



Basic angle rules

Mana Maths

Te reo Māori terms



koi

point

Open in Te Aka

hurihanga

full revolution

Open in Te Aka

tākiri

degree

Open in Te Aka

koki hāngai

angle

Open in Te Aka

Angle Rules - Line and Point



Key idea

Angles on a **straight line** add to 180° .

Angles **around a point** add to 360° .

On a line

One angle is 65° , so the other is $180^\circ - 65^\circ = 115^\circ$.

Around a point

Four equal angles around a point are each $360^\circ \div 4 = 90^\circ$.

Common mistake

Do not mix them up: a line is 180° , a full turn around a point is 360° .

 = **copy this into your book.** Boxes without a pencil are just to read.

Vertically Opposite Angles



Key idea

When two straight lines cross, the angles **opposite** each other are **equal**.

Example

One angle is 75° , so the angle opposite it is also 75° .
Each angle next to it is $180^\circ - 75^\circ = 105^\circ$.

Common mistake

Opposite angles are **equal**, not 180° apart.

Copy the same value across — do not subtract from 180° .



= copy this into your book. Boxes without a pencil are just to read.



Angles in a Triangle



Key idea

The three angles **inside a triangle** add to 180° .

Example

A triangle has angles 50° , 60° and x .

$$50 + 60 + x = 180, \text{ so } x = 70^\circ.$$

Common mistake

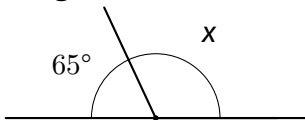
A triangle is 180° , not 360° .
Ask first: line, full point, or triangle?

 = **copy this into your book.** Boxes without a pencil are just to read.

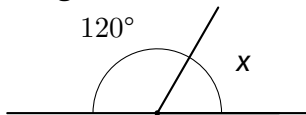
Angles on a Straight Line



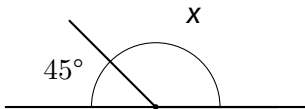
1. Find angle x .



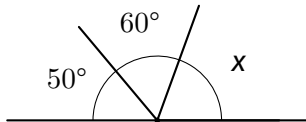
2. Find angle x .



3. Find angle x .



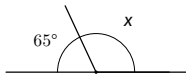
4. Find angle x .



Angles on a Straight Line – Answers



1. Find angle x .

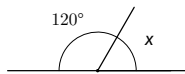


Solution

$$x = 180^\circ - 65^\circ$$

$$x = 115^\circ$$

2. Find angle x .

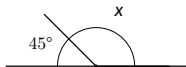


Solution

$$x = 180^\circ - 120^\circ$$

$$x = 60^\circ$$

3. Find angle x .

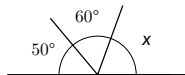


Solution

$$x = 180^\circ - 45^\circ$$

$$x = 135^\circ$$

4. Find angle x .



Solution

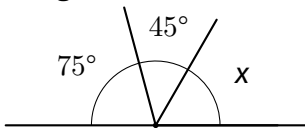
$$x = 180^\circ - 50^\circ - 60^\circ$$

$$x = 70^\circ$$

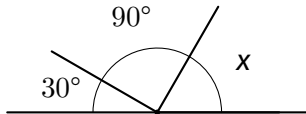
Angles on a Straight Line



5. Find angle x .



6. Find angle x .



7. What is the sum of all angles on a straight line?

8. Two angles on a line are equal and both are 90° . What is the third angle?

Angles on a Straight Line — Answers



5. Find angle x .

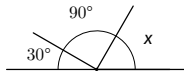


Solution

$$x = 180^\circ - 75^\circ - 45^\circ$$

$$x = 60^\circ$$

6. Find angle x .



Solution

$$x = 180^\circ - 30^\circ - 90^\circ$$

$$x = 60^\circ$$

7. What is the sum of all angles on a straight line?

Solution

Angles on a straight line
sum to 180° .

8. Two angles on a line are equal and both are 90° . What is the third angle?

Solution

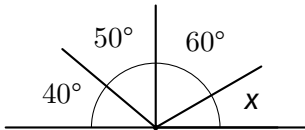
$$90^\circ + 90^\circ = 180^\circ$$

$$\text{Third angle} = 0^\circ$$

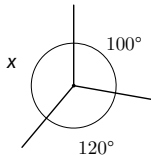
Straight Line & Around a Point



9. Find angle x .



10. Find angle x .



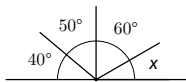
11. Angles around a point are 85° , 95° , and x . Find x .

