

# Points, Segments and Angles: Core Definitions

Grade 10 – Geometry math · Worksheet · Standards: G-CO.A.1

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Class: \_\_\_\_\_

These problems train precise geometric vocabulary and the habit of turning a diagram into an equation. They cover segment and angle addition, midpoints, bisectors, complementary and supplementary angles, linear pairs and vertical angles, all within standard G-CO.A.1. Problems climb from one-step measures to multi-step word situations with algebraic expressions. Sketch each figure and label what is given before solving.

**Standards:** G-CO.A.1 · **Level:** Grade 10 Geometry

## Problem 1 Adding two segments (easy)

Point  $Q$  lies between  $P$  and  $R$  on a line. Find  $PR$ .



Figure for Problem 1.

## Problem 2 Finding a midpoint length (easy)

$M$  is the midpoint of  $RS$ , and  $RM = 18.6$  centimeters. Find  $MS$  and  $RS$ .

## Problem 3 Complement and supplement (easy)

Find the complement and the supplement of a  $37^\circ$  angle.

## Problem 4 Angles in a linear pair (easy)

$\angle AOB$  and  $\angle BOC$  form a linear pair, and  $m\angle AOB = 118^\circ$ . Find  $m\angle BOC$ .

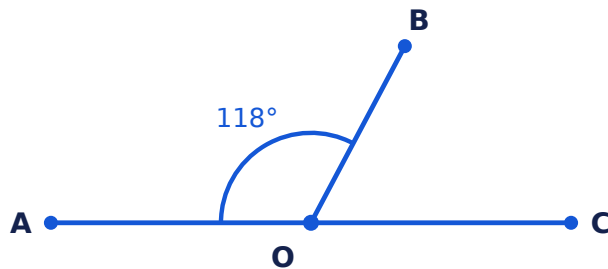


Figure for Problem 4.

### Problem 5 Vertical angles (easy)

Two lines cross at  $O$ .  $\angle POR$  measures  $74^\circ$ . Find the measure of its vertical angle and of each of the other two angles.

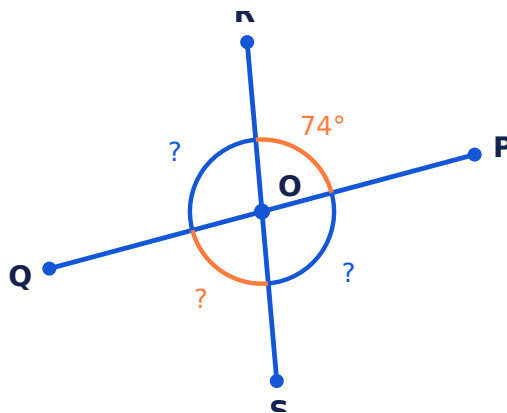


Figure for Problem 5.

### Problem 6 Segment addition with algebra (medium)

$B$  is between  $A$  and  $C$ , with  $AB = 3x + 2$ ,  $BC = 5x - 7$  and  $AC = 51$ . Find  $x$ ,  $AB$  and  $BC$ .

### Problem 7 Angle addition with algebra (medium)

Ray  $OB$  lies inside  $\angle AOC$ . If  $m\angle AOB = (2x + 10)^\circ$ ,  $m\angle BOC = (3x - 8)^\circ$  and  $m\angle AOC = 112^\circ$ , find  $x$  and both smaller angles.

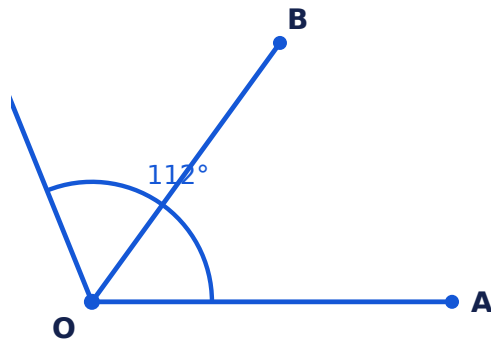


Figure for Problem 7.

### Problem 8 Angle bisector equation (medium)

Ray  $OB$  bisects  $\angle AOC$ . If  $m\angle AOB = (4x + 3)^\circ$  and  $m\angle BOC = (6x - 17)^\circ$ , find  $x$  and  $m\angle AOC$ .

### Problem 9 Midpoint on a number line (medium)

Points  $D$  and  $E$  are located at  $-7$  and  $12$  on a number line. Find the coordinate of the midpoint of  $DE$  and the length of  $DE$ .



Figure for Problem 9.

### Problem 10 A supplement and a complement (medium)

The supplement of an angle measures  $25^\circ$  more than 3 times the angle's complement. Find the angle.

