

## **MATH 494.594 / FINAL EXAM REVIEW**

---

Final Exam covers: Homework 0 – 9, Activities 1 – 20 and GSP 1 – 6 with an emphasis on the material covered after the midterm exam.

You may use both sides of one 3" × 5" card of notes on the exam

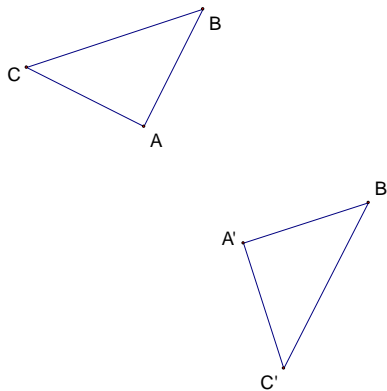
### **Concepts to know**

- ✓ Tessellations, creating and explaining: Regular polygons, triangles, quadrilaterals
- ✓ Side lengths, general and specific: 45°-45°-90° triangle and a 30°-60°-90° triangle (and how to derive them using the Pythagorean Theorem).
- ✓ Working with square roots
- ✓ Equilateral triangle area and how to derive for any equilateral triangle
- ✓ Regular hexagon area and how to derive for any regular hexagon
- ✓ Properties of, and area formulas for: Trapezoids, kites, darts, parallelograms, rhombi, rectangles and squares
- ✓ The four isometries—what are they?
- ✓ Find line of translation by measuring and constructing
- ✓ Find line of reflection by measuring and constructing
- ✓ Find center and degree of rotation between two figures by measuring and constructing
- ✓ Perform each isometry using a compass and straightedge
- ✓ Given a figure and an image; determine and create the corresponding isometry using no more than three lines of reflection
- ✓ Scale factors and length / perimeter
- ✓ Scale factors and area
- ✓ Scale factors and volume
- ✓ Rep-tiles and similarity
- ✓ Pythagorean Theorem—visual / algebraic proofs

*Review questions follow*

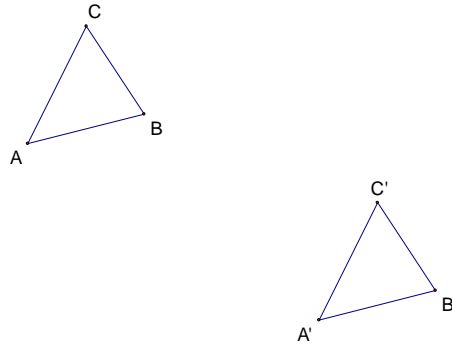
## Final Exam Review Questions

1. Create a Venn diagram to classify the following: Quadrilateral, Parallelogram, Rectangle, Rhombus, Square, Trapezoid and Kite. For each section of the Venn diagram, draw a quadrilateral that corresponds to that section only and describe the properties of that quadrilateral.
2. Which regular polygons rep-tile the plane? Explain your answer.
3. Which regular polygons tessellate the plane? Explain your answer.
4. Draw a quadrilateral that does not have any parallel sides. Tessellate the plane with this quadrilateral.
5. Is the composition of two translations commutative? Why or why not?
6. Is the composition of two reflections commutative? Why or why not?
7. Is the composition of two rotations commutative? Why or why not?
8. Is the composition of two glide reflections commutative? Why or why not?
9. The diagram below represents a transformation of  $\triangle ABC$  to  $\triangle A'B'C'$



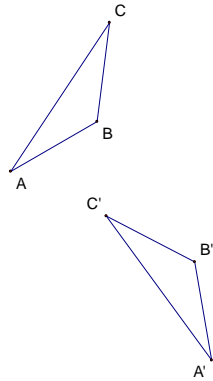
- a. Which single motion (rotation, reflection, translation or glide reflection) will move  $\triangle ABC$  to  $\triangle A'B'C'$ ?
- b. Use a compass and straightedge to construct the components of the isometry.
- c. Using no more than three lines of reflection, mathematically show how the motion in part (a) can be accomplished by a sequence of one, two or three reflections (no guess and check).

10. The diagram below represents a transformation of  $\triangle ABC$  to  $\triangle A'B'C'$



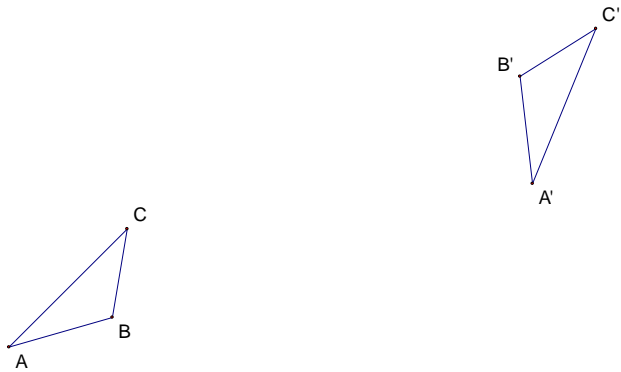
- Which single motion (rotation, reflection, translation or glide reflection) will move  $\triangle ABC$  to  $\triangle A'B'C'$ ?
- Use a compass and straightedge to construct the components of the isometry.
- Using no more than three lines of reflection, mathematically show how the motion in part (a) can be accomplished by a sequence of one, two or three reflections (no guess and check).

