

Geometry - Geometric Constructions - Answer Key

Common Core G-CO.D.12, G-CO.D.13 · maths-pdf.fr/en/

Use this answer key to check the 20 problems on constructions. Every solution shows the formula or theorem used, each step of the work, and the final answer in bold. If an answer differs from yours, compare the steps line by line to find where the work changed.

Geometry · Common Core State Standards: **G-CO.D.12, G-CO.D.13**

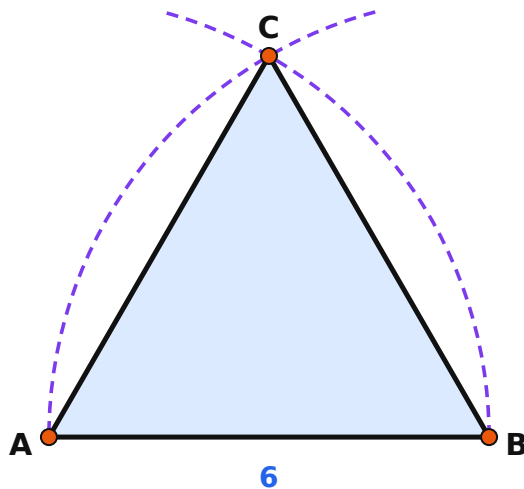
Exercise 1 - Compass and straightedge

The compass draws circles and arcs with a fixed radius and copies lengths.

The straightedge draws a straight line through two points but does not measure.

Compass: arcs and equal lengths; straightedge: lines

Exercise 2 - Equilateral triangle sides



All three sides are 6 cm.

Each arc has radius AB, so $AC = BC = AB = 6$ cm.

$$3 \cdot 6 = 18$$

AC = BC = 6 cm; perimeter 18 cm

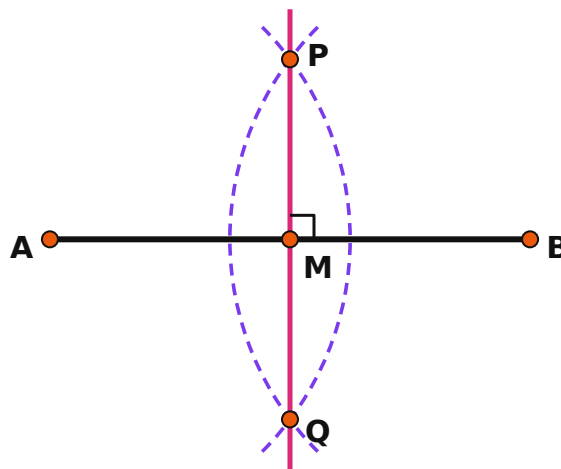
Exercise 3 - Choose the radius

Half of the segment is 7 cm. The arcs only cross if the radius is greater than 7 cm.

At 5 cm the arcs do not reach each other, and at exactly 7 cm they touch at one point on the segment.

8 cm

Exercise 4 - Point on the bisector



$$PA = PB = 11.$$

Points on the perpendicular bisector are equidistant from A and B.

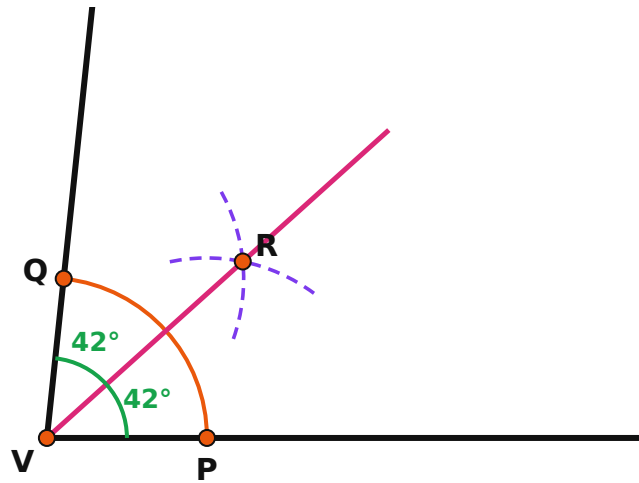
$$2x+1=3x-4$$

$$x=5$$

$$PA = 2(5)+1=11$$

$$\mathbf{x = 5; PA = 11}$$

Exercise 5 - Bisect an angle



Each half is 42 degrees.

