

24. [Shapes]

continues on page 216

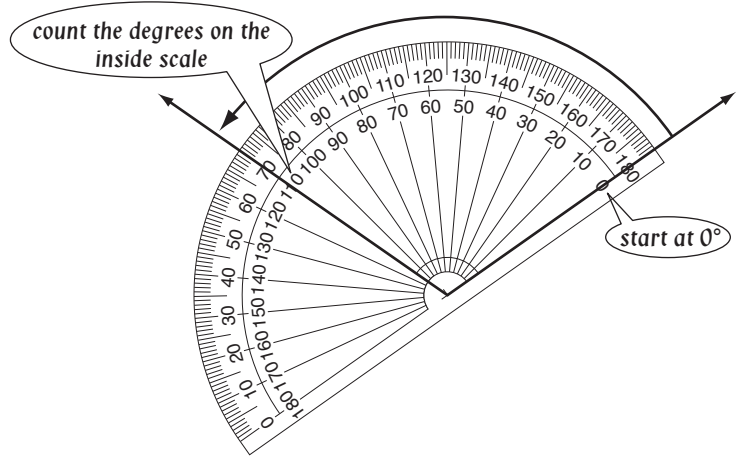
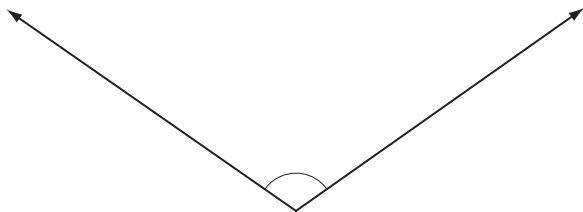
Skill 24.1 Measuring angles using a protractor (1).

MMBlue 1 1 2 2 3 3 4 4
MMGreen 1 1 2 2 3 3 4 4

- Place the center of the protractor at the vertex (corner) of the angle.
- Align one of the lines forming the angle to pass through 0° on either the inside or outside scale.
- Read the measurement where the other line of the angle crosses the scale on the protractor.

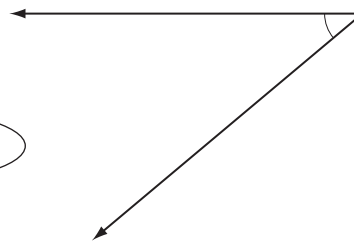
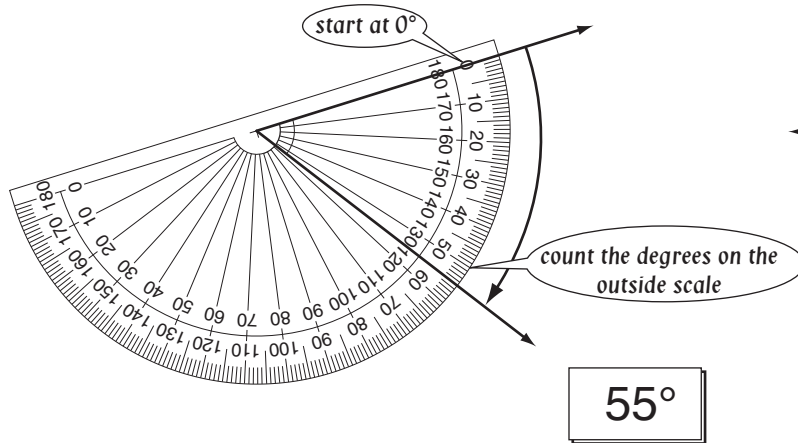
Q. Use a protractor to measure this angle.

