MATHEMATICS · GRADES 7-9

Basic Constructions with a Compass and Ruler

Difficulty level: Intermediate

Mathematics: Grades 7-9

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Overview of the concept

This is how you draw exact shapes without guessing by eye. Copying a line segment or building a perfect angle with only a compass and a straight edge gives you a result you can trust. It is the foundation of technical drawing, because a shape that is only roughly right will not fit when you try to build it.

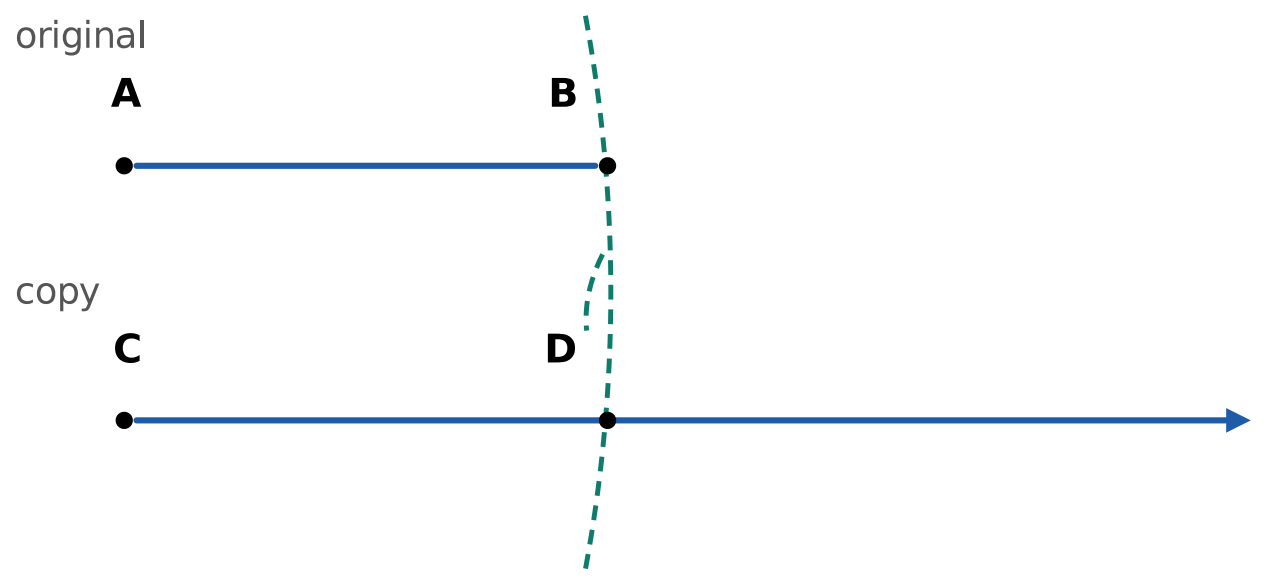


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Worked examples

EXAMPLE 1

Q Copy a line segment with a compass and ruler



SOLUTION

Draw a new ray starting at a point, longer than the original segment.