12. Angles around a point are 70° , 110° , and x . Find x .

Straight Line & Around a Point — Answers



9. Find angle x .

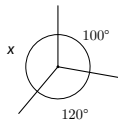


Solution

$$x = 180^\circ - 150^\circ$$

$$x = 30^\circ$$

10. Find angle x .



Solution

$$x = 360^\circ - 220^\circ$$

$$x = 140^\circ$$

11. Angles around a point are 85° , 95° , and x . Find x .

Solution

$$x = 360^\circ - 180^\circ$$

$$x = 180^\circ$$

12. Angles around a point are 70° , 110° , and x . Find x .

Solution

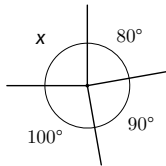
$$x = 360^\circ - 180^\circ$$

$$x = 180^\circ$$

Angles Around a Point



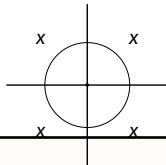
13. Find angle x .



14. Angles around a point are 60° , 60° , 60° , and x . Find x .

15. What is the sum of all angles around a point?

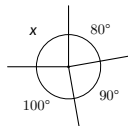
16. Four equal angles around a point. Find each angle.



Angles Around a Point — Answers



13. Find angle x .



Solution

$$x = 360^\circ - 270^\circ$$

$$x = 90^\circ$$

14. Angles around a point are 60° , 60° , 60° , and x . Find x .

Solution

$$x = 360^\circ - 180^\circ$$

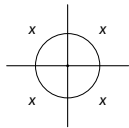
$$x = 180^\circ$$

15. What is the sum of all angles around a point?

Solution

Angles around a point sum to 360° .

16. Four equal angles around a point. Find each angle.



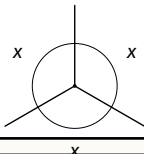
Solution

$$\begin{aligned}\text{Each} &= 360^\circ \div 4 \\ &= 90^\circ\end{aligned}$$

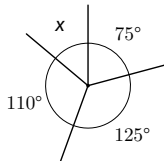
Around a Point & Vertically Opposite



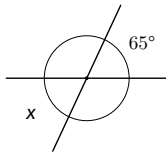
17. Three equal angles around a point. Find each angle.



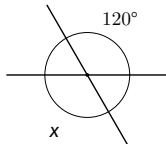
18. Find angle x .



19. Two lines cross. Find angle x .



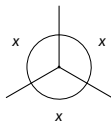
20. Two lines cross. Find angle x .



Around a Point & Vertically Opposite – Answers



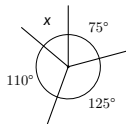
17. Three equal angles around a point. Find each angle.



Solution

$$\begin{aligned}\text{Each} &= 360^\circ \div 3 \\ &= 120^\circ\end{aligned}$$

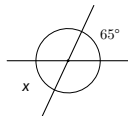
18. Find angle x .



Solution

$$\begin{aligned}x &= 360^\circ - 310^\circ \\ x &= 50^\circ\end{aligned}$$

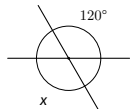
19. Two lines cross. Find angle x .



Solution

$$\begin{aligned}\text{Vertically opposite:} \\ x &= 65^\circ\end{aligned}$$

20. Two lines cross. Find angle x .



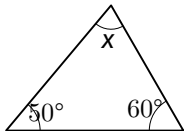
Solution

$$\begin{aligned}\text{Vertically opposite:} \\ x &= 120^\circ\end{aligned}$$

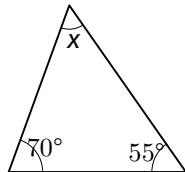
Angles in a Triangle



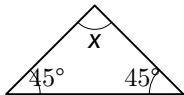
21. Find angle x in the triangle.