A. 110°



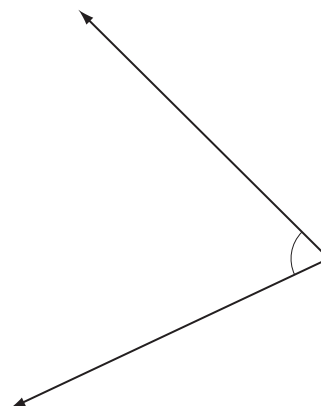
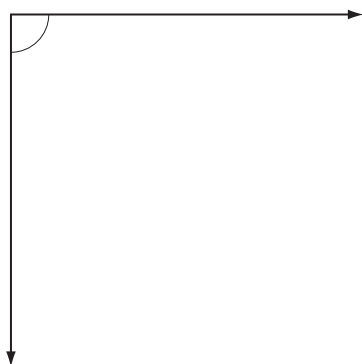
a) Use a protractor to measure this angle.

b) Use a protractor to measure this angle.



c) Use a protractor to measure this angle.

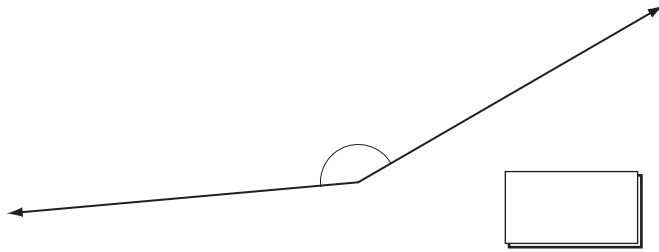
d) Use a protractor to measure this angle.



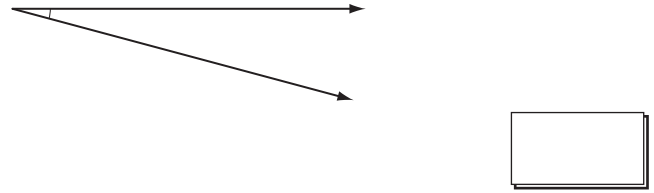
Skill 24.1 Measuring angles using a protractor (2).

MMBlue 1 1 2 2 3 3 4 4
MMGreen 1 1 2 2 3 3 4 4

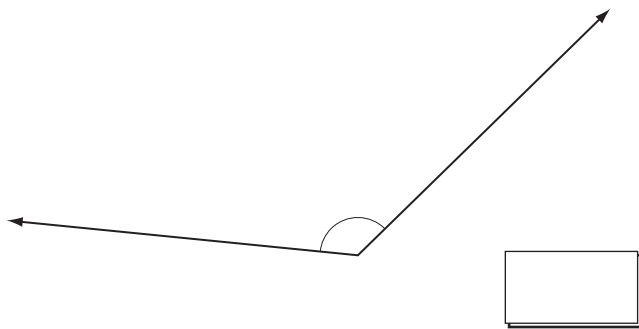
e) Use a protractor to measure this angle.



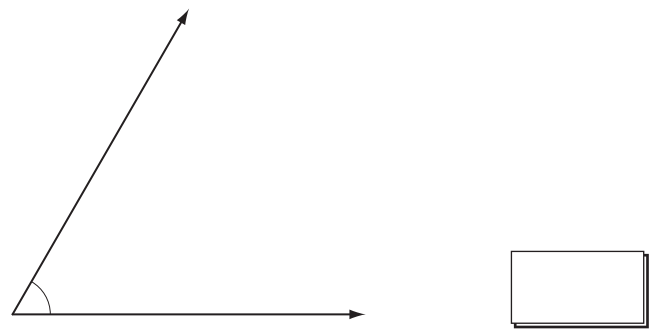
f) Use a protractor to measure this angle.



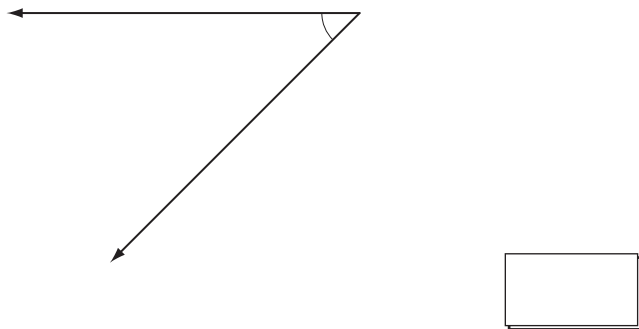
g) Use a protractor to measure this angle.



