

5.1 Copies of Line Segments and Angles

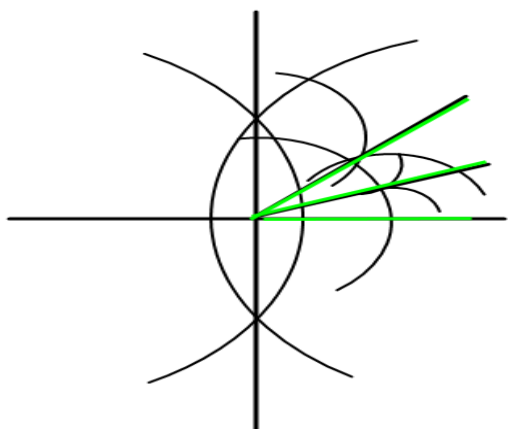
Answers

1. A drawing is a rough sketch and a construction is a process to create an exact and accurate geometric figure.
2. A straightedge can create straight line, but can't measure. A ruler can create straight lines and measure distances.
3. 1) Use a straightedge to draw a ray.
2) Use the compass to measure the length of the line.
3) Mark off the correct endpoint on the ray using the width of the compass.
4. 1) Use a straightedge to draw a ray.
2) Make congruent arcs through the original angle and the new ray.
3) Measure the width of the arc using the compass.
4) Mark off the correct width of the angle using the width of the compass.
5) Draw in the second ray to create the angle.
5. No, an angle is about the width of the opening, not about the lengths of the rays/lines.
6. You can be confident that a method for copying triangles that relies on the triangle congruence criteria actually creates congruent triangles.
7. Answers vary. See Example A for help.
8. Answers vary. See Example A for help.
9. Answers vary. See Example B for help.
10. Answers vary. See Example B for help.
11. Answers vary. See Guided Practice #1 for help.
12. Answers vary. See Guided Practice #2 for help.
13. Answers vary. See Guided Practice #3 for help.
14. Not directly. Given two angles and a non-included side, you would need to use the fact that the sum of the angles is 180° in order to construct the correct angle at one of the endpoints of the given side. However, this is really just ASA.
15. Answers vary. AAS is definitely harder (and really just becomes ASA). SSS is probably the fastest method, but this is partially an issue of preference.

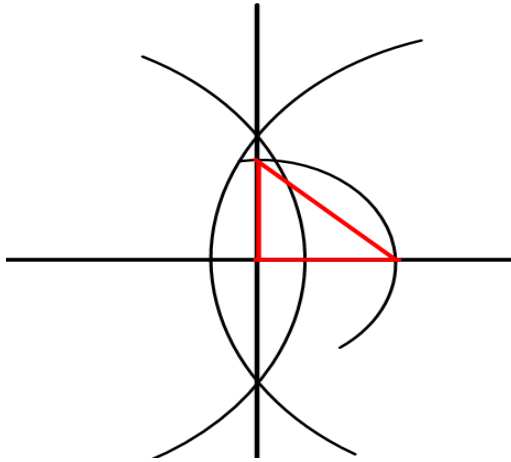
5.2 Bisections of Line Segments and Angles

Answers

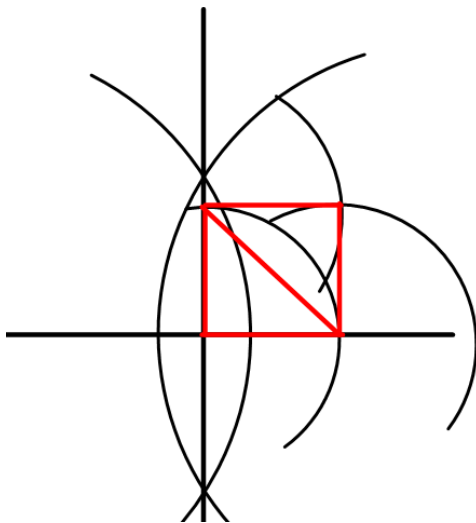
1. To bisect means to divide into two congruent parts.
2. Create two circles with the same radius centered at each endpoint. The line connecting the intersection points of the circles is the perpendicular bisector.
3. The midpoint is the point where the line segment and perpendicular bisector intersect.
4. A bisector cuts a line segment in half while a perpendicular bisector is also perpendicular to the bisector. To construct a non perpendicular bisector, draw another line through the midpoint of a segment that is not the perpendicular bisector.
5. Answers vary. Steps for constructing a perpendicular bisector are shown in Examples A and B.
6. Answers vary. Steps for constructing a perpendicular bisector are shown in Examples A and B.
7. Answers vary. Steps for constructing an angle bisector are shown in Guided Practice #1 and #2.
8. Answers vary. Steps for constructing an angle bisector are shown in Guided Practice #1 and #2.
9. Specific triangles/points vary. The point of intersection is the incenter.
10. Specific triangles/points vary. The point of intersection is the circumcenter.
11. Specific triangles/points vary. The point of intersection is the centroid.
12. Answers vary. Paper folding is faster, but only works on paper that can be folded and partially seen through. Compass and straightedge would work on any surface that can be written on.
13. Construct a perpendicular bisector of a segment. Then, bisect the 90° angle. Bisect it again to create a 22.5° angle.



14. Construct a perpendicular bisector. Let one of those angles be the right angle of a triangle. Draw a quarter circle centered at the midpoint of the segment. Connect the two points of intersection to create an isosceles right triangle.



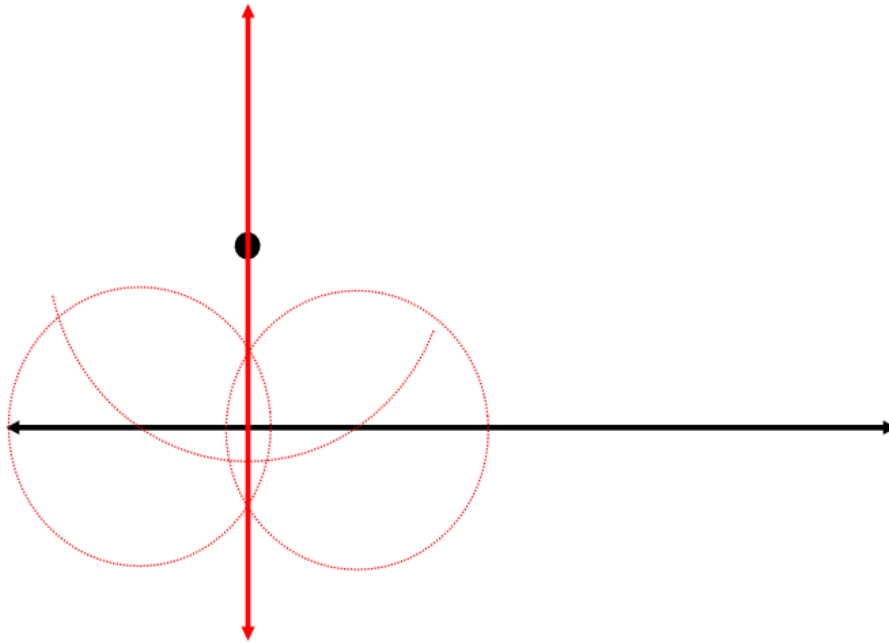
15. From each base angle of the isosceles triangle, construct a partial circle with a radius the length of the legs of the isosceles triangle. The point of intersection is the fourth vertex of the square.