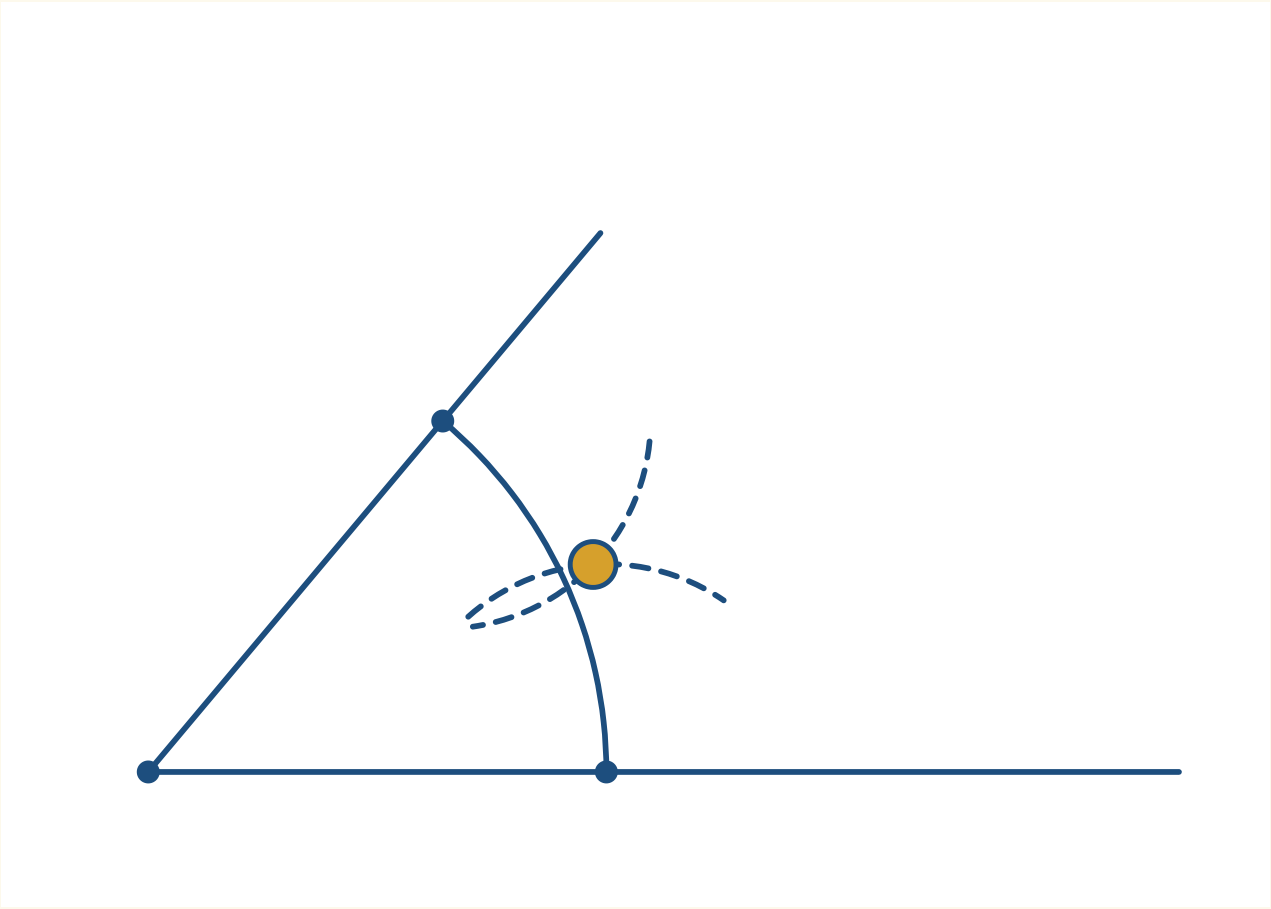
Set the compass width to the original segment, with the point on one end and the pencil on the other.

With the compass point on the ray start, mark the ray. That mark gives the copied segment.

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EXAMPLE 2

Q Bisect an angle with a compass and ruler



SOLUTION

With the compass point on the vertex, draw an arc crossing both sides of the angle.

From each crossing point, draw arcs of the same width that cross each other inside the angle.

Draw a ray from the vertex through that crossing point. It bisects the angle.

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Practice questions

1 A line segment is 6 cm long. You copy it with a compass and ruler. After you draw a new ray, what do you set the compass width to?

- **A** 6 cm, the length of the original segment
- **B** 3 cm, half the length of the original segment
- **C** 12 cm, twice the length of the original segment
- **D** 6 cm, the length of the new ray