22. Find angle x in the triangle.



23. Find angle x in the triangle.

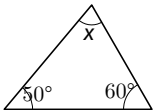


24. What is the sum of all angles in a triangle?

Angles in a Triangle – Answers



21. Find angle x in the triangle.

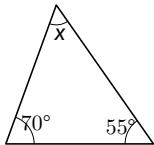


Solution

$$x = 180^\circ - 50^\circ - 60^\circ$$

$$x = 70^\circ$$

22. Find angle x in the triangle.

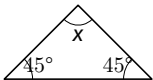


Solution

$$x = 180^\circ - 70^\circ - 55^\circ$$

$$x = 55^\circ$$

23. Find angle x in the triangle.



Solution

$$x = 180^\circ - 45^\circ - 45^\circ$$

$$x = 90^\circ$$

24. What is the sum of all angles in a triangle?

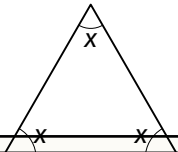
Solution

Angles in a triangle
sum to 180° .

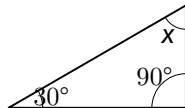
Triangles & Vertically Opposite



25. An equilateral triangle has all angles equal. Find each angle.



26. Find angle x in the triangle.



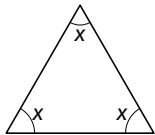
27. Vertically opposite angles are always...

A. equal B. supplementary C. complementary

Triangles & Vertically Opposite – Answers



25. An equilateral triangle has all angles equal. Find each angle.



Solution

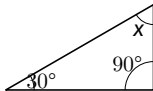
$$\begin{aligned}\text{Each} &= 180^\circ \div 3 \\ &= 60^\circ\end{aligned}$$

27. Vertically opposite angles are always... A, B, or C?

Solution

A. equal

26. Find angle x in the triangle.



Solution

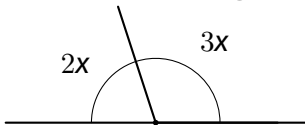
$$x = 180^\circ - 30^\circ - 90^\circ$$

$$x = 60^\circ$$

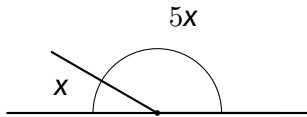
Angles on a Straight Line



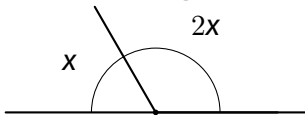
- 1.** Two angles on a line are in the ratio $2 : 3$. Find both angles.



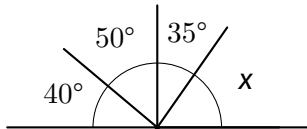
- 2.** Two angles on a line are in the ratio $1 : 5$. Find both angles.



- 3.** One angle on a line is twice the other. Find both angles.



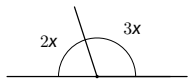
- 4.** Four angles on a line are 40° , 50° , 35° , and x . Find x .



Angles on a Straight Line – Answers



1. Two angles on a line are in the ratio 2 : 3. Find both angles.

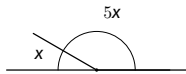


Solution

$$5x = 180^\circ$$

$$x = 36^\circ: 72^\circ, 108^\circ$$

2. Two angles on a line are in the ratio 1 : 5. Find both angles.

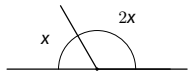


Solution

$$6x = 180^\circ$$

$$x = 30^\circ: 30^\circ, 150^\circ$$

3. One angle on a line is twice the other. Find both angles.

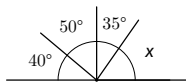


Solution

$$3x = 180^\circ$$

$$x = 60^\circ: 60^\circ, 120^\circ$$

4. Four angles on a line are 40° , 50° , 35° , and x . Find x .



Solution

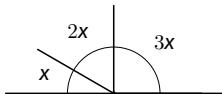
$$x = 180^\circ - 125^\circ$$

$$x = 55^\circ$$

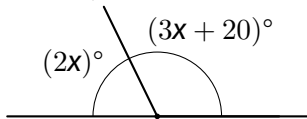
Angles on a Straight Line



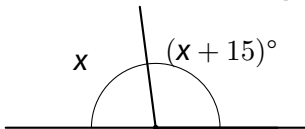
- 5.** Three angles on a line are in the ratio $1 : 2 : 3$. Find the largest angle.



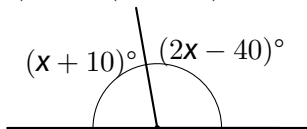
- 6.** Two angles on a line are $(2x)^\circ$ and $(3x + 20)^\circ$. Find x .



- 7.** An angle on a line is 15° more than another. Find both angles.