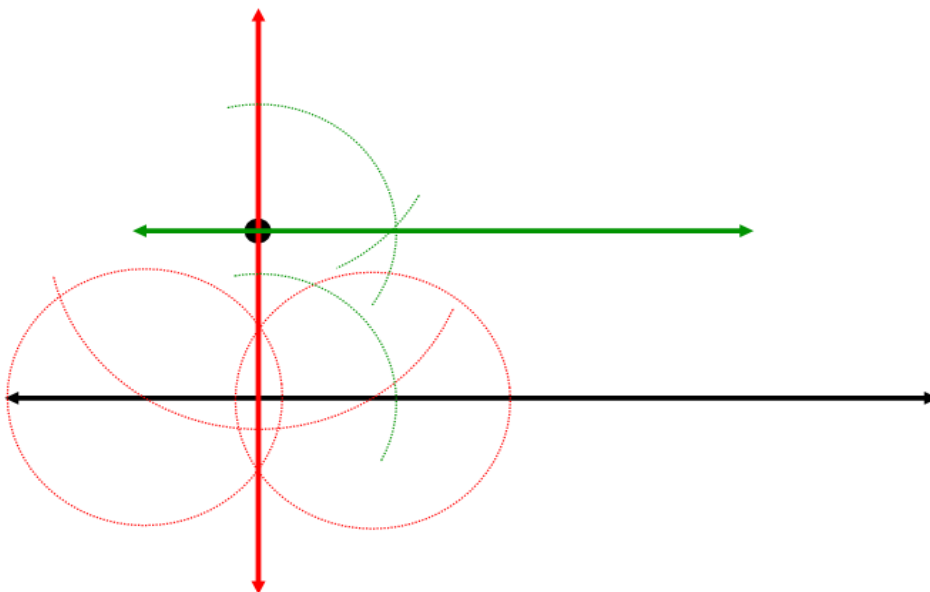
5.3 Parallel and Perpendicular Line Constructions

Answers

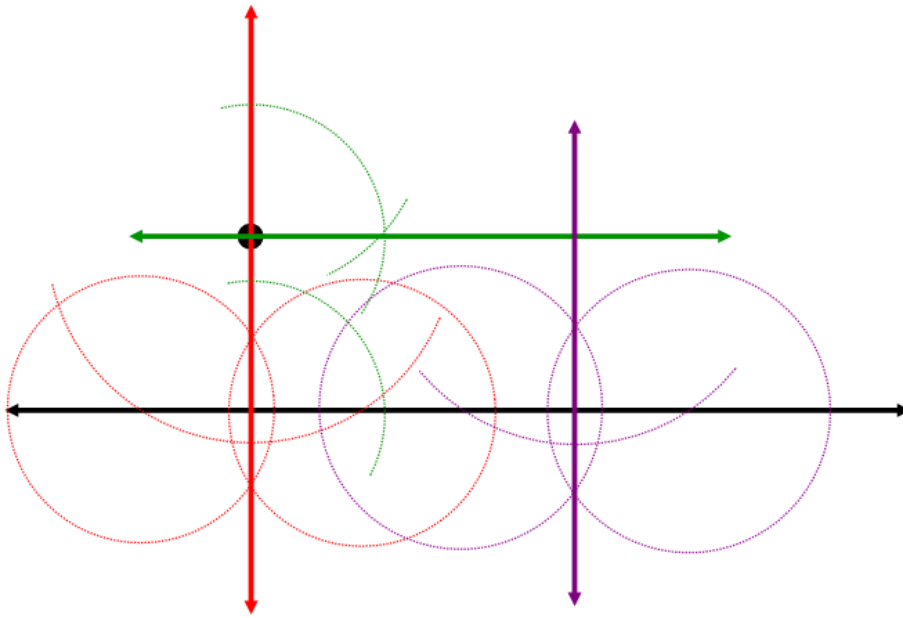
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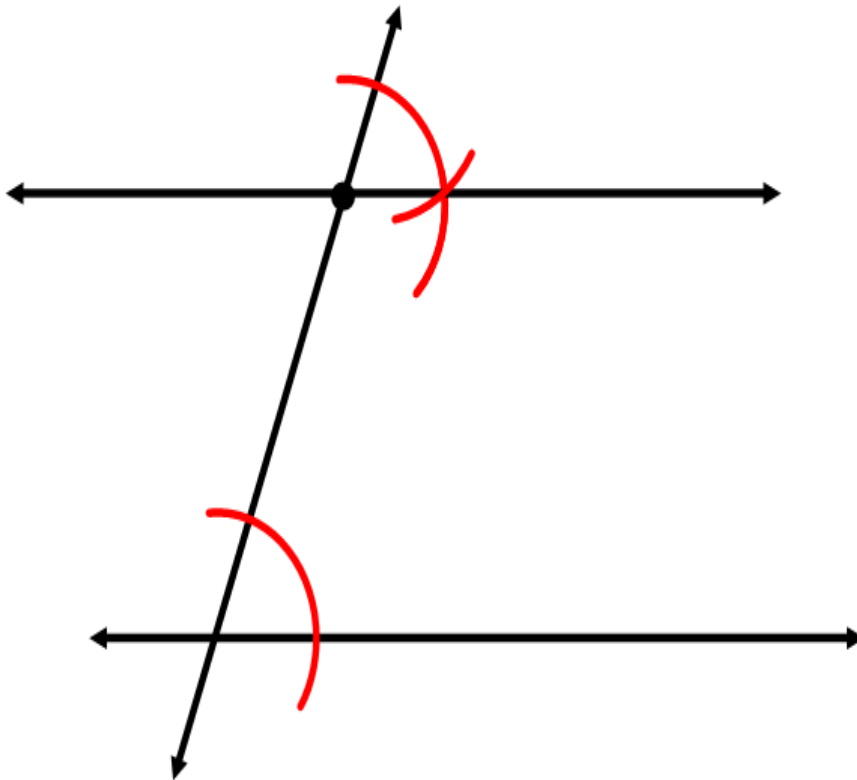
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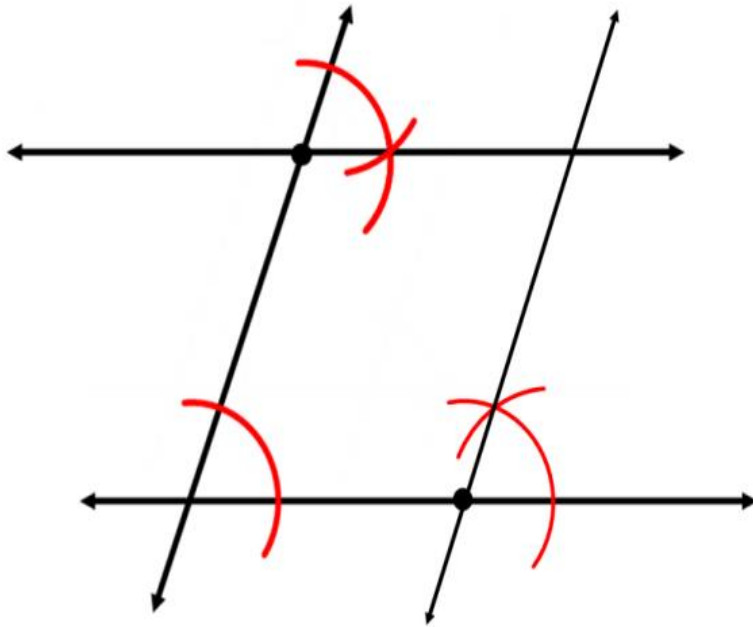
3. Construct another line perpendicular to the original line, or a line parallel to the red line. The quadrilateral formed by the intersections is a rectangle.