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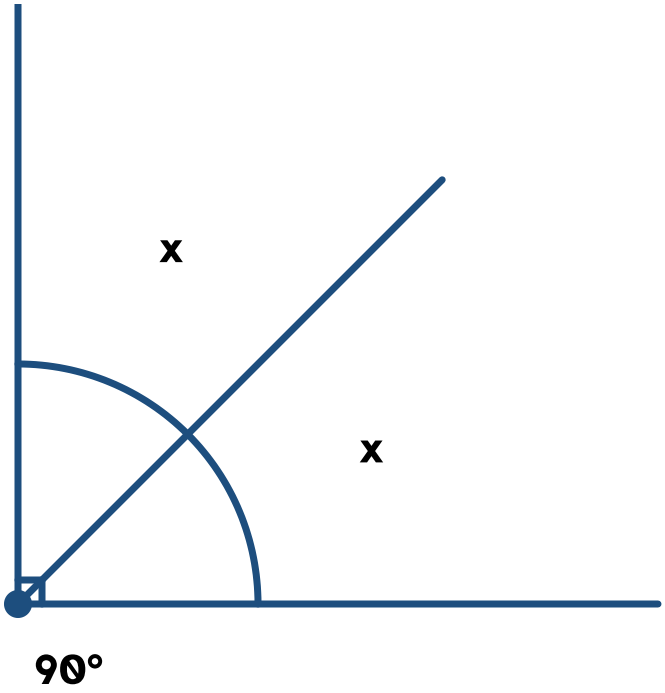
2 **You have copied a line segment with a compass and ruler. How do you mark the copied length on the new ray?**

- **A** Put the compass point on the end of the ray and mark the ray with the pencil.
- **B** Put the compass point on the start of the ray and mark the ray with the pencil.
- **C** Measure the new ray with the ruler and draw the segment.
- **D** Draw a second ray twice as long as the first.

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3 **The diagram shows a 90° angle with its bisector drawn. Bisect the angle with a compass and ruler. What size are the two angles you make?**



A 90 degrees each

B 30 degrees each

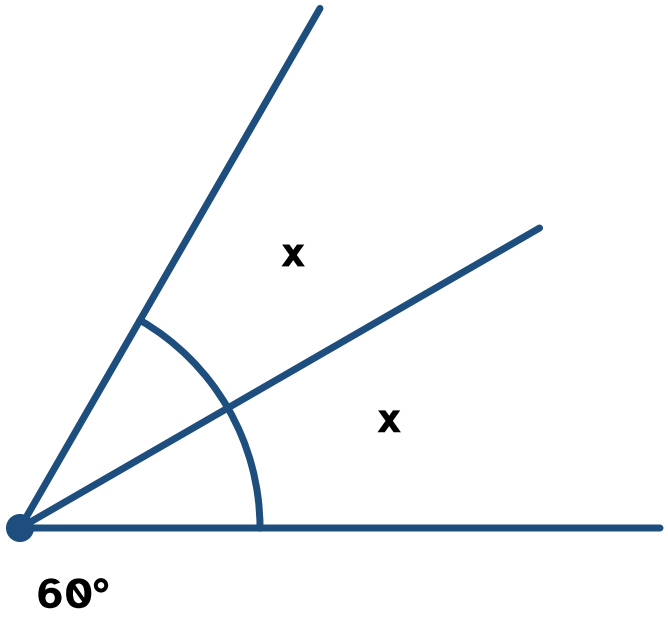
C 45 degrees each

D 60 degrees each

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4 **The diagram shows a 60° angle with its bisector drawn. Bisect the angle with a compass and ruler. Each half measures 30°. Is each half an acute angle, a right angle or an obtuse angle?**



A Acute angle

B Right angle

C Obtuse angle

D Reflex angle

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5

To bisect an angle, you first put the compass point on the vertex and draw an arc. What does the arc cross?

A Only one side of the angle

B The vertex only

C The bisector

D Both sides of the angle

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To copy a line segment, you set the compass width to the segment. Where do you put the compass point and the pencil?