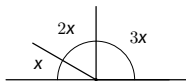
- 8.** Two angles on a line are $(x + 10)^\circ$ and $(2x - 40)^\circ$. Find x .



Angles on a Straight Line — Answers



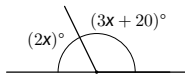
5. Three angles on a line are in the ratio 1 : 2 : 3. Find the largest angle.



Solution

$$6x = 180^\circ, x = 30^\circ$$
$$\text{largest} = 90^\circ$$

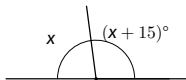
6. Two angles on a line are $(2x)^\circ$ and $(3x + 20)^\circ$. Find x .



Solution

$$5x + 20 = 180^\circ$$
$$x = 32^\circ$$

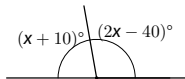
7. An angle on a line is 15° more than another. Find both angles.



Solution

$$2x + 15 = 180^\circ$$
$$x = 82.5^\circ:$$
$$82.5^\circ, 97.5^\circ$$

8. Two angles on a line are $(x + 10)^\circ$ and $(2x - 40)^\circ$. Find x .



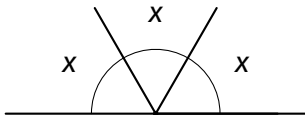
Solution

$$3x - 30 = 180^\circ$$
$$x = 70^\circ$$

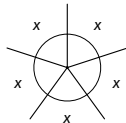
Straight Line & Around a Point



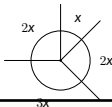
- 9.** Three angles on a line are equal. Find each angle.



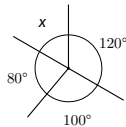
- 10.** Five angles around a point are all equal. Find each angle.



- 11.** Angles around a point are in the ratio $1 : 2 : 3 : 2$. Find the largest angle.



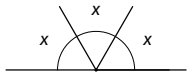
- 12.** Angles around a point are 120° , 100° , 80° , and x . Find x .



Straight Line & Around a Point — Answers



- 9.** Three angles on a line are equal. Find each angle.

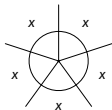


Solution

$$3x = 180^\circ$$

$$x = 60^\circ$$

- 10.** Five angles around a point are all equal. Find each angle.

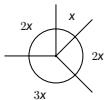


Solution

$$5x = 360^\circ$$

$$x = 72^\circ$$

- 11.** Angles around a point are in the ratio 1 : 2 : 3 : 2. Find the largest angle.

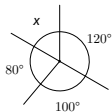


Solution

$$8k = 360^\circ, \quad k = 45^\circ$$

$$\text{largest} = 3k = 135^\circ$$

- 12.** Angles around a point are 120° , 100° , 80° , and x . Find x .



Solution

$$x = 360^\circ - 300^\circ$$

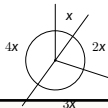
$$x = 60^\circ$$

Angles Around a Point

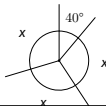


13. Two angles around a point are $(x + 20)^\circ$ and $(2x + 10)^\circ$. The other two are equal. Find all angles.

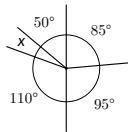
14. Four angles around a point are in the ratio $1 : 2 : 3 : 4$. Find each angle.



15. An angle around a point is 40° . The remaining three are equal. Find each of the three.



16. Angles around a point are 85° , 95° , 110° , x , and 50° . Find x .



Angles Around a Point — Answers

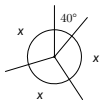


13. Two angles around a point are $(x + 20)^\circ$ and $(2x + 10)^\circ$. The other two are equal. Find all angles.

Solution

Given pair make 180° : $x = 50^\circ$
 $70^\circ, 110^\circ, 70^\circ, 110^\circ$

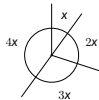
15. An angle around a point is 40° . The remaining three are equal. Find each of the three.



Solution

$$40^\circ + 3x = 360^\circ$$
$$x = 106\frac{2}{3}^\circ$$

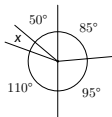
14. Four angles around a point are in the ratio $1 : 2 : 3 : 4$. Find each angle.