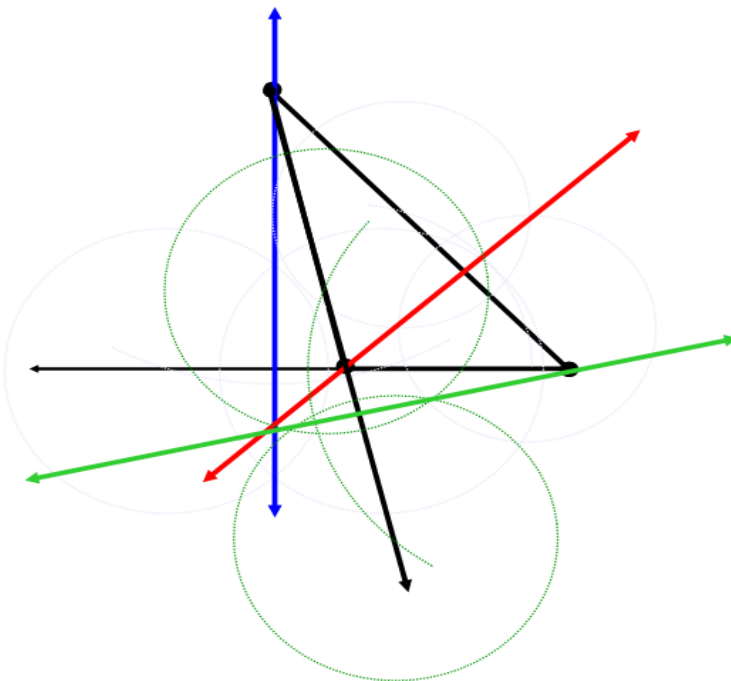
- 4.



5. Follow the steps from the guided practice.



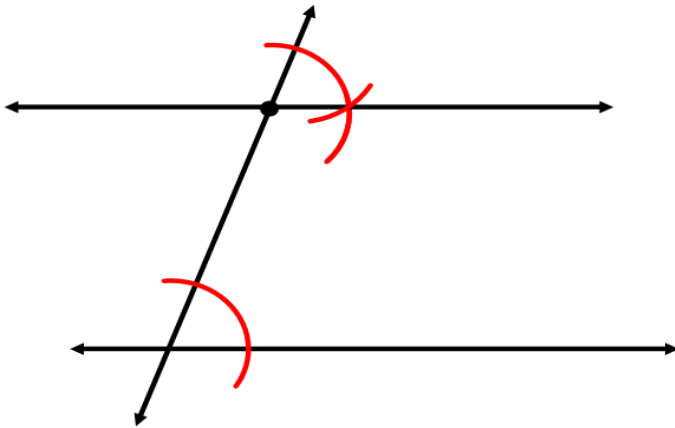
6. Follow the steps from the concept problem revisited.



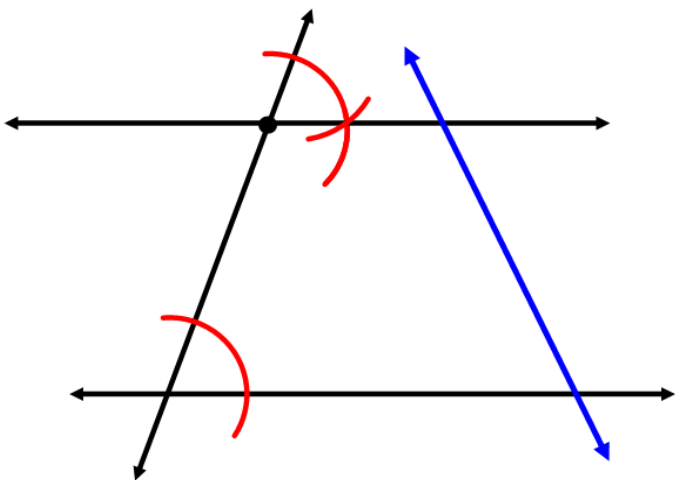
7. The point of intersection is the orthocenter.

8. To create an orthocenter inside the triangle, the triangle must be acute. To create an orthocenter outside the triangle, the triangle must be obtuse.

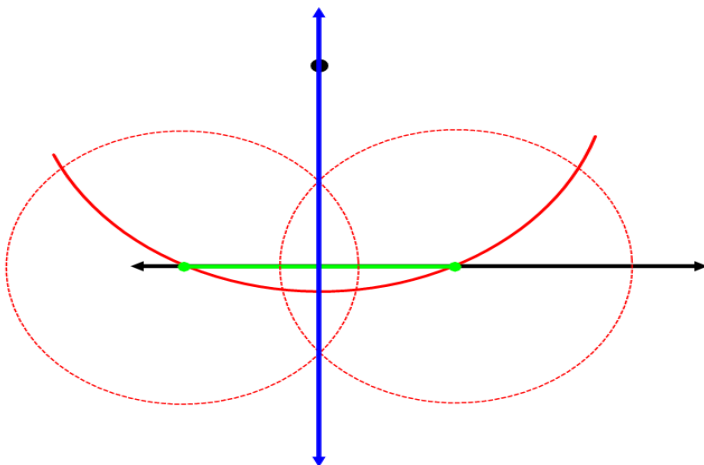
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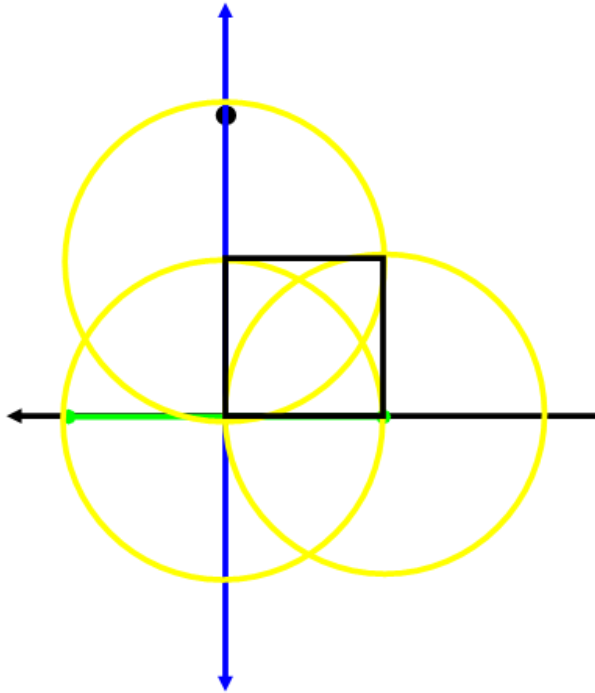
10. A trapezoid has one pair of parallel sides. Simply draw another transversal that is not parallel to the original transversal to create a trapezoid.



