

Angles and Geometric Constructions: practice solutions, Grade 7 – download the PDF

Written solutions to the chapter problems. Check each step, then correct yourself.

1 Complement and supplement



Complement: $90 - 38 = 52$, so 52° .

Supplement: $180 - 38 = 142$, so 142° .

The complement of 38° is 52° and its supplement is 142° .

2 Sorting pairs



a. $18 + 72 = 90$: complementary.

b. $110 + 70 = 180$: supplementary.

c. $44 + 47 = 91$: neither.

d. $120 + 60 = 180$: supplementary.

3 Crossing lines



Angle b is vertical to the 72° angle, so $b = 72^\circ$.

Angle a forms a linear pair with the 72° angle: $a = 180 - 72 = 108^\circ$.

Angle c is vertical to a , so $c = 108^\circ$.

Answer: $a = 108^\circ$, $b = 72^\circ$, $c = 108^\circ$.

4 Can it be a triangle?



a. $5 + 6 = 11 > 10$: yes.

b. $2 + 3 = 5 < 7$: no.

c. $8 + 8 = 16 > 15$: yes.

d. $4 + 9 = 13$, which is not greater than 13: no, the triangle would be flat.

5 Name the cross section



a. A square, the same size as the face.

b. A circle.

c. A circle.

d. A triangle.

6 Angles on a line



Angles on a straight line add up to 180° .

$40 + 75 + x = 180$, so $115 + x = 180$ and $x = 65$.

The angle x measures 65° .

7 The leaning ladder



The wall and the ground meet at 90° , so the two angles of the ladder are complementary.

$$90 - 74 = 16.$$

The ladder makes a 16° angle with the wall.

8 A supplementary equation



$(x + 14) + (2x - 5) = 180$, so $3x + 9 = 180$ and $3x = 171$, thus $x = 57$.

The angles are $57 + 14 = 71$ and $2(57) - 5 = 109$, so 71° and 109° .

Check: $71 + 109 = 180$.

9 Vertical angles with variables



Vertical angles are equal: $4x - 7 = 2x + 21$, so $2x = 28$ and $x = 14$.

The angle is $4(14) - 7 = 49$. Check: $2(14) + 21 = 49$.

Each angle measures 49° .

10 One angle four times the other



Let the smaller angle be x . Then $x + 4x = 180$, so $5x = 180$ and $x = 36$.

The angles are 36° and $4(36) = 144^\circ$.

11 Twenty degrees more



Let the smaller angle be x ; the larger is $x + 20$. Then $2x + 20 = 90$, so $x = 35$.

The angles are 35° and 55° .

Check: $35 + 55 = 90$ and $55 - 35 = 20$.

12 Range for the third side



$s < 9 + 14 = 23$ and $s > 14 - 9 = 5$, so $5 < s < 23$

The whole numbers are $6, 7, \dots, 22$. That is $22 - 6 + 1 = 17$ values.

13 Craft sticks



The third length must satisfy $|12 - 7| < s < 12 + 7$

4 cm: no. 6 cm: yes. 18 cm: yes. 19 cm: no, because $12 + 7 = 19$ is not greater than 19.

Dana can use 6 cm or 18 cm.

14 How many triangles?



- a. $5 + 5 = 10 < 12$: no triangle.
- b. $6 + 8 = 14 > 10$: exactly one triangle.
- c. The angles add up to 180° but no length is given: many triangles of different sizes.
- d. Two sides and the included angle: exactly one triangle.

15 Slicing a box



A cut parallel to a face gives a rectangle congruent to that face.

- a. $10 \times 6 = 60 \text{ in}^2$.
- b. $6 \times 4 = 24 \text{ in}^2$.

16 A linear pair in a crossing



The angles form a linear pair: $(2x + 10) + (3x + 20) = 180$, so $5x + 30 = 180$ and $x = 30$.

The angles are $2(30) + 10 = 70$ and $3(30) + 20 = 110$. Check: $70 + 110 = 180$.

The vertical angle of the first one is also 70° .

17 Three angles on a line



The sum is 180: $(x + 10) + (2x - 15) + (3x + 5) = 180$, so $6x = 180$ and $x = 30$.

The angles are 40° , $2(30) - 15 = 45^\circ$ and $3(30) + 5 = 95^\circ$.

Check: $40 + 45 + 95 = 180$.

18 Complement and supplement together



Let the angle be a . Then $90 - a = \frac{180 - a}{4}$. Multiply by 4: $360 - 4a = 180 - a$, so $180 = 3a$ and $a = 60$.

Check: complement 30° , supplement 120° , and $120 \div 4 = 30$.

The angle measures 60° .

19 Three times the complement



$180 - a = 3(90 - a)$, so $180 - a = 270 - 3a$ and $2a = 90$, thus $a = 45$.

Check: supplement 135° , complement 45° , and $3 \times 45 = 135$.

The angle measures 45° .

20 Sides with a variable



$x + (x + 3) > 2x + 1$ gives $2x + 3 > 2x + 1$, which is always true.

$x + (2x + 1) > x + 3$ gives $3x + 1 > x + 3$, so $2x > 2$ and $x > 1$.

$(x + 3) + (2x + 1) > x$ gives $3x + 4 > x$, true for positive x .

So $x > 1$; the smallest whole number is $x = 2$, with sides 2 cm, 5 cm and 5 cm. Check:
 $2 + 5 > 5$.

21 Construction plan



a. $180 - 50 - 60 = 70$, so the third angle is 70° .

b. Draw $AB = 8$ cm. With the protractor centered on A , mark 50° and draw a ray. Center it on B , mark 60° from side BA and draw a ray. Point C is where the rays cross.

c. Yes: two angles and the included side determine exactly one triangle.

22 Slicing a cone



Halfway up, the radius is $5 \div 2 = 2.5$ cm.

Area = $\pi r^2 = \pi(2.5)^2 = 6.25\pi \approx 19.6$ cm².

The cross section is a circle of radius 2.5 cm and area about 19.6 cm².

23 The garden fence



Triangle inequality: $15 + 8 > s$

Fence limit: $15 + 8 + s \leq 40$, so $s \leq 17$.

Therefore $8 \leq s \leq 17$, which gives $17 - 8 + 1 = 10$ possible lengths.



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