11. The diagram below represents a transformation of  $\triangle ABC$  to  $\triangle A'B'C'$



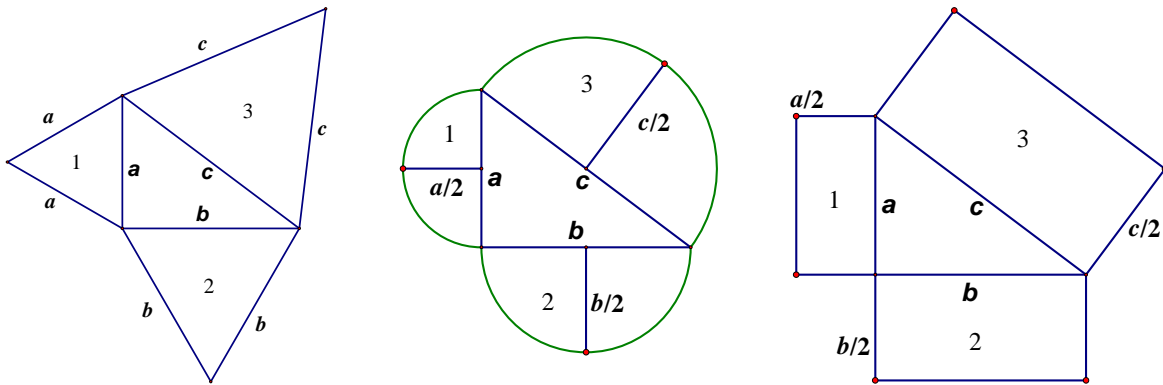
- Which single motion (rotation, reflection, translation or glide reflection) will move  $\triangle ABC$  to  $\triangle A'B'C'$ ?
- Use a compass and straightedge to construct the components of the isometry.
- Using no more than three lines of reflection, mathematically show how the motion in part (a) can be accomplished by a sequence of one, two or three reflections (no guess and check).

12. The diagram below represents a transformation of  $\triangle ABC$  to  $\triangle A'B'C'$

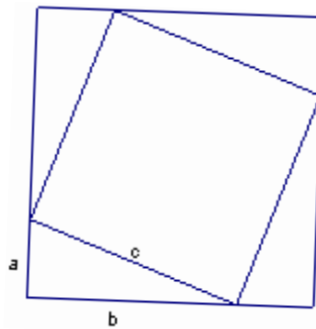
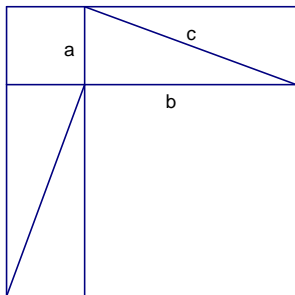


- Which single motion (rotation, reflection, translation or glide reflection) will move  $\triangle ABC$  to  $\triangle A'B'C'$ ?
- Use a compass and straightedge to construct the components of the isometry.
- Using no more than three lines of reflection, mathematically show how the motion in part (a) can be accomplished by a sequence of one, two or three reflections (no guess and check).

13. For each diagram, prove that Area 1 + Area 2 = Area 3.



14. Use the diagrams and prove that  $a^2 + b^2 = c^2$ .



15. Calculate the area of an isosceles right triangle, where each leg is length  $S$  cm.
16. Calculate the area of an equilateral triangle, where each side is length  $S$  cm.
17. Calculate the area of a regular hexagon,, where each side is length  $S$  cm.
18. True or False? If a regular polygon tessellates the plane, then it is also a rep-tile. Explain and justify your answer.
19. Is every triangle a rep-tile? Explain in detail and support your answer will careful illustrations.
20. Construct two polygons where corresponding angles are congruent, but the polygons are not similar.
21. Construct two polygons where the ratio of corresponding sides is constant, but the polygons are not similar.
22. If the scaling ratio from one box  $A$  to a similar larger box  $B$  is 3.2 and the surface area of box  $B$  is  $1484 \text{ cm}^2$ , what is the surface area of box  $A$ ?
23. If the scale factor from one cube  $A$  to a smaller cube  $B$  is  $\frac{1}{4}$  and the surface area of cube  $A$  is  $384 \text{ in}^2$ , what is the volume of cube  $B$ ?
24. If the scale factor from a regular hexagon to a smaller regular hexagon is  $\frac{3}{4}$  and the side length of the first hexagon is  $A$ , then, for the smaller hexagon, what is the a) side length, b) perimeter and c) area?
25. Find the scale factor and the center of enlargement from Polygon  $P$  to Polygon  $P'$ (each diagram). You may use a ruler.

