DESIGN A HOLE PROJECT

For

THE WILSON SCHOOL

Miniature Golf Course

You have just been chosen to design a mini golf course for the US Pro Mini Golf Association (PMGA) Tour.

Your course needs to be challenging for the players. You can include obstacles, bunkers, and water hazards. Once you have designed your hole, you need to show how a professional player would hit (using angles) to make a hole-in-one. To have a successful project, follow all outlines in this guide and meet all deadlines.

First, let's establish that, yes, there is a US Pro Mini Golf Association. Learn more through this video:

It's Cutthroat Competition at the Masters of Mini Golf

Also, play around a bit with mini golf online:

Online Mini Golf Games

After watching and playing, write a reflection to the following question:

How did you see math while playing mini golf today?

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Sketch an idea for your mini golf hole below.

THE GEOMETRY

The study of physics and math is really cool! From these disciplines, we can explain how things will act in the world. For instance, if a ball (without a spin) is bounced off a wall, it will bounce off at the same angle that it hit the wall. In physics, there is a formula that states:

The Angle of Incidence = The Angle of Reflection

It can be seen in this image:

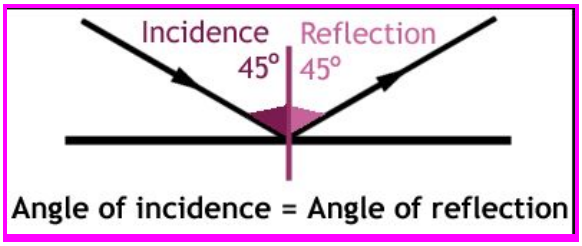
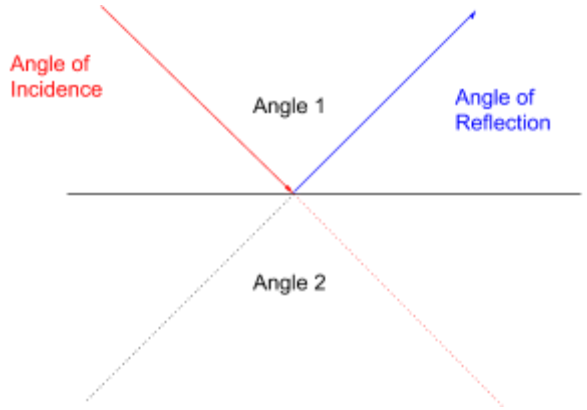


Image source: https://scienceaid.net/images/3/3a/reflection.png

Another way to think about this formula mathematically is to imagine the ball rolling through the wall (as seen in the dotted lines).

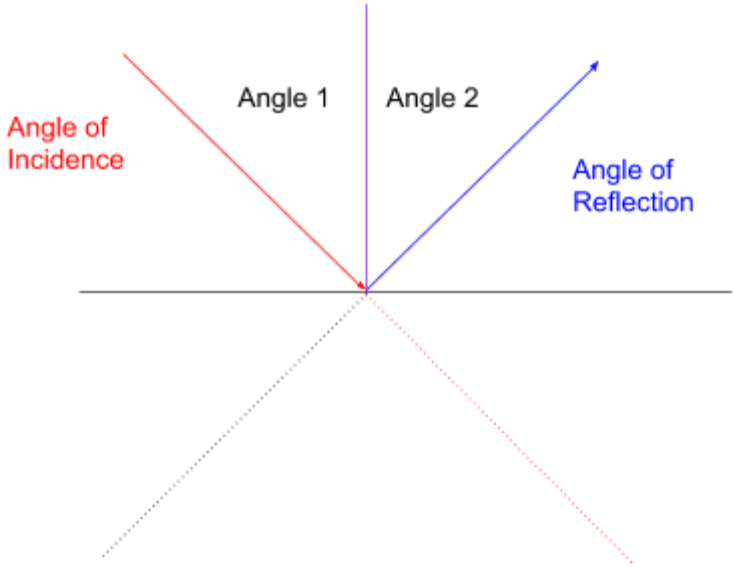


The red vector (arrow) shows the line of incidence. The ball rolls toward the wall. It bounces off, as shown by the blue vector (arrow). If the path could continue "through" the wall, it is depicted with the dotted lines.