$$84^{\circ} \div 2 = 42^{\circ}$$

42° each

Exercise 6 - Bisector with x

$$8x+4=2(3x+12)$$

$$8x+4=6x+24$$

$$x=10$$

$$8(10)+4=84^{\circ}$$

x = 10; 84°

Exercise 7 - Angles from 60 degrees

$$60^{\circ} \div 2 = 30^{\circ}, \text{ then } 30^{\circ} \div 2 = 15^{\circ}.$$

30°, then 15°

Exercise 8 - Add constructed angles

Bisect the 60° angle twice to get 15°, then place the 15° angle next to a 60° angle:

$$60^{\circ} + 15^{\circ} = 75^{\circ}.$$

60° + 15°

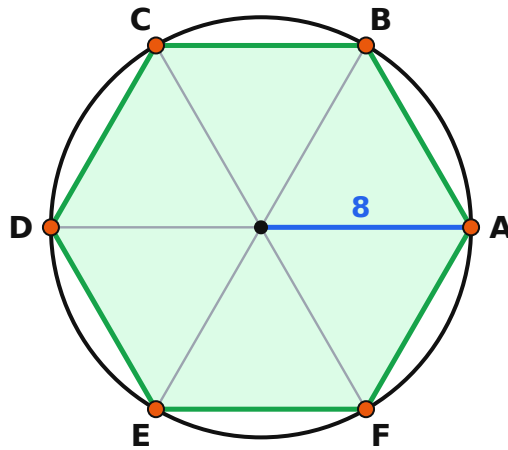
Exercise 9 - Inscribed equilateral triangle

$6\sqrt{3}$ cm.

Check: the chord subtends 120° at the center, so half of it is $6\sin 60^\circ = 3\sqrt{3}$.

$6\sqrt{3}$ cm, about 10.39 cm

Exercise 10 - Hexagon in a circle



Each side is 8 cm.

The side of an inscribed regular hexagon equals the radius.

$$6 \cdot 8 = 48$$

Side 8 cm; perimeter 48 cm

Exercise 11 - Square in a circle

The diagonal is the diameter, 10 inches.

$$s\sqrt{2} = 10, \text{ so } s = 5\sqrt{2}.$$

$$\text{Area } (5\sqrt{2})^2 = 50.$$

Side $5\sqrt{2}$ in; area 50 sq in

Exercise 12 - Order the steps

First arcs from A (c), then arcs from B (b), then line PQ (a).

c, b, a

Exercise 13 - Copy an angle for parallels

Congruent corresponding angles prove the lines are parallel.

The same-side interior angle is supplementary to the copied angle: $180^\circ - 58^\circ = 122^\circ$.

Corresponding angles are congruent; 122°

Exercise 14 - Why the bisector works

AM = 7 and AP = 9, and the triangle AMP has a right angle at M.

$$PM = \sqrt{9^2 - 7^2} = \sqrt{32} = 4\sqrt{2}$$

$$\mathbf{PM = 4\sqrt{2}}$$

Exercise 15 - Bisector proof by SSS

VP = VQ, PR = QR and VR = VR (shared), so the triangles are congruent by SSS.

By CPCTC, $\angle PVR = \angle QVR$, so VR bisects the angle.

SSS; the two angles at V are congruent

Exercise 16 - Perpendicular bisector equation

Midpoint: (2,4). Slope of AB: $\frac{6-2}{5-(-1)} = \frac{2}{3}$, so the perpendicular slope is $-\frac{3}{2}$.

$$y - 4 = -\frac{3}{2}(x - 2), \text{ so } y = -\frac{3}{2}x + 7.$$

$$\mathbf{y = -3/2 x + 7}$$

Exercise 17 - Paver pattern

The distance across is a diameter: $2 \cdot 8 = 16$ inches.

The side equals the radius, so the perimeter is $6 \cdot 8 = 48$ inches.

16 in; 48 in

Exercise 18 - Equal distance from two gates

The bench is equidistant from A and B, so it is 130 yards from B.

$$PM = \sqrt{130^2 - 50^2} = \sqrt{14400} = 120.$$

130 yards from B; 120 yards from M

Exercise 19 - Rug design

The diagonal is 12 feet, so $s = \frac{12}{\sqrt{2}} = 6\sqrt{2}$ feet.

Square area: $(6\sqrt{2})^2 = 72$ square feet.

Rug area: $\pi \cdot 6^2 = 36\pi = 113.04$, so the square covers about $\frac{72}{113.04} = 0.64$ or 64%.

Side $6\sqrt{2}$ ft; area 72 sq ft; about 64% of the rug

Exercise 20 - Copy a segment

Each mark is one copy of AB further along the ray.

$$3 \cdot 7.5 = 22.5$$

22.5 cm