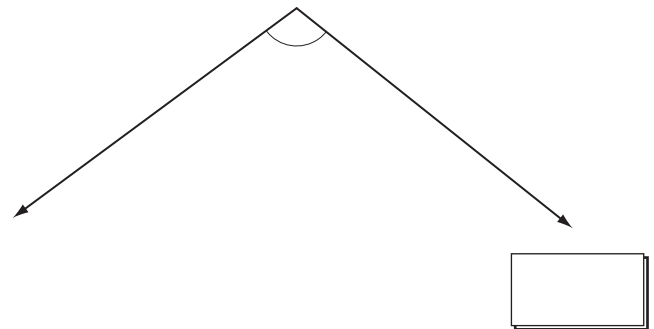
h) Use a protractor to measure this angle.



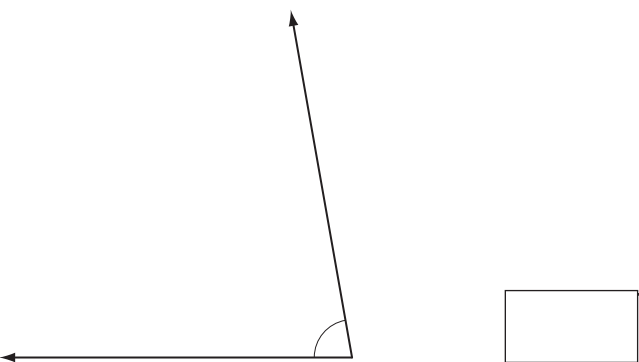
i) Use a protractor to measure this angle.



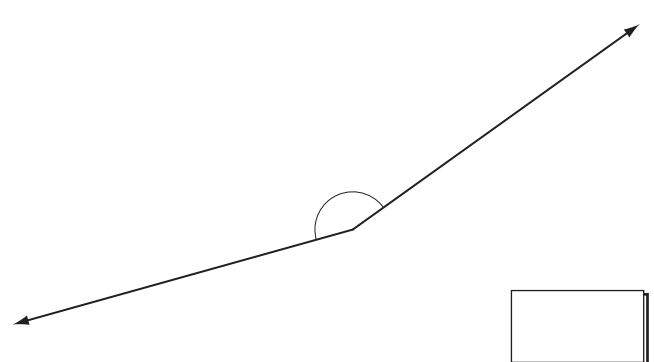
j) Use a protractor to measure this angle.



k) Use a protractor to measure this angle.



l) Use a protractor to measure this angle.

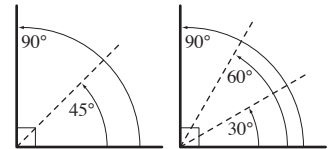


Skill 24.2 Estimating the size of angles (1).

MMBlue 1 1 2 2 3 3 4 4
MMGreen 1 1 2 2 3 3 4 4

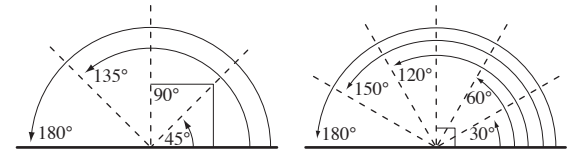
To estimate the size of an acute angle:

- Draw a right angle (90°) overlapping one line of the given angle.
- Divide the right angle into smaller divisions, e.g. halves or thirds.