What do you notice about angle 1 as compared to angle 2?

_____

Now, if angle 1 is bisected (cut in half), the angle it bounces onto the wall is the same as it bounces off.

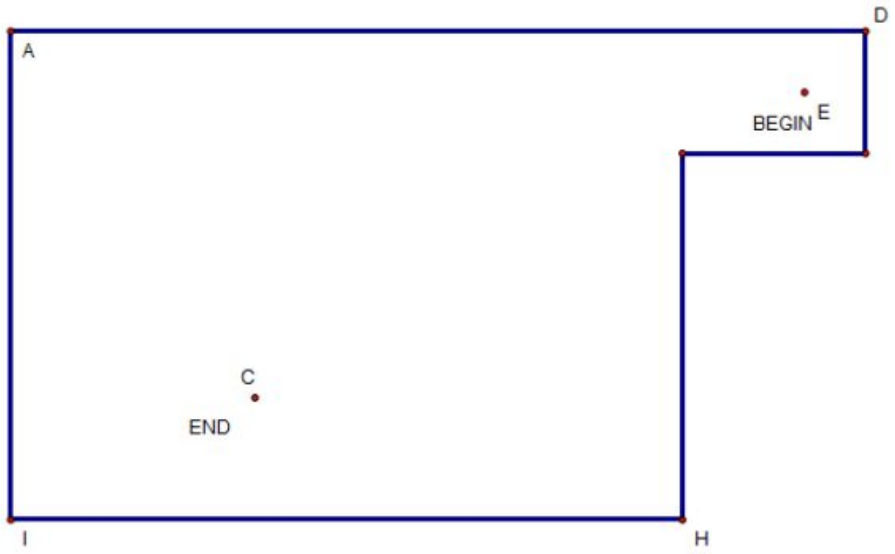


This formula is also true for things such as light rays, sound waves, and radio waves. When you look in a mirror, you are experiencing this formula in action. You see your image in the mirror, your eye sees the images from those light waves which bounced off the mirror into your direction. The image appears to be the same distance "behind" the mirror as the person is in front of it.

In golf, the goal is to get your ball into the hole in as few strokes as possible. In mini golf, there are often many challenging obstacles between the tee box (starting point) and hole. Often, you use the surfaces to bounce your ball toward the hole. This is where geometry helps the golfer!

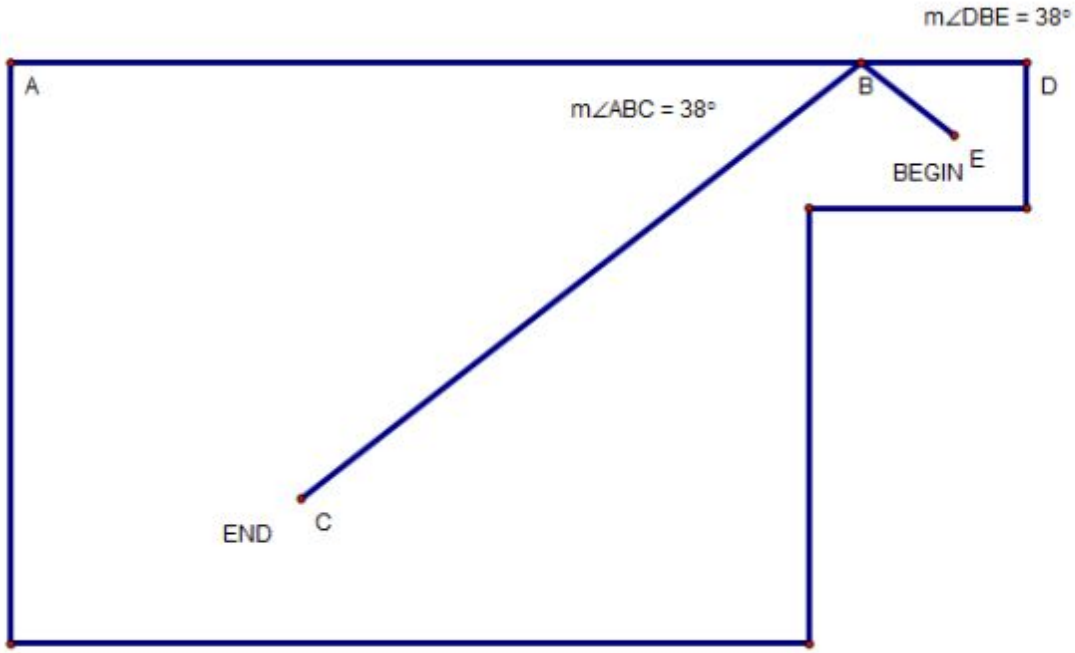
Let's try it for ourselves. Look at Diagram One:

DIAGRAM ONE



Use your protractor and ruler to draw a line from the B (ball) to the wall at the top of the pretend miniature golf hole. Measure the angle between the line and the upper part of the wall. Then draw another line that has the same measure with the wall going out from the wall. Continue this process until your line will hit the hole, or point H.

Diagram One (Completed)
This is just ONE solution. There are many more!



The same idea can be used to get a hole in one by bouncing off more than one wall. For example, you may hit the ball down first instead of up. Then the ball will have to bounce off two walls in order to get a hole in one. Sometimes this might be necessary in mini-golf if there is an obstacle in the way of the hole. Try finding a path that will cause the ball to bounce off of two walls to get a hole in one.

Use DIAGRAM 2 and DIAGRAM 3 for the next step.

- Plot TWO paths on the pretend mini-golf hole.
- Use different colors for each path.
- The paths must either have the balls bouncing off one, two or three walls.
- Remember, the angle of incidence must equal the angle of reflection.

Diagram Two

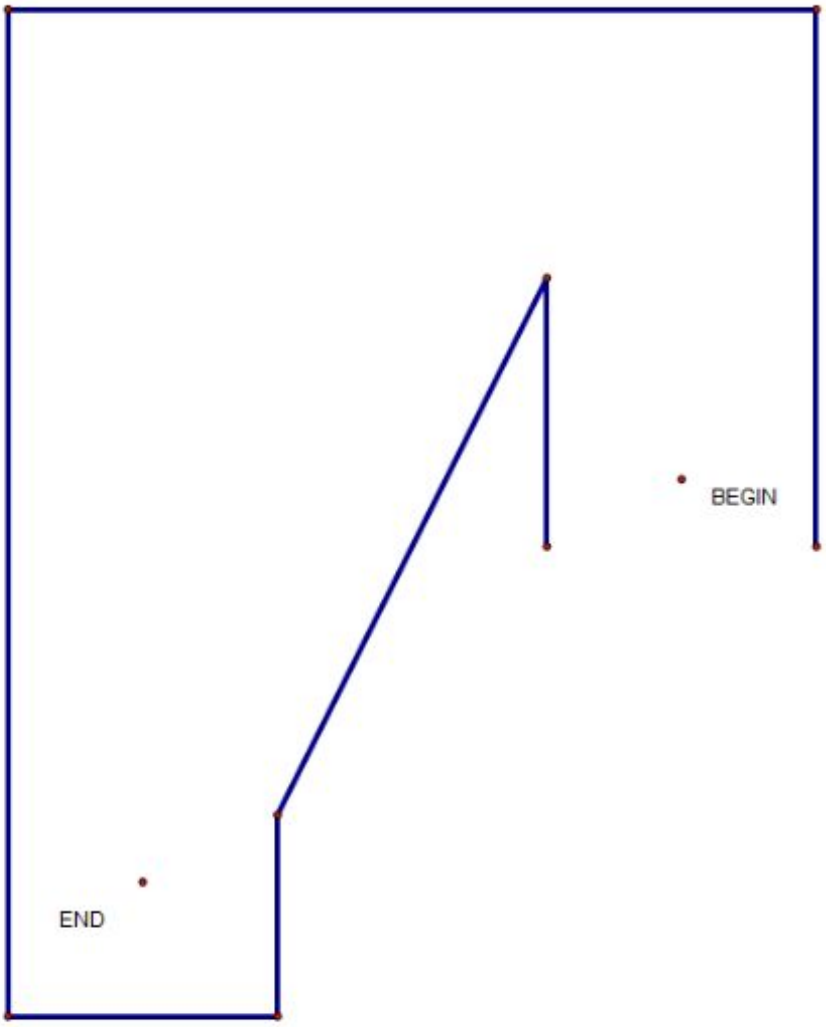
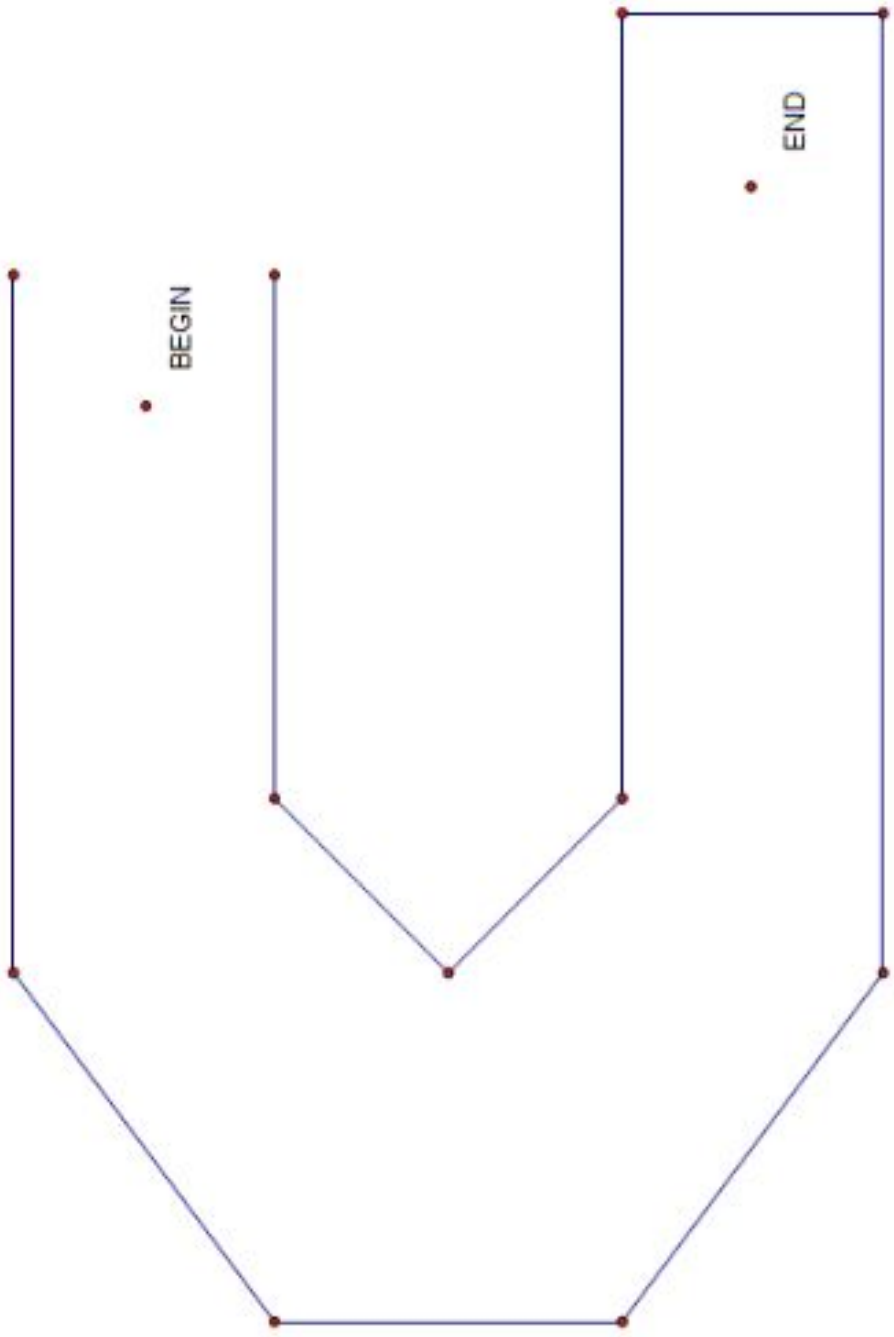


Diagram Three



THE DESIGN

1. Design your hole on paper.
   - Pick out a shoebox lid(s) and measure it.
   - Using grid paper, make a blueprint that includes accurate measurements of all parts of your hole.
   - Use the following scale: 1 cm square = 1 cm square
   - Include accurate measurements of the dimensions of the entire hole and of hazards. Label the tee and hazards.
   - Include a tee box that is 3 cm by 4 cm.
   - Find the perimeter and area of your golf hole.

