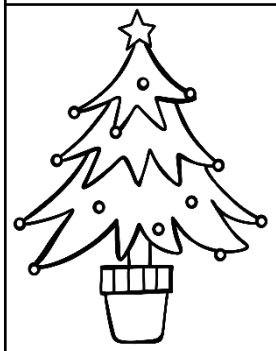




pyramid

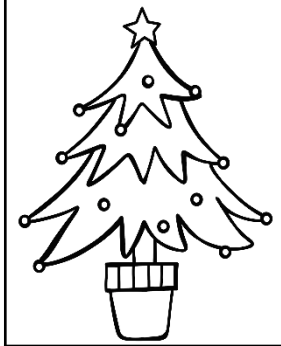
a solid with a polygonal base and triangular faces that meet at a point





cone

a solid that tapers from a circular base to a point



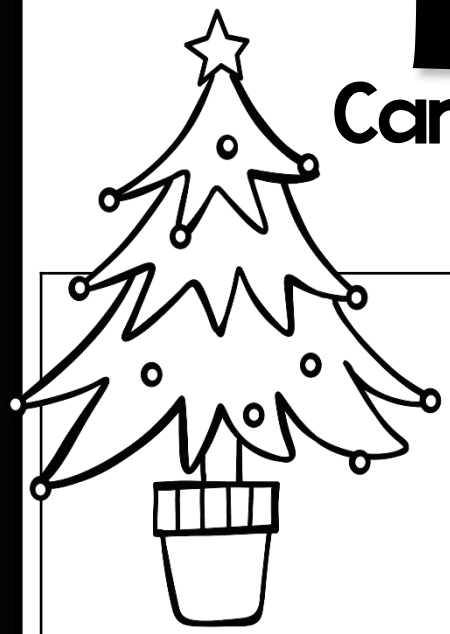
structure

something that is built or constructed

Name:_____

Tallest Tree

Can you use the cups to construct the tallest tree possible?



Materials:

Tests:

TEST	Height in Centimeters
1	
2	
3	

Blueprint:

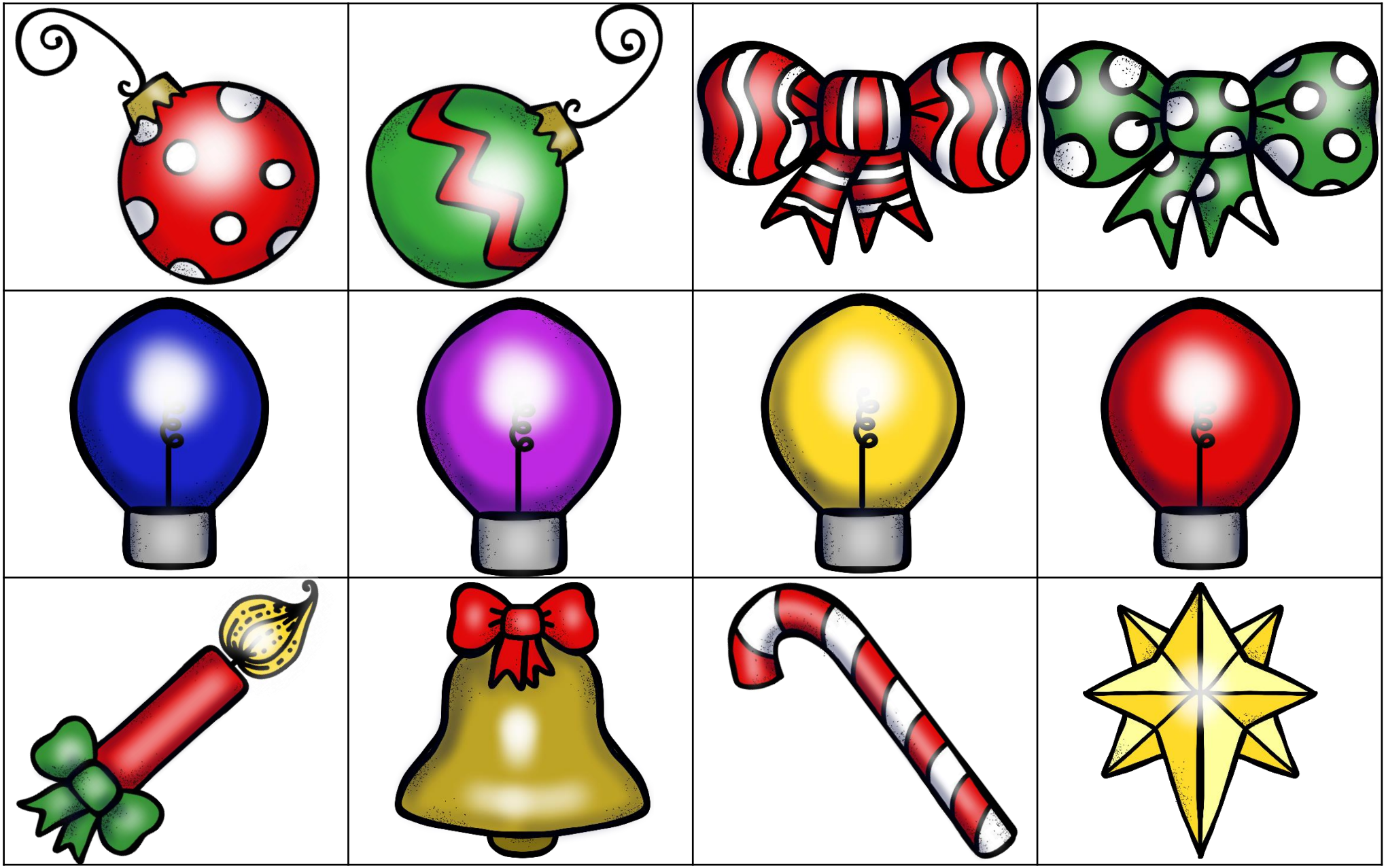
Which design or shape worked well and WHY?