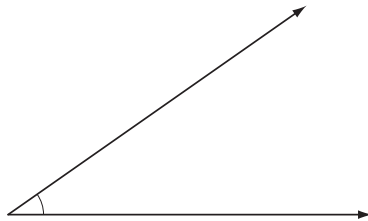


To estimate the size of an obtuse angle:

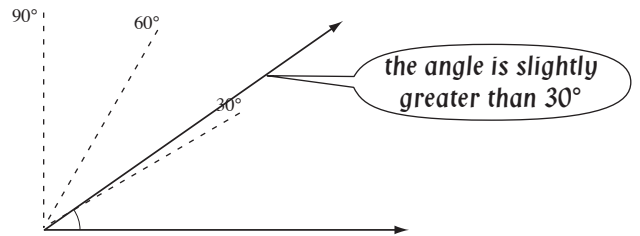
- Draw a straight angle (180°) overlapping one line of the given angle.
- Divide the straight angle into smaller divisions, e.g. quarters or sixths.



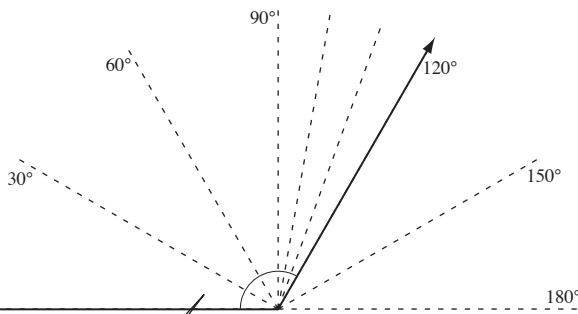
Q. Without measuring, would you estimate that the size of this angle is closer to 35° or to 50° ?



A. 35°



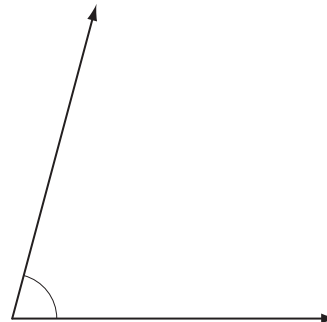
a) Without measuring, would you estimate that the size of this angle is closer to 110° or to 120° ?



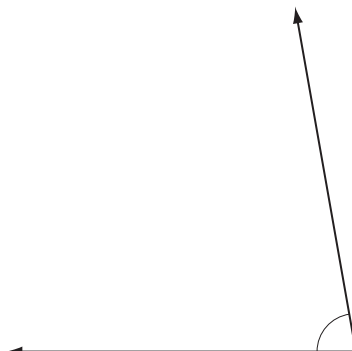
the angle is very close to 120°

120°

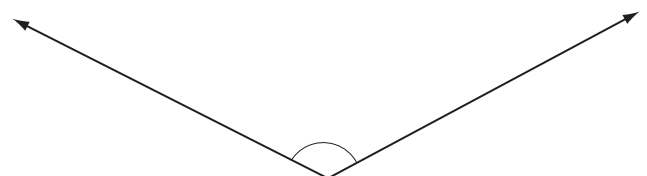
b) Without measuring, would you estimate that the size of this angle is closer to 75° or to 90° ?



c) Without measuring, would you estimate that the size of this angle is closer to 70° or to 80° ?



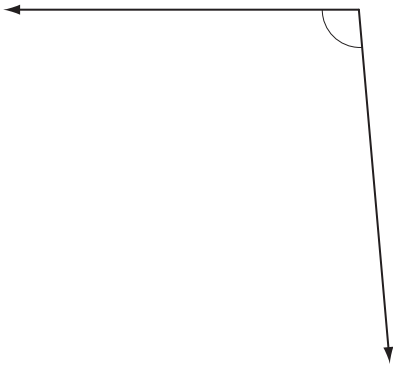
d) Without measuring, would you estimate that the size of this angle is closer to 125° or to 140° ?



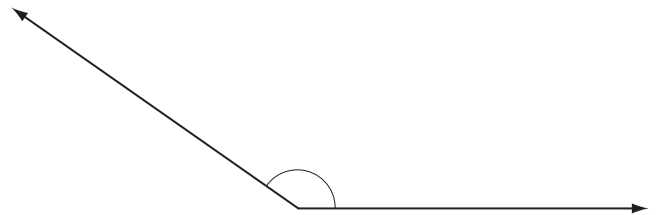
Skill 24.2 Estimating the size of angles (2).

