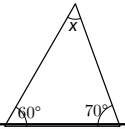
# Internal and external

Mana Maths

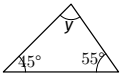
# Interior Angles of Triangles

*Find the missing angle in each triangle. The angles in any triangle sum to* $180°$.

**1.**

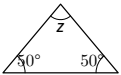



**2.**



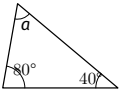

Find *y*.

**3.**



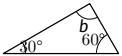

Find *z*.

**4.**



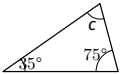

Find *a*.

**5.**



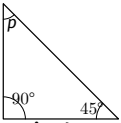

Find *b*.

**6.**



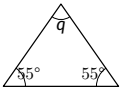

Find *c*.

**7.**



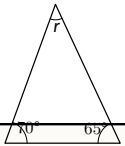

Find *p*.

**8.**




Find *q*.

**9.**



# Interior Angles of Triangles — Answers

*Find the missing angle in each triangle. The angles in any triangle sum to* $180°$.

**1.** Find $x$.


**Solution**

$x = 180° - 60° - 70°$

$x = 50°$

**2.** Find $y$.


**Solution**

$y = 180° - 45° - 55°$

$y = 80°$

**3.** Find $z$.


**Solution**

$z = 180° - 50° - 50°$

$z = 80°$

**4.** Find $a$.


**Solution**

$a = 180° - 80° - 40°$

$a = 60°$

**5.** Find $b$.


**Solution**

$b = 180° - 30° - 60°$

$b = 90°$

**6.** Find $c$.


**Solution**

$c = 180° - 35° - 75°$

$c = 70°$

**7.** Find $p$.


**Solution**

$p = 180° - 90° - 45°$

$p = 45°$

**8.** Find $q$.


**Solution**

$q = 180° - 55° - 55°$

$q = 70°$

**9.** Find $r$.


**Solution**

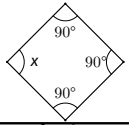
$r = 180° - 70° - 65°$

$r = 45°$

# Interior Angles of Quadrilaterals

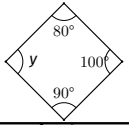
*Find the missing angle. The angles in any quadrilateral sum to $360°$.*

**10.**



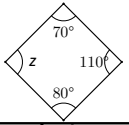

Find $x$.

**11.**



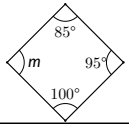

Find $y$.

**12.**



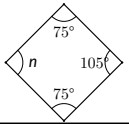

Find $z$.

**13.**



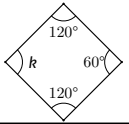

Find $m$.

**14.**



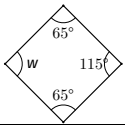

Find $n$.

**15.**



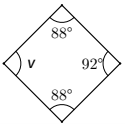

Find $k$.

**16.**



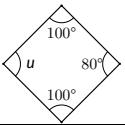

Find $w$.

**17.**




Find $v$.

**18.**




Find $u$.

# Interior Angles of Quadrilaterals — Answers

*Find the missing angle. The angles in any quadrilateral sum to $360°$.*

**10.** Find *x*.


**Solution**

$x = 360° - 90° - 90° - 90°$

$x = 90°$

**11.** Find *y*.


**Solution**

$y = 360° - 80° - 100° - 90°$

$y = 90°$

**12.** Find *z*.


**Solution**

$z = 360° - 70° - 110° - 80°$

$z = 100°$

**13.** Find *m*.


**Solution**

$m = 360° - 85° - 95° - 100°$

$m = 80°$

**14.** Find *n*.


**Solution**

$n = 360° - 75° - 105° - 75°$

$n = 105°$

**15.** Find *k*.


**Solution**

$k = 360° - 120° - 60° - 120°$

$k = 60°$

**16.** Find *w*.


**Solution**

$w = 360° - 65° - 115° - 65°$

$w = 115°$

**17.** Find *v*.


**Solution**

$v = 360° - 88° - 92° - 88°$

$v = 92°$

**18.** Find *u*.


**Solution**

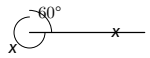
$u = 360° - 100° - 80° - 100°$

$u = 80°$

# Interior Angles: Multiple Unknowns

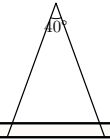
*Angles in a triangle sum to $180°$. Set up an equation and solve for the unknown.*

**1.**

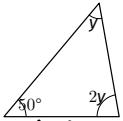



Find $x$ when two angles are equal.

**2.**

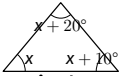



**3.**



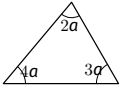

Find $y$.