Solution

$$10k = 360^\circ, k = 36^\circ$$
$$36^\circ, 72^\circ, 108^\circ, 144^\circ$$

16. Angles around a point are 85° , 95° , 110° , x , and 50° . Find x .



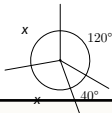
Solution

$$x = 360^\circ - 340^\circ$$
$$x = 20^\circ$$

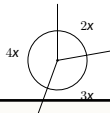
Around a Point & Triangles



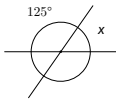
17. One angle around a point is 120° . Another is 40° . The remaining two are equal. Find each.



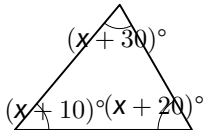
18. Three angles around a point are in the ratio $2 : 3 : 4$. Find each angle.



19. Two straight lines cross forming angle x . An adjacent angle is 125° . Find x .



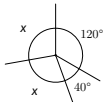
20. A triangle has angles $(x + 10)^\circ$, $(x + 20)^\circ$, and $(x + 30)^\circ$. Find x .



Around a Point & Triangles – Answers



17. One angle around a point is 120° . Another is 40° . The remaining two are equal. Find each.

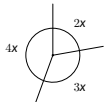


Solution

$$2x = 360^\circ - 160^\circ$$

$$x = 100^\circ$$

18. Three angles around a point are in the ratio $2 : 3 : 4$. Find each angle.

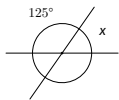


Solution

$$9k = 360^\circ, k = 40^\circ$$

$$80^\circ, 120^\circ, 160^\circ$$

19. Two straight lines cross forming angle x . An adjacent angle is 125° . Find x .

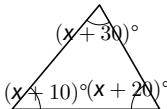


Solution

$$x + 125^\circ = 180^\circ$$

$$x = 55^\circ$$

20. A triangle has angles $(x + 10)^\circ$, $(x + 20)^\circ$, and $(x + 30)^\circ$. Find x .



Solution

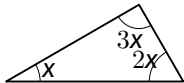
$$3x + 60 = 180^\circ$$

$$x = 40^\circ$$

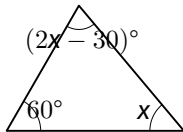
Angles in a Triangle



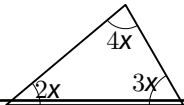
21. A triangle's angles are in the ratio $1 : 2 : 3$. Find the largest angle.



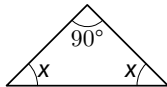
22. A triangle has angles 60° , x , and $(2x - 30)^\circ$. Find x .



23. A triangle's angles are in the ratio $2 : 3 : 4$. Find the smallest angle.



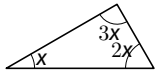
24. One angle in a triangle is 90° . The other two are equal. Find them.



Angles in a Triangle – Answers



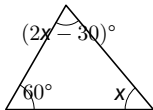
21. A triangle's angles are in the ratio 1 : 2 : 3. Find the largest angle.



Solution

$$6k = 180^\circ, k = 30^\circ$$
$$\text{largest} = 90^\circ$$

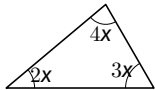
22. A triangle has angles 60° , x , and $(2x - 30)^\circ$. Find x .



Solution

$$3x + 30 = 180^\circ$$
$$x = 50^\circ$$

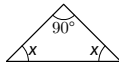
23. A triangle's angles are in the ratio 2 : 3 : 4. Find the smallest angle.



Solution

$$9k = 180^\circ, k = 20^\circ$$
$$\text{smallest} = 40^\circ$$

24. One angle in a triangle is 90° . The other two are equal. Find them.



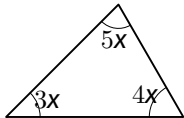
Solution

$$90^\circ + 2x = 180^\circ$$
$$x = 45^\circ \text{ each}$$

Triangles & Vertically Opposite

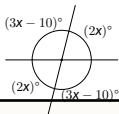


25. A triangle has angles in the ratio $3 : 4 : 5$. Find each angle.



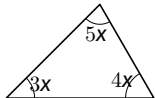
26. An exterior angle of a triangle is 140° . One remote interior angle is 55° . Find the other remote interior angle.