MMBlue 1 2 2 3 3 4 4
MMGreen 1 1 2 2 3 3 4 4

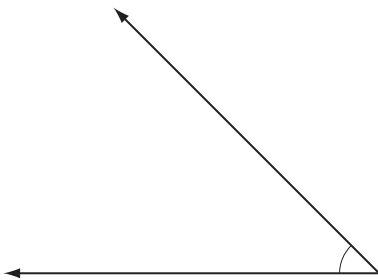
- e) Without measuring, would you estimate that the size of this angle is closer to 95° or to 110° ?



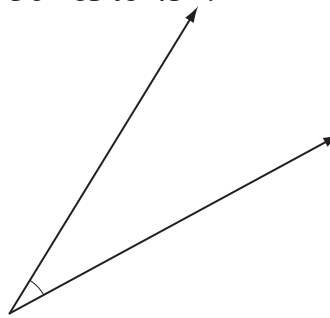
- f) Without measuring, would you estimate that the size of this angle is closer to 135° or to 145° ?



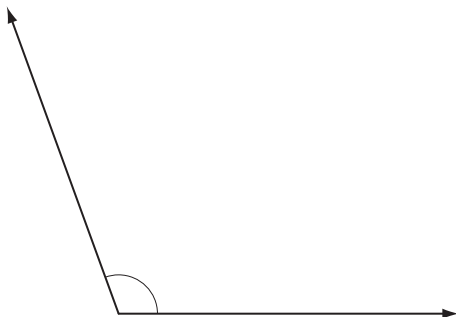
- g) Without measuring, would you estimate that the size of this angle is closer to 45° or to 60° ?



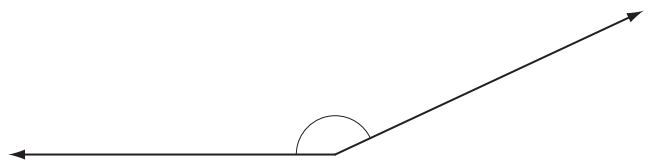
- h) Without measuring, would you estimate that the size of this angle is closer to 30° or to 45° ?



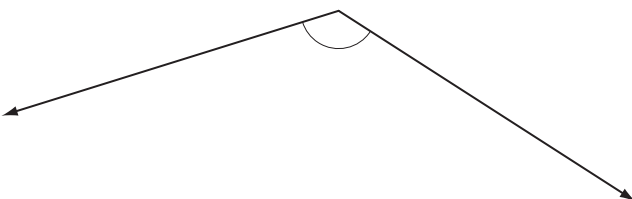
- i) Without measuring, would you estimate that the size of this angle is closer to 95° or to 110° ?



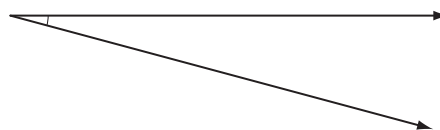
- j) Without measuring, would you estimate that the size of this angle is closer to 155° or to 170° ?



- k) Without measuring, would you estimate that the size of this angle is closer to 130° or to 150° ?



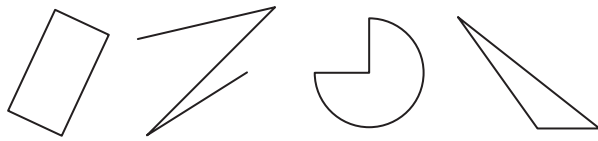
- l) Without measuring, would you estimate that the size of this angle is closer to 5° or to 15° ?



Skill 24.3 Recognizing polygons and quadrilaterals.