11.



12. Answers vary. One possibility is to use the right angle created from the perpendicular lines as one corner of the square. Then, construct three congruent circles in order to find the other vertices of the square.

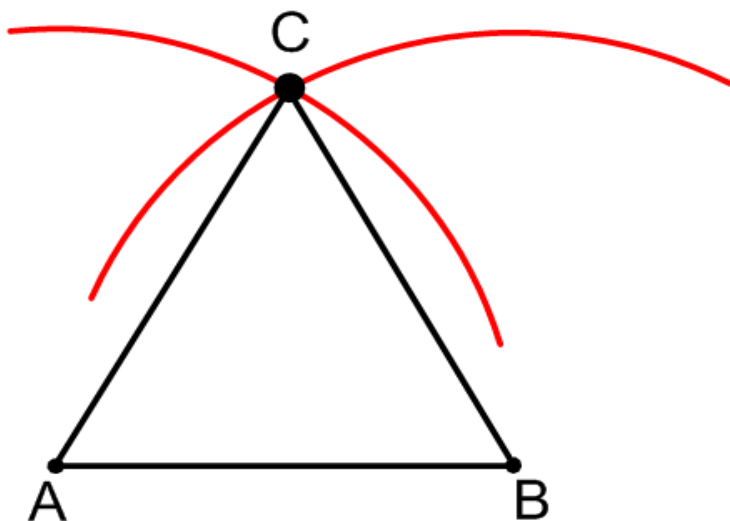


13. Answers vary depending on steps taken in #12.
14. If corresponding angles are congruent due to being copied, then lines are parallel.
15. When you construct a perpendicular bisector, you are constructing perpendicular lines. Therefore, you can use that method for constructing perpendicular lines in general by first constructing the correct line to bisect.

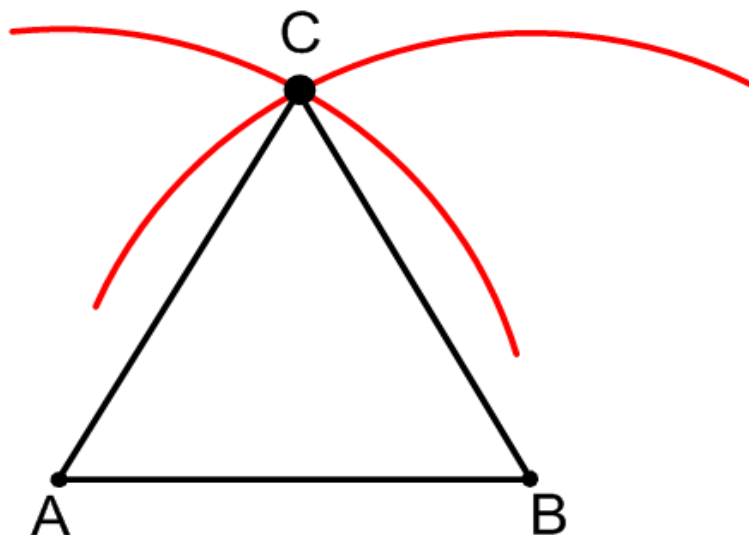
5.4 Constructions of Regular Polygons

Answers

1. Specific answers vary.

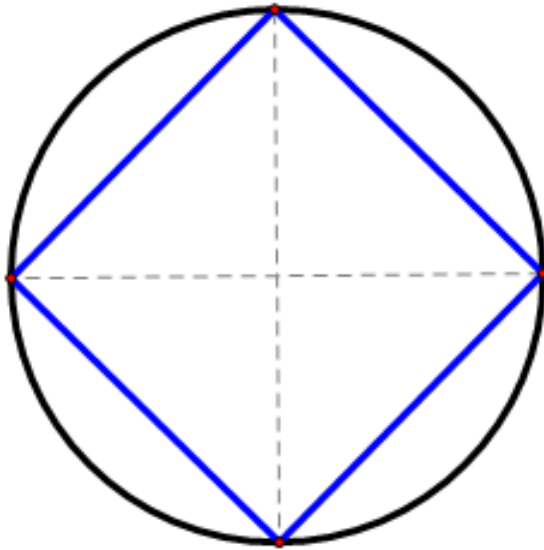


2. Specific answers vary.



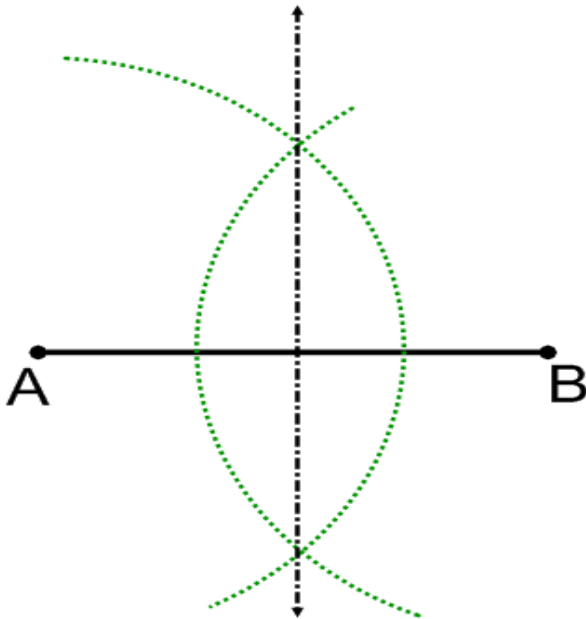
3. This method works because it creates a triangle with three congruent sides. Point C is the same distance from A as from B, and the distance from C to A is the same as the distance from A to B.

4.

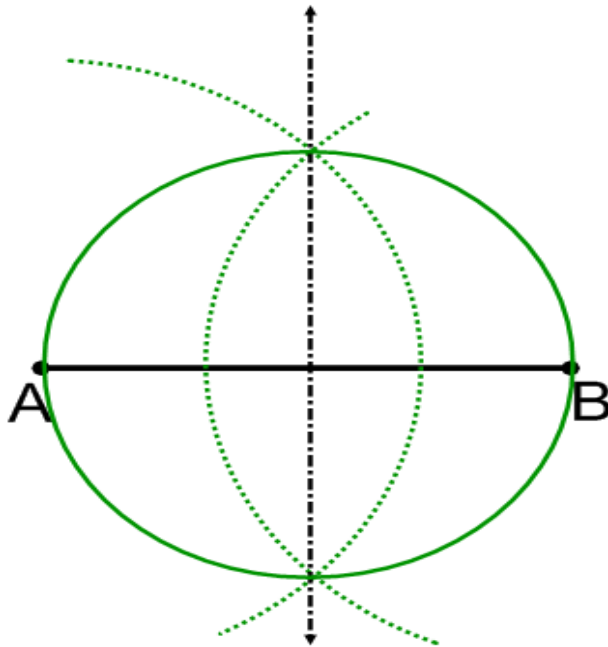


5. The inner angles are right angles by construction, and their intersection point is the center of the circle. As described in Example C, the four right triangles must be congruent with 45° base angles, so the four sides of the quadrilateral are congruent (by CPCTC) and the four angles making up the quadrilateral are 90° (because $45+45=90$).

