Triangle in Circle — *M012 scoring rubric*

Math Domain

- [ ] Number/Quantity
- [x] Shape/Space
- [ ] Function/Pattern
- [ ] Chance/Data
- [ ] Arrangement

Math Actions (possible weights: 0 through 4)

2	Modeling/Formulating
0	Manipulating/Transforming
2	Inferring/Drawing Conclusions
2	Communicating

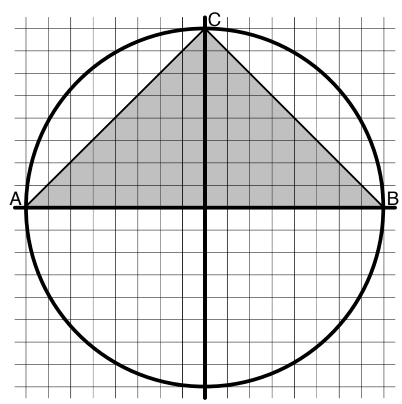
Math Big Ideas

- [ ] Scale
- [ ] Reference Frame
- [ ] Representation
- [ ] Continuity
- [ ] Boundedness
- [ ] Invariance/Symmetry
- [ ] Equivalence
- [x] General/Particular
- [ ] Contradiction
- [x] Use of Limits
- [ ] Approximation
- [ ] Other

Recall that the area of any triangle can be found as ½ · base · height. We can regard segment AB as the base for any of the triangles described in the problem. Then, the only varying quantity in the area formula is the height. Moreover, the area of the triangle is directly proportional to the height.

1. To achieve the maximum area, the triangle must have the maximum height. This maximum height is 8 units, and it can be obtained in two ways: placing C at (0, 8) as shown, or placing C at (0, –8).

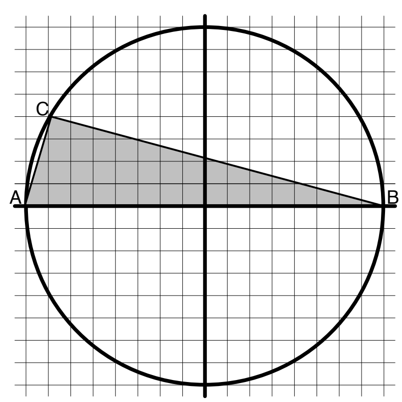
For either choice of C, the area of triangle ABC is ½ · (16 units) · (8 units) = 64 sq. units.



2. An area that is half of the maximum area can be achieved by choosing a height that is half of the maximum height, which is a height of 4 units.

There are four possible points C meeting this criterion, two on the line $y = 4$ and two on the line $y = -4$. One of the four possibilities is pictured.

For any of the four possible triangles, the area is ½ · (16 units) · (4 units) = 32 sq. units.



3. The area can be made smaller by decreasing the height. If we place C very close to A, the area of the triangle can be made as small as desired. If C actually coincides with A, the area becomes 0, but ABC is arguably no longer a triangle.

	partial level (1 or 2)	full level (3)
Modeling/ Formulating (weight: 2)	Student has a partial or unclear mental image of the relationship between the area of a triangle and its height.	Student explicitly understands that the area of any triangles having the same base will be directly proportional to the height.
Transforming/ Manipulating (weight: 0)		
Inferring/ Drawing Conclusions (weight: 2)	Student is unable to determine how to achieve either the maximum or the minimum area for the triangle.	Student answers questions **1** and **3** correctly.
Communicating (weight: 2)	Explanations in questions **1**, **2** and **3** are incomplete or unclear.	All explanations are clear and complete, with appropriate vocabulary throughout.