- Consider the definition of a polygon. (see Glossary, page 348)
- Consider the definition of a quadrilateral. (see Glossary, page 352)

Q. Circle the shapes that are **not** polygons.

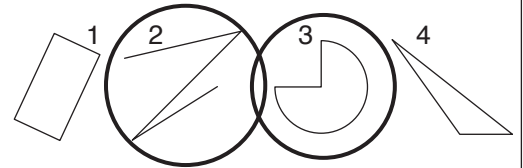


A. 1st shape - closed shape with all sides line segments (polygon)

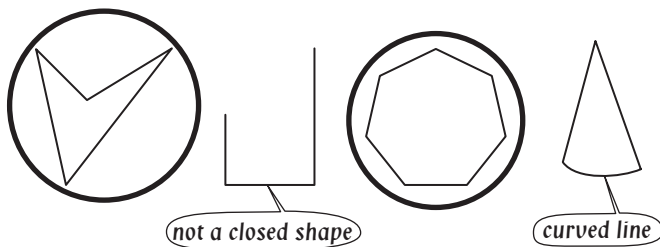
2nd shape - not a closed shape (**not a polygon**)

3rd shape - closed shape with two sides line segments and a curved line (**not a polygon**)

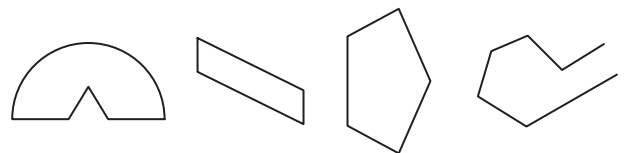
4th shape - closed shape with all sides line segments (polygon)



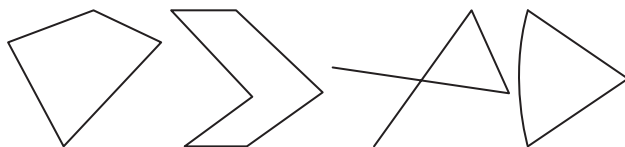
a) Circle the shapes that are polygons.



b) Circle the shapes that are **not** polygons.



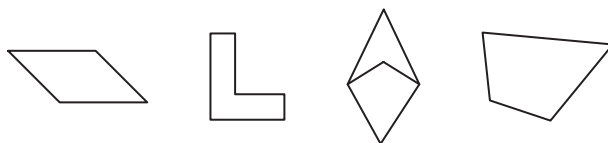
c) Circle the shapes that are polygons.



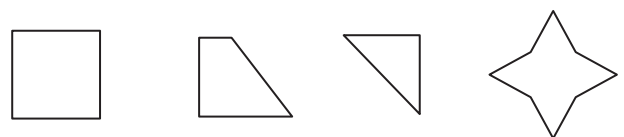
d) Circle the shapes that are **not** polygons.



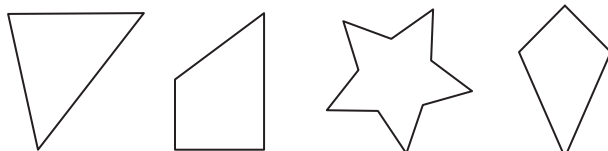
e) Circle the shapes that are quadrilaterals.



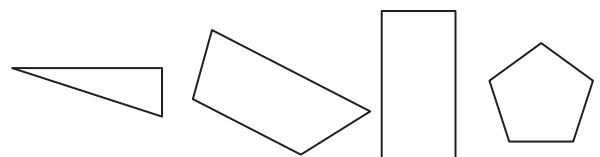
f) Circle the shapes that are quadrilaterals.



g) Circle the shapes that are quadrilaterals.



h) Circle the shapes that are **not** quadrilaterals.



Skill 24.4 Classifying and describing the properties of quadrilaterals.