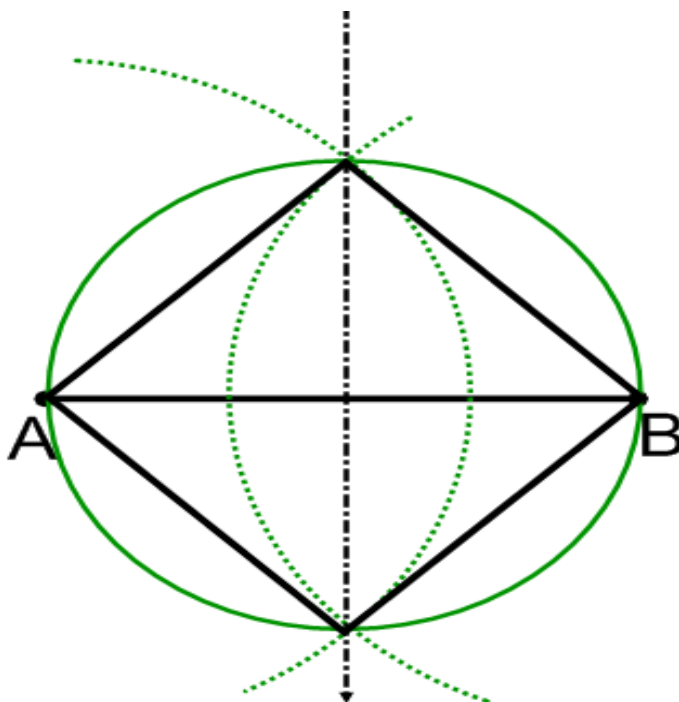
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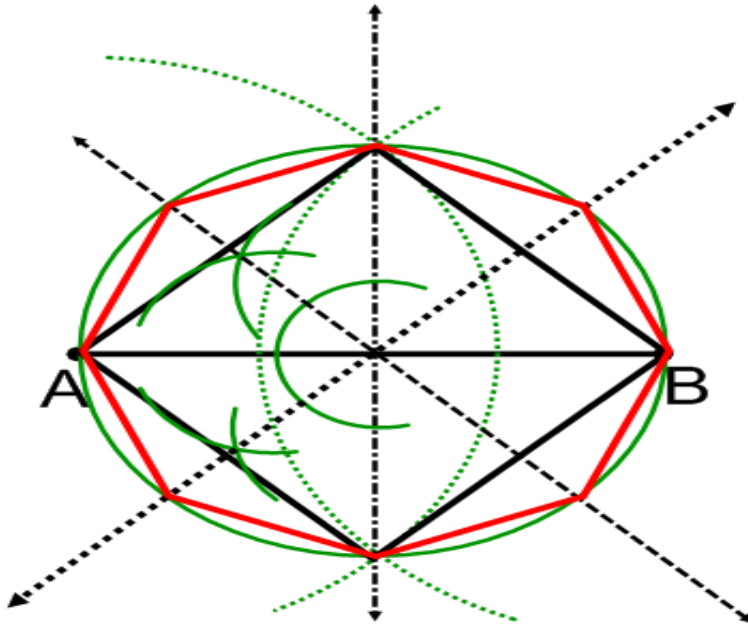
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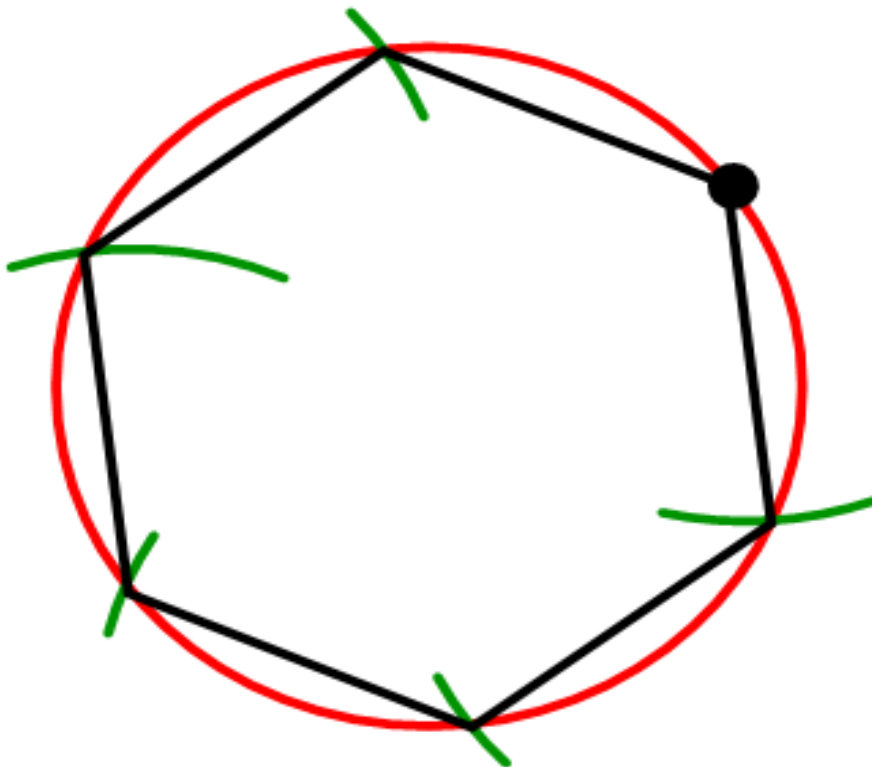
8.



9.



10.