2. Show at least 2 ways to make a hole in one.
   - Draw the angles and shots on the diagrams of your hole.
   - Be sure to use 2 different colors in your drawing.
   - Label all angles. (There should be 3 per bounce off hazard/wall.)

3. Begin building.
   - Build the hole as shown on your blueprint.
   - Remember to make a tee area and a putter.
   - Give your hole a theme and make it look attractive.

4. Write the description for your hole.
   - Decide on a name for your hole. Use this as a title for your write up.
   - Write a meaty paragraph or more that answers the question, "How did you use geometry?"
     - Use your math/geometry vocabulary to explain how you created your hole.
     - What new math did you learn?
     - What did you learn about completing a project?
     - EXPLAIN what you mean with anything you write.
   - Type the final draft.
   - Proofread the description. Be sure you use ALL your good, English writing rules.

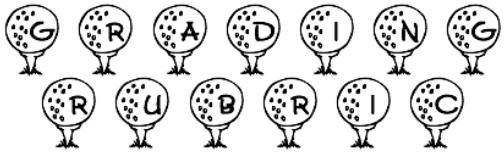
5. Play!

Must haves for the hole:

- Area
- Perimeter
- 2 ways to get a hole in one using the angle of incidence/reflection
- Geometric hazards
- Tee box that is 4 cm by 3 cm
- Description
- Creative

Bonus!

- Have moving parts
- The Sheldon will be selecting a few projects to showcase this summer in their Golf the Galleries Exhibit. Be creative, colorful, and neat and do your personal BEST to have your design considered.



	Points Earned	Points possible	Notes
DESIGN			
The blueprint is a clear, accurate representation of the hole.		10	
The perimeter measurement is accurate.		5	
The area measurement is accurate.		5	
HOLE-IN-ONE DIAGRAMS			
There are at least 2 ways to make a hole-in-one.		10	
All angles are measured and labeled correctly.		10	
BUILDING			
The design follows the blueprint plans.		10	
All parts of the hole (tee box, holes, hazards, sides) were built following the blueprint measurements.		10	
DESCRIPTION			
The description is a paragraph or more and answers "How did you use geometry?" (See guidelines for more questions to guide you.)		10	*The writing is edited for spelling, punctuation, and grammar (2 points lost for each mistake)
CREATIVITY			
Project shows originality and attention to detail.		30	
PROJECT TOTAL		100	

Project Timetable

Friday, April 26 (Problem Solving Class) -
- Project Overview & Hole in One Math Introduced
- HW: Practice Holes - remember angle of incidence = angle of reflection

Monday, April 29 & Tuesday, April 30 -
- Mini Lesson: How to sketch hole to scale/angle measurements
- Work Day: Pick Box Lids & Start Sketches
- HW: Sketch Hole to Scale

Friday, May 3 - Work Day
- Mini Lesson: Review Angle Measurements; Work on perfecting two ways to make a hole in one
- HW: Finish the Hole - In - One Diagram & Blueprint

Monday, May 6-
- DUE: Hole - In - One Diagram & Blueprint
- Mini Lesson: Construction Techniques
- Work Day: Start building

Thursday, May 9 -
- Mini Lesson: Finding perimeter and area of your hole
- Work Day: Keep building

Monday, May 13 -
- Work Day: Keep building
- HW: Find the perimeter and area of your hole; Make sure your hole matches your blueprint; revise if necessary; work on draft of your writing

Tuesday, May 14-
- DUE: Perimeter and Area Measurement; Blueprint is finalized
- Work Day: Keep building
- HW: Finalize your paragraph writing

Thursday, May 16 -
- DUE: Description Writing - Complete with math in detail!
- Work Day: Keep building
- HW: Do anything you need to get your project complete

Friday, May 17 -
- Work Day: Finalize hole - decorate, write, etc.
- HW: Finish your project

Monday, May 20 - Project Due

Tuesday, May 28 - Present Project and Play with the school