27. Two lines cross. The four angles are $(2x)^\circ$, $(3x - 10)^\circ$, $(2x)^\circ$, and $(3x - 10)^\circ$. Find x .



Triangles & Vertically Opposite — Answers

25. A triangle has angles in the ratio 3 : 4 : 5. Find each angle.



Solution

$$12k = 180^\circ, k = 15^\circ$$

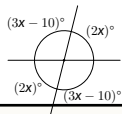
$$45^\circ, 60^\circ, 75^\circ$$

26. An exterior angle of a triangle is 140° . One remote interior angle is 55° . Find the other remote interior angle.

Solution

$$x = 140^\circ - 55^\circ = 85^\circ$$

27. Two lines cross. The four angles are $(2x)^\circ$, $(3x - 10)^\circ$, $(2x)^\circ$, and $(3x - 10)^\circ$. Find x .



Solution

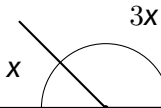
$$2x + (3x - 10) = 180^\circ$$

$$x = 38^\circ$$

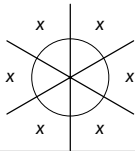
Combined Angle Problems



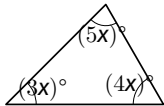
- 1.** On a straight line, one angle is three times another. Find both angles.



- 2.** Six angles around a point are equal. Find each angle.



- 3.** A triangle has angles $(3x)^\circ$, $(4x)^\circ$, and $(5x)^\circ$. Find x .

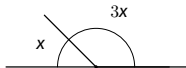


- 4.** At a point, five angles are $(2x)^\circ$, $(x + 10)^\circ$, $(3x - 20)^\circ$, x° , and 60° . Find x .

Combined Angle Problems — Answers



1. On a straight line, one angle is three times another. Find both angles.

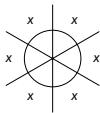


Solution

$$x + 3x = 180^\circ$$

$$x = 45^\circ, 3x = 135^\circ$$

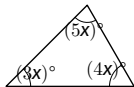
2. Six angles around a point are equal. Find each angle.



Solution

$$\begin{aligned}\text{Each} &= 360^\circ \div 6 \\ &= 60^\circ\end{aligned}$$

3. A triangle has angles $(3x)^\circ$, $(4x)^\circ$, and $(5x)^\circ$. Find x .



Solution

$$12x = 180^\circ$$

$$x = 15^\circ: 45^\circ, 60^\circ, 75^\circ$$

4. At a point, five angles are $(2x)^\circ$, $(x + 10)^\circ$, $(3x - 20)^\circ$, x° , and 60° . Find x .

Solution

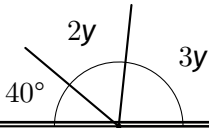
$$7x + 50^\circ = 360^\circ$$

$$7x = 310^\circ, x = 44\frac{2}{7}^\circ$$

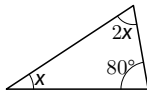
Ratios & Multi-step Angles



- 5.** A straight line has three angles. One is 40° . The other two are in ratio $2 : 3$. Find them.

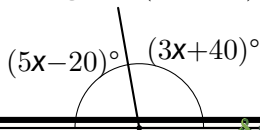


- 6.** In a triangle, the largest angle is twice the smallest. The middle angle is 80° . Find all angles.



- 7.** Four angles around a point are in ratio $3 : 4 : 5 : 6$. Find the difference between the largest and smallest.

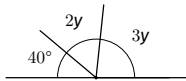
- 8.** Two straight lines intersect. If one angle is $(5x - 20)^\circ$ and its adjacent angle is $(3x + 40)^\circ$, find x .



Ratios & Multi-step Angles – Answers



5. A straight line has three angles. One is 40° . The other two are in ratio 2 : 3. Find them.

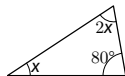


Solution

$$40^\circ + 5y = 180^\circ$$

$$y = 28^\circ: 56^\circ, 84^\circ$$

6. In a triangle, the largest angle is twice the smallest. The middle angle is 80° . Find all angles.



Solution

$$3x + 80^\circ = 180^\circ$$

$$x = 33\frac{1}{3}^\circ, 2x = 66\frac{2}{3}^\circ$$

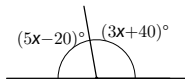
7. Four angles around a point are in ratio 3 : 4 : 5 : 6. Find the difference between the largest and smallest.