Which design or shape did not work well and WHY?

How did you IMPROVE your design?

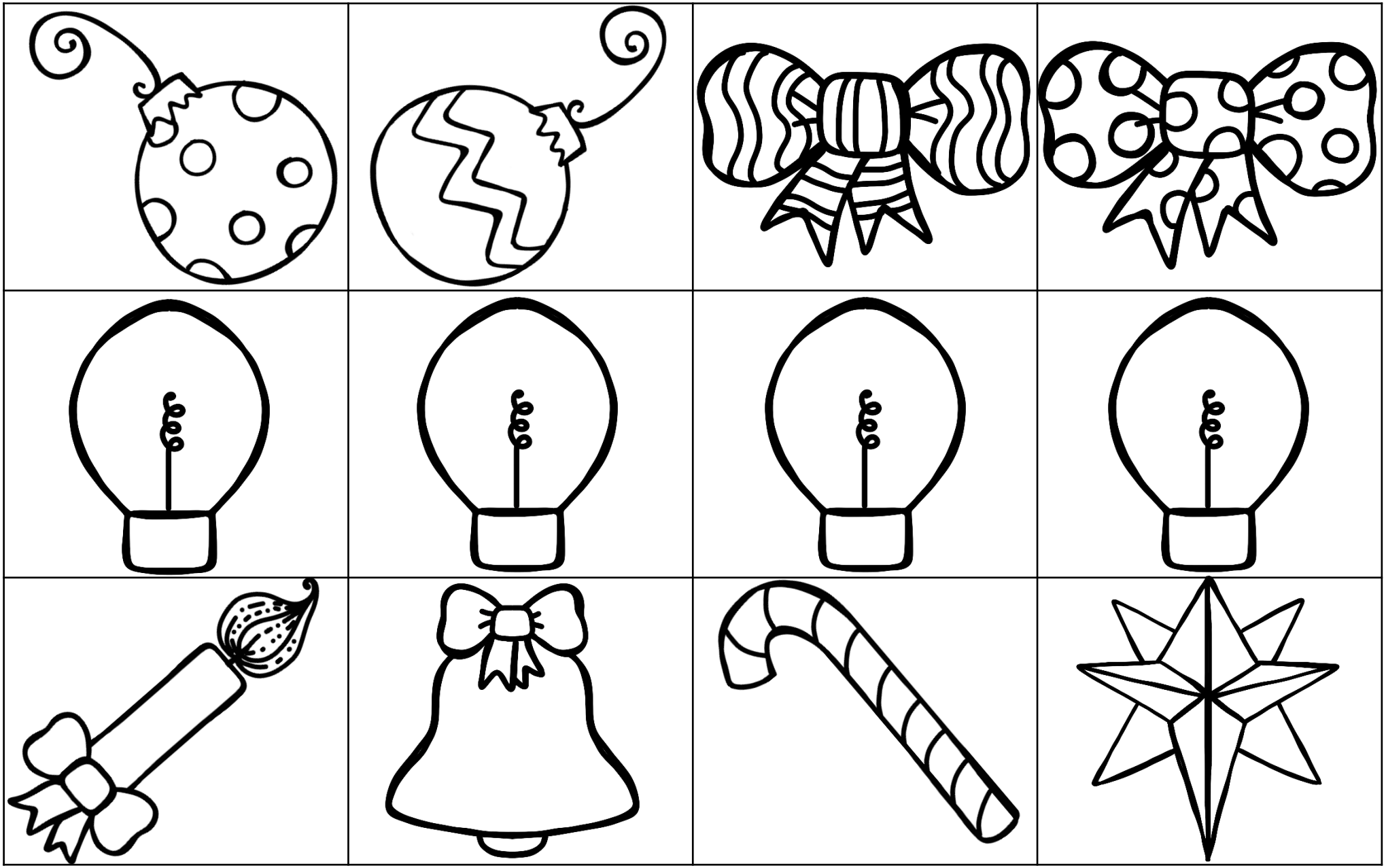
Tallest Tree Challenge

(optional ornaments to tape onto cups)



Tallest Tree Challenge

(optional ornaments to tape onto cups)



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