**4.**



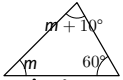

Find $x$.

**5.**



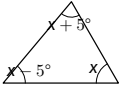

Find $a$.

**6.**



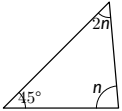

Find $m$.

**7.**



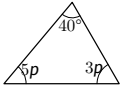

Find $x$.

**8.**




Find $n$.

**9.**




Find $p$.

# Interior Angles: Multiple Unknowns — Answers

*Angles in a triangle sum to $180°$. Set up an equation and solve for the unknown.*

**1.** Find $x$ (two equal angles).

**Solution**

$60° + x + x = 180°$

$2x = 120°;\ x = 60°$

**2.** Find $x$.

**Solution**

$2x + 3x + 40° = 180°$

$5x = 140°;\ x = 28°$

**3.** Find $y$.

**Solution**

$50° + 2y + y = 180°$

$3y = 130°;\ y = 43.3°$

**4.** Find $x$.

**Solution**

$x + (x{+}10°) + (x{+}20°) = 180°$

$3x + 30° = 180°;\ x = 50°$

**5.** Find $a$.

**Solution**

$4a + 3a + 2a = 180°$

$9a = 180°;\ a = 20°$

**6.** Find $m$.

**Solution**

$m + 60° + (m{+}10°) = 180°$

$2m = 110°;\ m = 55°$

**7.** Find $x$.

**Solution**

$(x{-}5°) + x + (x{+}5°) = 180°$

$3x = 180°;\ x = 60°$

**8.** Find $n$.

**Solution**

$45° + n + 2n = 180°$

$3n = 135°;\ n = 45°$

**9.** Find $p$.

**Solution**

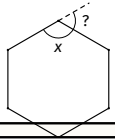
$5p + 3p + 40° = 180°$

$8p = 140°;\ p = 17.5°$

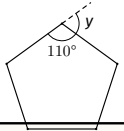
# Exterior Angles of Polygons

*An exterior angle and its adjacent interior angle sum to $180°$. Find each angle.*

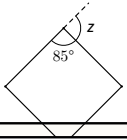
**10.**



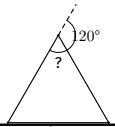

**11.**




**12.**

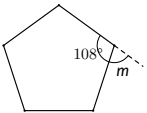



**13.**



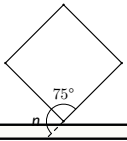

Find interior angle at

**14.**

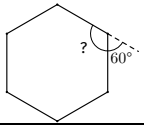



Find exterior angle *m*.

**15.**

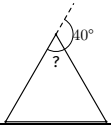



**16.**



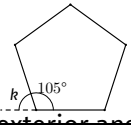

Find interior angle.

**17.**




Find interior angle.

**18.**




Find exterior angle *k*.

# Exterior Angles of Polygons — Answers

*An exterior angle and its adjacent interior angle sum to $180°$. Find each angle.*

**10.** Find the exterior angle.

**Solution**

Regular hexagon interior $= 120°$

Exterior $= 180° - 120° = 60°$

**11.** Find exterior angle $y$.

**Solution**

$y = 180° - 110°$

$y = 70°$

**12.** Find exterior angle $z$.

**Solution**

$z = 180° - 85°$

$z = 95°$

**13.** Find interior angle at vertex.

**Solution**

Interior $= 180° - 120°$

$= 60°$

**14.** Find exterior angle $m$.

**Solution**

Regular pentagon interior $= 108°$

$m = 180° - 108° = 72°$

**15.** Find exterior angle $n$.

**Solution**

$n = 180° - 75°$

$n = 105°$

**16.** Find interior angle.

**Solution**

Interior $= 180° - 60°$

$= 120°$

**17.** Find interior angle.

**Solution**

Interior $= 180° - 40°$

$= 140°$

**18.** Find exterior angle $k$.

**Solution**

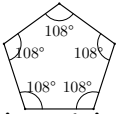
$k = 180° - 105°$

$k = 75°$

# Regular Polygons: Interior Angles

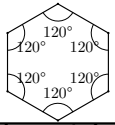
*A regular polygon has all equal interior angles. Formula: interior angle* $= \dfrac{(n-2)\times 180^\circ}{n}$.