### Problem 11 Vertical angles with algebra (medium)

Two vertical angles measure  $(5x - 12)^\circ$  and  $(3x + 22)^\circ$ . Find  $x$ , the common measure, and the measure of each angle that forms a linear pair with them.

### Problem 12 Linear pair with algebra (medium)

Two angles form a linear pair and measure  $(7x + 9)^\circ$  and  $(5x + 15)^\circ$ . Find both angles.

**Problem 13 A right angle split in two** (medium)

Line  $BA$  is perpendicular to line  $BD$ , and ray  $BC$  lies inside  $\angle ABD$ . If  $m\angle ABC = (2x + 7)^\circ$  and  $m\angle CBD = (3x - 2)^\circ$ , find both angles.

**Problem 14 Always, sometimes or never** (medium)

Decide whether each statement is always, sometimes or never true. Justify each answer in one sentence.

- Two lines in the same plane that do not intersect are parallel.
- Three points are collinear.
- A ray has a midpoint.
- Two vertical angles are supplementary.

**Problem 15 Hiking trail midpoint** (hard)

On a straight trail, the trailhead  $T$ , a lookout  $L$  and a campsite  $C$  appear in that order.  $TL = 2.4$  miles and  $LC = 1.75$  miles. A water fountain  $W$  sits at the midpoint of  $TC$ . Find  $TC$ , then find how far the fountain is from the lookout and say which side of the lookout it is on.

**Problem 16 Robot sensor beam** (hard)

Two walls meet at corner  $O$  and form  $\angle AOC = 128^\circ$ . A robot at  $O$  aims a sensor along ray  $OB$ , which bisects  $\angle AOC$ . It then turns toward the wall  $OC$  and stops at ray  $OD$ , where  $m\angle BOD = 19^\circ$ . Find  $m\angle AOB$  and  $m\angle DOC$ .

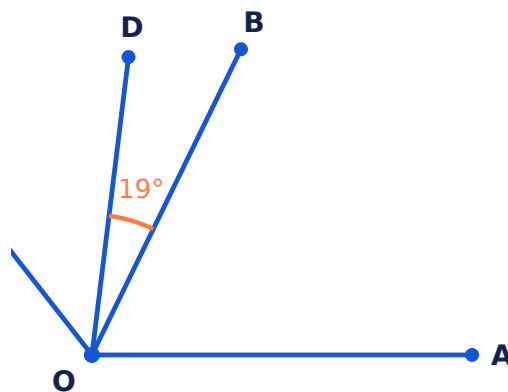


Figure for Problem 16.

**Problem 17 Four collinear points** (hard)

Points  $A$ ,  $B$ ,  $C$  and  $D$  lie on a line in that order.  $AB = x$ ,  $BC = 2x - 4$ ,  $CD = x + 10$  and  $AD = 62$ . Point  $M$  is the midpoint of  $AD$ . Find  $x$  and each segment length, and state whether  $M$  lies

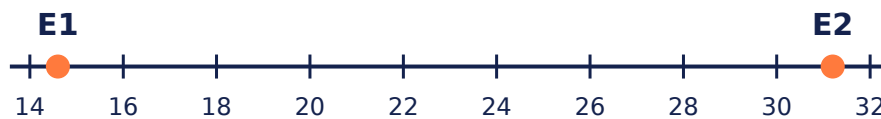
between  $B$  and  $C$ .

### Problem 18 Linear pair, vertical angles, bisector (hard)

Two lines cross at  $O$ .  $\angle 1 = (3x + 5)^\circ$  and its neighbor  $\angle 2 = (2x + 15)^\circ$  form a linear pair.  $\angle 3$  is vertical to  $\angle 1$  and  $\angle 4$  is vertical to  $\angle 2$ . Find all four angles. Then find the measure of each piece when a ray bisects  $\angle 2$ .

### Problem 19 Highway mile markers (hard)

Exit 1 is at mile marker 14.6 and Exit 2 is at mile marker 31.2 on a straight highway. A rest stop is exactly halfway between the exits. A gas station is 3.5 miles past the rest stop toward Exit 2. Find the mile marker of the rest stop and the distance from the gas station to Exit 2.



*Mile markers for Problem 19.*

### Problem 20 Bisector on a straight angle (hard)

Points  $A$ ,  $O$  and  $D$  lie on a line. Ray  $OC$  bisects  $\angle BOD$ . If  $m\angle AOB = (4x - 6)^\circ$  and  $m\angle BOC = (x + 18)^\circ$ , find  $x$  and all three angles.