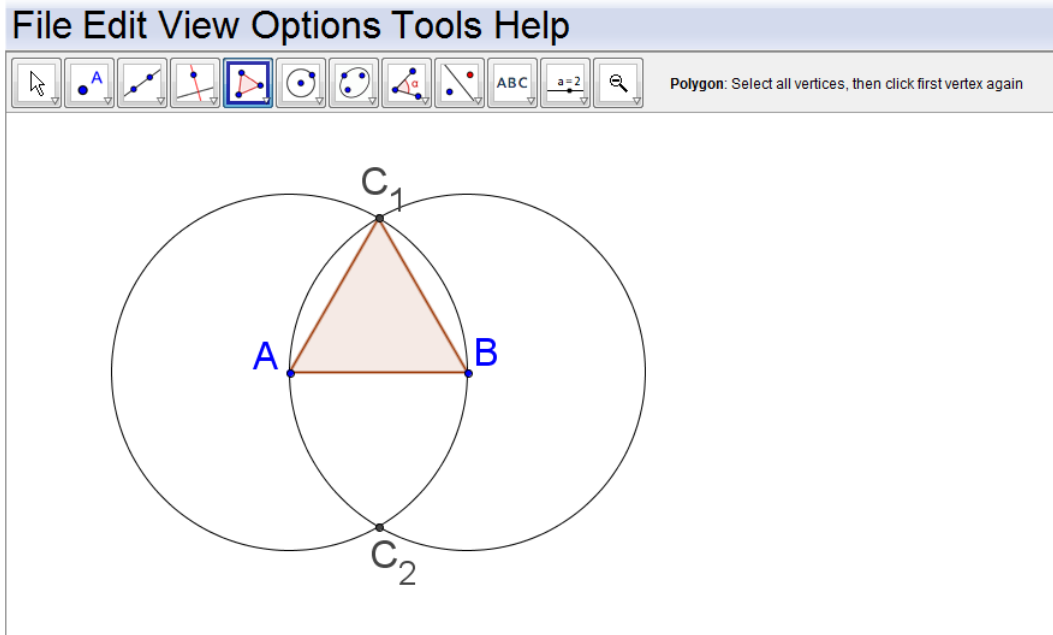


11. All the points on a circle are the same distance from a central point. Each point on the hexagon has to be the same distance from a central point and the same distance from its surrounding points. The circle guarantees that points created are all the same distance from the center point.
12. Bisect each of the angles and find the points of intersection of the angle bisectors and the circle. The six points that define the hexagon plus the six angle bisector intersection points will define the regular 12-gon.
13. One method is to find the perpendicular bisector of each of the sides of the triangle. The point of intersection of the perpendicular bisectors is the circumcenter, which is the center of the circle that circumscribes the triangle. Construct a circle with this center that passes through one of the points of the triangle and it will pass through all three points of the triangle.
14. One method is to find the perpendicular bisector of each of the sides of the triangle. Extend the perpendicular bisectors so that they each intersect the circle twice. Connect the six points to form a regular hexagon.
15. Construct a circle and the radius of the circle. Use the protractor to rotate the radius $\frac{360}{5} = 72^\circ$. Continue rotating in increments of 72° until 5 radii have been drawn. Connect the endpoints of the radii to form the regular pentagon.

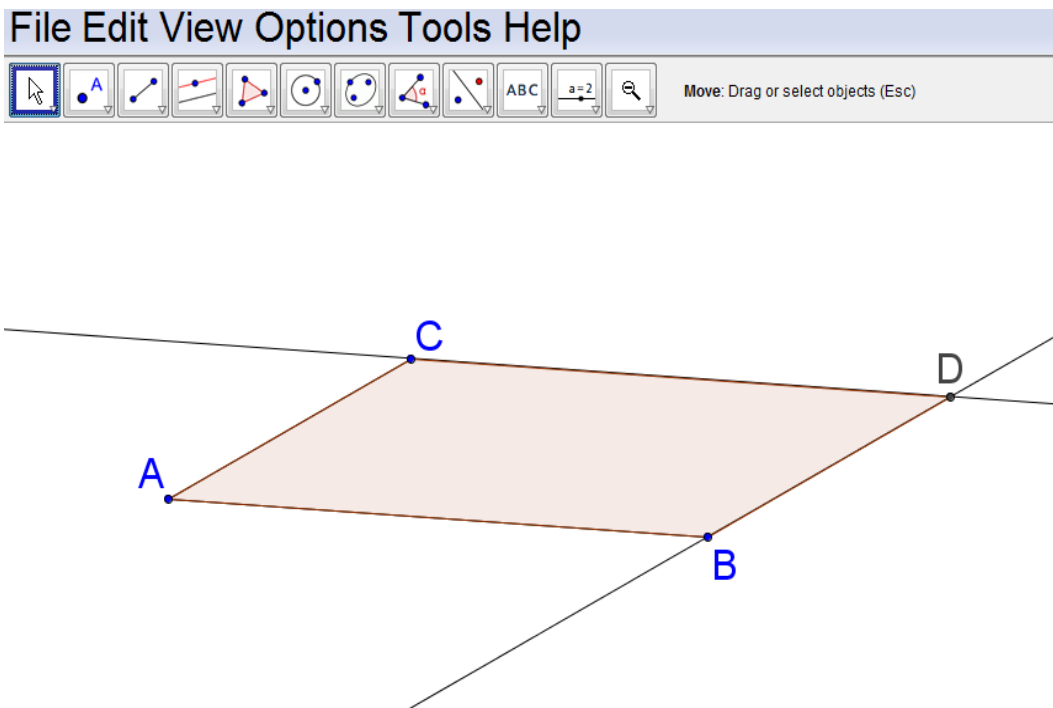
5.5 Geometry Software for Constructions

Answers

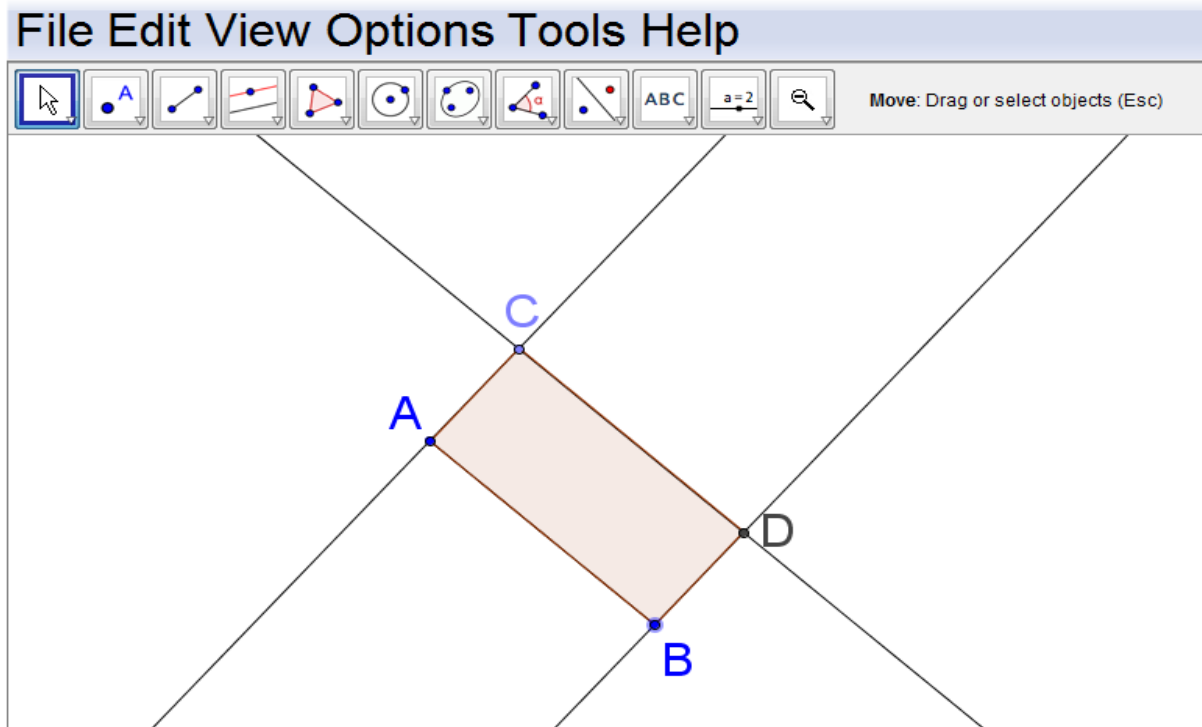
1. See Example A for help.