**1.**



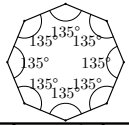

What is each interior

**2.**




What is each interior

**3.**




What is each interior

**4.**
Each interior angle of a regular polygon is $144^\circ$. How many sides does it have?

**5.**
Each interior angle of a regular polygon is $120^\circ$. How many sides does it have?

**6.**
Each interior angle of a regular polygon is $156^\circ$. How many sides does it have?

**7.**
Each interior angle of a regular polygon is $150^\circ$. How many sides?

**8.**
A regular 12-gon has interior angles of what measure?

**9.**
A regular 9-gon has interior angles of what measure?

# Regular Polygons: Interior Angles — Answers

*A regular polygon has all equal interior angles. Formula: interior angle* $= \frac{(n-2)\times 180^\circ}{n}$.

**1.** Each interior angle of a regular pentagon?

**Solution**

$(5-2) \times 180^\circ = 540^\circ$

$540^\circ \div 5 = 108^\circ$

**2.** Each interior angle of a regular hexagon?

**Solution**

$(6-2) \times 180^\circ = 720^\circ$

$720^\circ \div 6 = 120^\circ$

**3.** Each interior angle of a regular octagon?

**Solution**

$(8-2) \times 180^\circ = 1080^\circ$

$1080^\circ \div 8 = 135^\circ$

**4.** Each interior angle of a regular polygon is $144^\circ$. How many sides?

**Solution**

$(n-2) \times 180^\circ = 144n$

$36n = 360^\circ$; $n = 10$ sides

**5.** Each interior angle of a regular polygon is $120^\circ$. How many sides?

**Solution**

$(n-2) \times 180^\circ = 120n$

$60n = 360^\circ$; $n = 6$ sides

**6.** Each interior angle of a regular polygon is $156^\circ$. How many sides?

**Solution**

$180n - 360^\circ = 156n$

$24n = 360^\circ$; $n = 15$ sides

**7.** Each interior angle of a regular polygon is $150^\circ$. How many sides?

**Solution**

$180n - 360^\circ = 150n$

$30n = 360^\circ$; $n = 12$ sides

**8.** A regular 12-gon has interior angles of what measure?

**Solution**

$(12-2) \times 180^\circ = 1800^\circ$

$1800^\circ \div 12 = 150^\circ$

**9.** A regular 9-gon has interior angles of what measure?

**Solution**

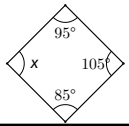
$(9-2) \times 180^\circ = 1260^\circ$

$1260^\circ \div 9 = 140^\circ$

# Irregular Polygons & Exterior Angles

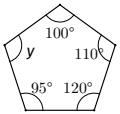
*The sum of exterior angles of any polygon is always $360°$. Exterior angle + interior angle $= 180°$.*

**10.**



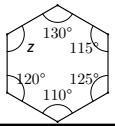

Interior angles sum to

**11.**




Interior angles sum to

**12.**



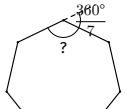

Sum of interior = 720°

**13.**
Interior angle = $115°$. What is the exterior angle?

**14.**
Exterior angle = $52°$. What is the interior angle?

**15.**
Exterior angle = $30°$. Is this a regular 12-gon?

**16.**




**17.**
Interior $= 162°$. Exterior $=?$. Name polygon type.

**18.**
Sum of all exterior angles of a 15-gon is...? Find a value.

# Irregular Polygons & Exterior Angles — Answers

*The sum of exterior angles of any polygon is always $360°$. Exterior angle + interior angle $= 180°$.*

**10.** Sum $= 360°$. Find *x*.


**Solution**

$95° + 105° + 85° + x = 360°$

$x = 360° - 285° = 75°$

**11.** Sum $= 540°$. Find *y*.


**Solution**

$100° + 110° + 120° + 95° + y = 540°$

$y = 540° - 425° = 115°$

**12.** Sum $= 720°$. Find *z*.


**Solution**

$130°+115°+125°+110°+120°+z = 720°$

$z = 720° - 600° = 120°$

**13.** Interior angle $= 115°$. What is the exterior angle?

**Solution**

Exterior $= 180° - 115°$

$= 65°$

**14.** Exterior angle $= 52°$. What is the interior angle?

**Solution**

Interior $= 180° - 52°$

$= 128°$

**15.** Exterior angle $= 30°$. Is this a regular 12-gon?

**Solution**

$360° \div 12 = 30°$

Yes — it is a regular 12-gon.

**16.** Interior angle of regular heptagon?

**Solution**

$(7-2) \times 180° = 900°$

$900° \div 7 \approx 128.6°$

**17.** Interior $= 162°$. Exterior $= ?$. Name the polygon type.

**Solution**

Exterior $= 180° - 162° = 18°$

Sides $= 360° \div 18° = 20$

It is a 20-gon.

**18.** Sum of all exterior angles of a 15-gon?

**Solution**

The sum of exterior angles of

ANY polygon $= 360°$.