Solution

$$\text{Each part} = 360^\circ \div 18 = 20^\circ$$

$$6(20^\circ) - 3(20^\circ) = 60^\circ$$

8. Two straight lines intersect. If one angle is $(5x - 20)^\circ$ and its adjacent angle is $(3x + 40)^\circ$, find x .



Solution

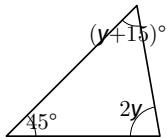
$$8x + 20^\circ = 180^\circ$$

$$x = 20$$

Multi-step Angle Applications

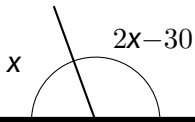


- 9.** A triangle's angles are 45° , $2y$, and $(y+15)^\circ$. Find y and all angles.

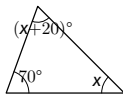


- 10.** At a point, angles are in ratio $1 : 2 : 2 : 3 : 4 : 6$. Find the largest angle.

- 11.** An angle on a line is 30° less than twice another. Find both angles.

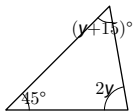


- 12.** A triangle has one angle 70° and another is 20° more than the third. Find the other two angles.



Multi-step Angle Applications — Answers

9. A triangle's angles are 45° , $2y$, and $(y+15)^\circ$. Find y and all angles.



Solution

$$3y + 60^\circ = 180^\circ$$

$$y = 40^\circ: 80^\circ, 55^\circ$$

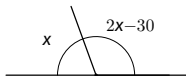
10. At a point, angles are in ratio $1 : 2 : 2 : 3 : 4 : 6$. Find the largest angle.

Solution

Parts sum to 18; each = 20° .

$$\text{Largest} = 6 \times 20^\circ = 120^\circ$$

11. An angle on a line is 30° less than twice another. Find both angles.

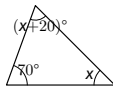


Solution

$$3x = 210^\circ$$

$$x = 70^\circ: 70^\circ, 110^\circ$$

12. A triangle has one angle 70° and another is 20° more than the third. Find the other two angles.



Solution

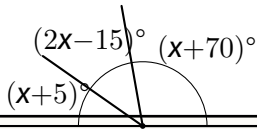
$$2x + 90^\circ = 180^\circ$$

$$x = 45^\circ: 45^\circ, 65^\circ$$

Multi-step Angle Applications



13. Three angles on a straight line are $(x + 5)^\circ$, $(2x - 15)^\circ$, and $(x + 70)^\circ$. Find x .



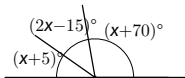
15. In triangle ABC , angle A is $\frac{2}{3}$ of angle B , and angle C is 50° . Find angles A and B .

14. Two intersecting lines form an angle of $2x^\circ$. What is the sum of all four angles formed?

16. Seven angles around a point increase by 5° each. Find the smallest angle.

Multi-step Angle Applications — Answers

13. Three angles on a straight line are $(x + 5)^\circ$, $(2x - 15)^\circ$, and $(x + 70)^\circ$. Find x .



Solution

$$4x + 60^\circ = 180^\circ$$

$$x = 30$$

15. In triangle ABC , angle A is $\frac{2}{3}$ of angle B , and angle C is 50° . Find angles A and B .

Solution

Let $B = 3y$, $A = 2y$: $5y + 50^\circ = 180^\circ$

Basic Angle Rules $A = 52^\circ$, $B = 78^\circ$

14. Two intersecting lines form an angle of $2x^\circ$. What is the sum of all four angles formed?

Solution

The four angles make a full turn.

$$\text{Sum} = 360^\circ.$$

16. Seven angles around a point increase by 5° each. Find the smallest angle.

Solution

$$7x + 105^\circ = 360^\circ$$

$$7x = 255^\circ, x = 36\frac{3}{7}^\circ$$

Angle Reasoning & Proof



17. A triangle's exterior angle is 130° . If one remote interior angle is 50° , prove the other must be 80° .

18. On a line, angles are x° , $(180 - 2x)^\circ$, and x° . Find x if all angles are positive.

Angle Reasoning & Proof — Answers



17. A triangle's exterior angle is 130° . If one remote interior angle is 50° , prove the other must be 80° .

Solution

Exterior = sum of remote interiors.

$$50^\circ + x = 130^\circ \Rightarrow x = 80^\circ \text{ (proven)}$$

18. On a line, angles are x° , $(180 - 2x)^\circ$, and x° . Find x if all angles are positive.

Solution

$x + (180 - 2x) + x = 180^\circ$ is always true.

For positive angles: $0 < x < 90$