2. See Example B for help.

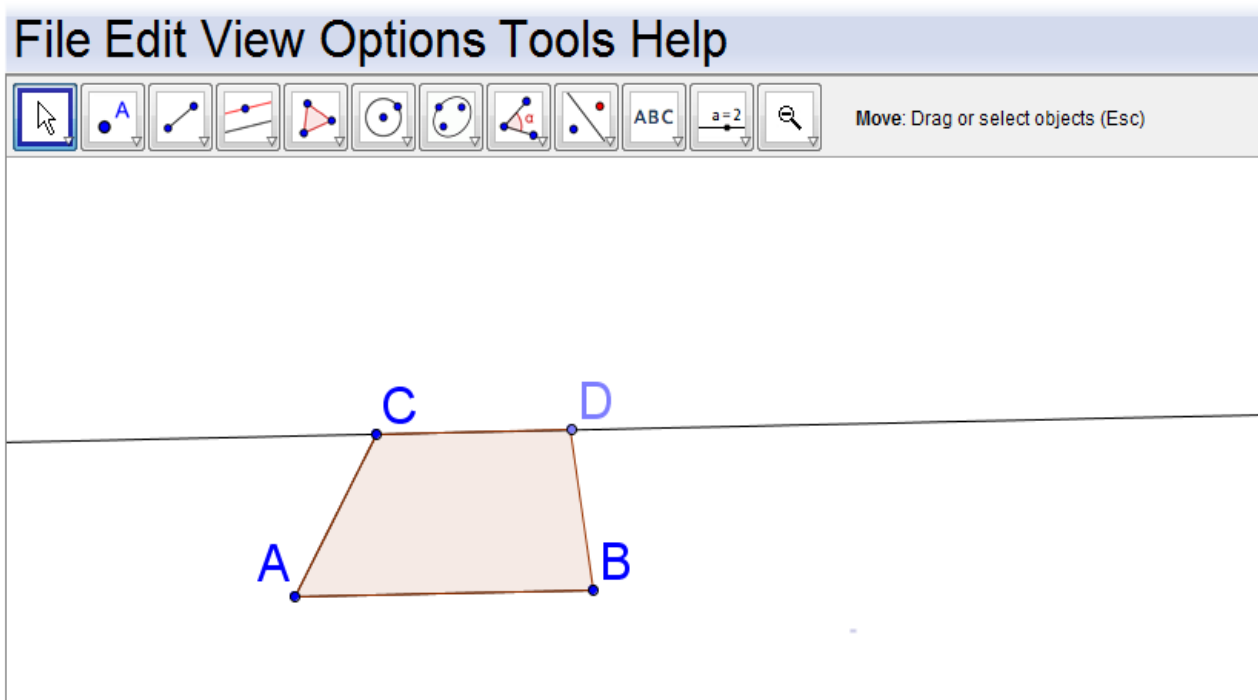


3. See Example C for help.

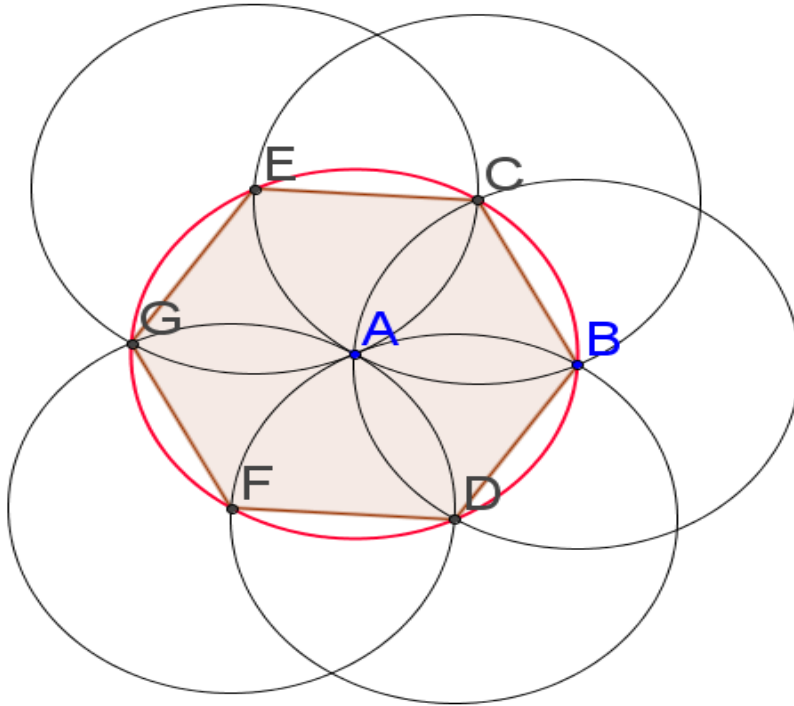


4. Answers vary. Make sure you can move all points that define the rectangle and have it stay a rectangle.

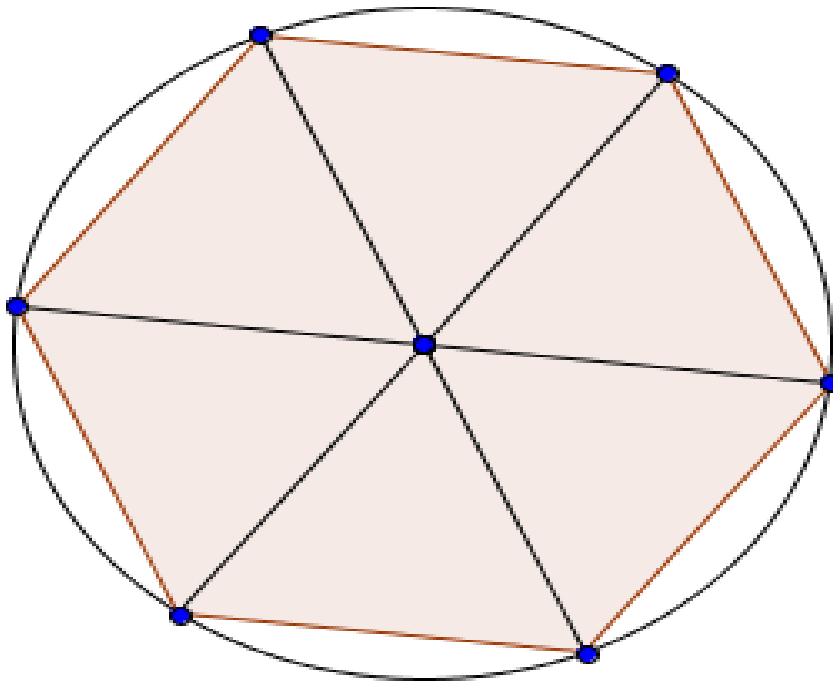
5. See guided practice #1 for help:



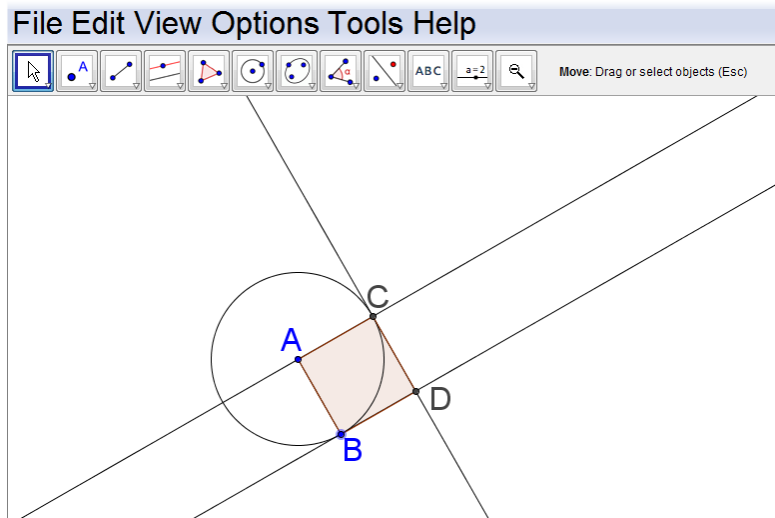
6. See guided practice #2 for help:



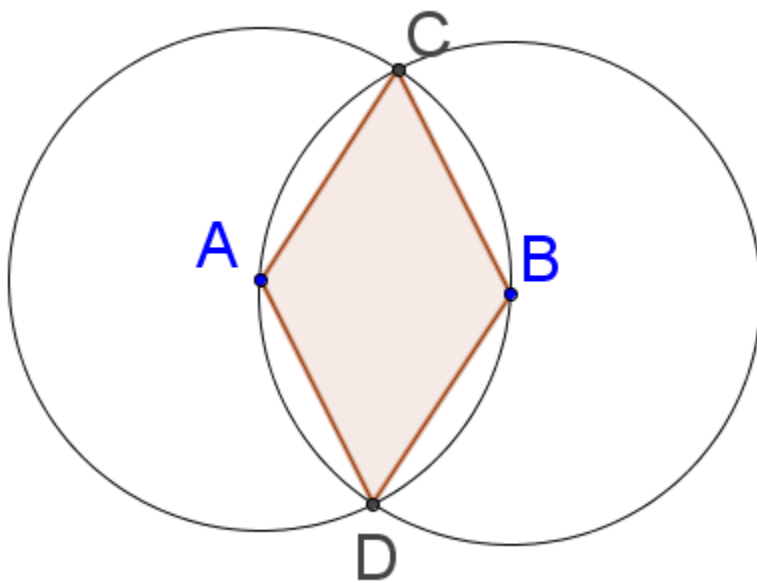
7. Repeatedly rotate the radius 60° .



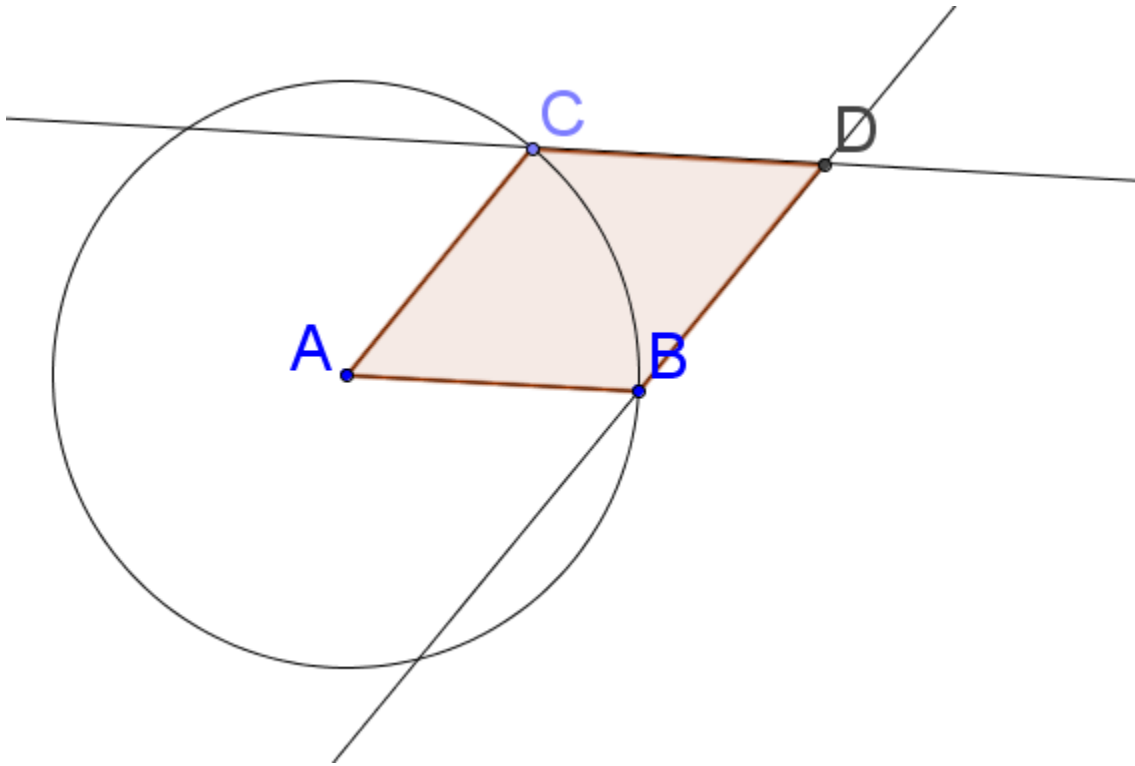
8. Answers vary.
9. $\frac{360}{10} = 36^\circ$. Repeatedly rotate the radius 36° .
10. See Concept Problem Revisited for help.



11. Answers vary. Make sure you can move any of the points that define the square and it still looks like a square.
12. Possible answer: construct two circles that each pass through each other's centers. Connect the centers and the two points of intersection to form a rhombus.



13. Possible answer: Construct a circle and two radii of the circle. Create parallel lines of the radii to form a rhombus.



14. Construct an equilateral triangle (see Example A). Construct the midpoints of each side of the triangle (use the midpoint tool). Construct a triangle within the triangle that connects the midpoints.
15. In dynamic geometry software, drawing is when you create shapes by plotting points so that the shape looks like the desired shape. When moved, the drawing will fall apart because it did not have any of the properties of the desired shape. Construction is when you consider the properties of the desired shape and create points to define the shape that will satisfy these properties.