A. The point and the pencil both on the same end of the segment

B. The point on one end of the segment and the pencil on the other end

C. The point in the middle of the segment and the pencil on one end

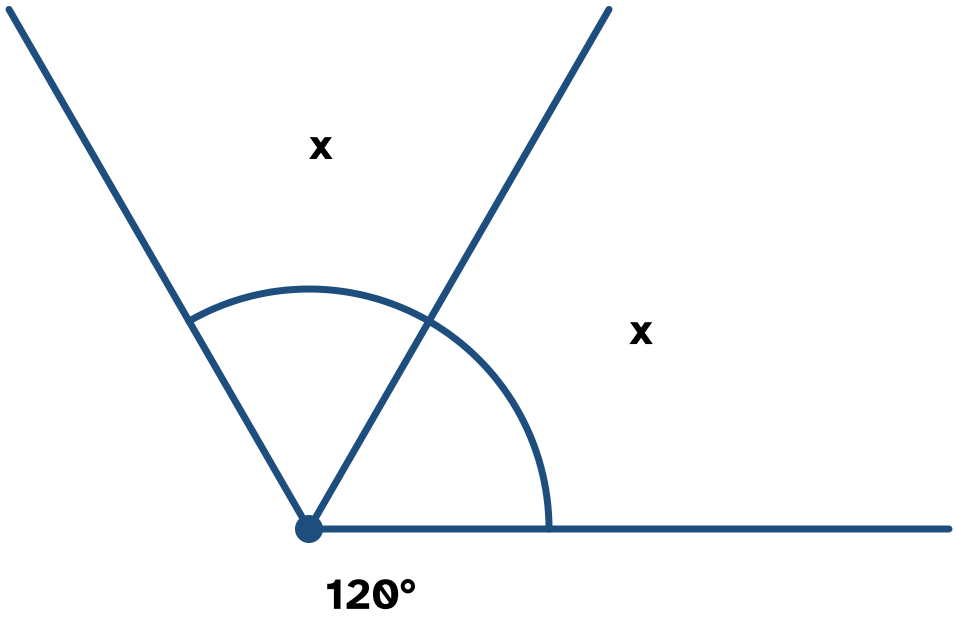
D. The point on the start of the new ray and the pencil on the end

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7 The diagram shows a 120° angle with its bisector drawn. Bisect the angle with a compass and ruler. The last step is to draw a ray from the vertex through the point where the two arcs cross. What is that ray called?



- **A** The perpendicular
- **B** The radius
- **C** The chord
- **D** The bisector

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To bisect an angle, after the first arc you draw two more arcs from the crossing points. What must be true of those two arcs?

A. They have the same width, and they cross each other inside the angle.

B. They have different widths, and they cross each other inside the angle.

C. They have the same width, and they cross each other outside the angle.

D. They have the same width, and they never cross each other.

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9

Copy a line segment 4 cm long with a compass and ruler. How long is the copied segment?

A 8 cm

B 2 cm

C 4 cm

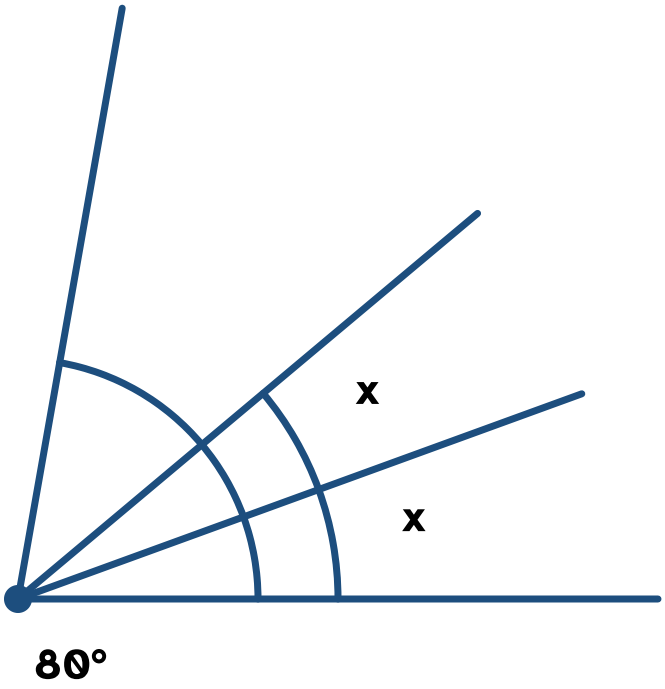
D 6 cm

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10 The diagram shows an 80° angle bisected, then one half bisected again. Bisect the angle with a compass and ruler, then bisect one of the halves again. What size are the smallest angles you make?



A 40 degrees each

B 20 degrees each

C 80 degrees each

D 10 degrees each

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ANSWER KEY

1. 6

cm, the length of the original segment

2. Put the compass point on the start of the ray and mark the ray with the pencil.

3. 45 degrees each

4. Acute angle

5. Both sides of the angle

6. The point on one end of the segment and the pencil on the other end

7. The bisector

8. They have the same width, and they cross each other inside the angle.

9. 4 cm

10. 20 degrees each

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