- Consider the properties of squares, rectangles, rhombi, parallelograms, kites and trapezoids. (see Glossary, page 352)

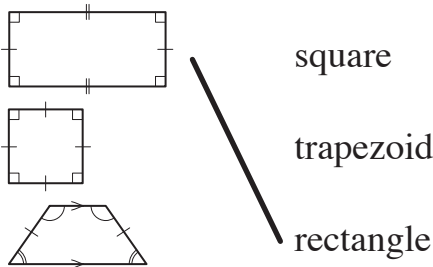
Q. I am a quadrilateral with no parallel sides. I have one pair of opposite angles equal, and my diagonals intersect at right angles. What am I?

- A) a rhombus
- B) a trapezoid
- C) a kite
- D) a square

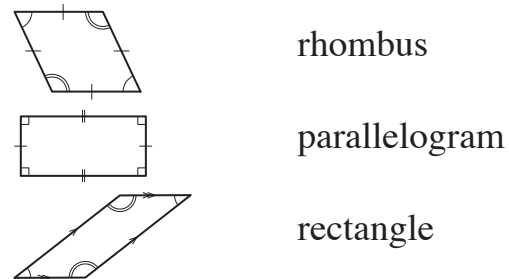
- A.** A) a rhombus has opposite sides parallel \Rightarrow A false
 B) a trapezoid has one pair of opposite sides parallel \Rightarrow B false
 C) a kite has a pair of opposite angles equal and diagonals intersecting at right angles \Rightarrow C true
 D) a square has opposite sides parallel \Rightarrow D false

The answer is **C**.

a) Match each quadrilateral to its name:



b) Match each quadrilateral to its name:



c) I am a 2-dimensional shape with four sides. Both my pairs of opposite sides are parallel. All angles are equal to 90° . What am I?

- A) a trapezoid
- B) a rectangle
- C) a rhombus
- D) a parallelogram



d) I am a quadrilateral with all my sides equal in length. My diagonals intersect at right angles, but are not equal in length. What am I?

- A) a kite
- B) a rectangle
- C) a rhombus
- D) a parallelogram



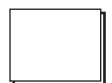
e) I am a 2-dimensional shape with four sides. My diagonals are equal, and all my sides are equal. What am I?

- A) a rhombus
- B) a rectangle
- C) a parallelogram
- D) a square

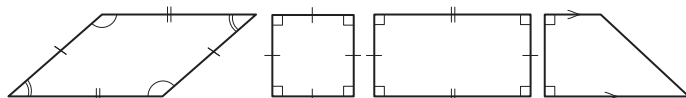


f) I am a quadrilateral with all my angles equal to 90° . My diagonals are equal in length. What am I?

- A) a trapezoid
- B) a parallelogram
- C) a rectangle
- D) a rhombus



g) Circle the shape that is **not** a parallelogram.



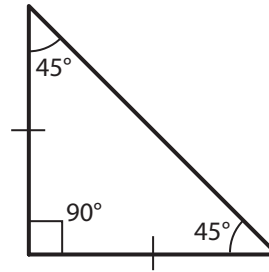
h) Circle the shape that is a rhombus.



Skill 24.5 Drawing lines and polygons.

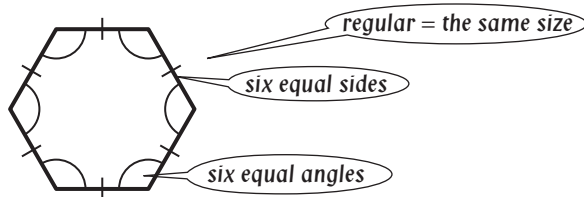
- Consider the definitions of triangles, squares, rectangles, rhombi, parallelograms, kites, trapezoids and regular polygons. (see Glossary)
- Mark:
 - Right angles with a corner (\perp).
 - Congruent angles with similar curved lines (\frown)
(the second pair of congruent angles takes on a pair of curved lines).
 - Congruent sides with a dash ($|$)
(the second pair of congruent lines takes on a pair of dashes).
 - Parallel lines with an arrow ($>$)
(the second pair of parallel lines take on a second pair of arrows).

Q. Draw an isosceles right triangle marking the congruent sides and congruent angles.



One corner marking the right angle (90°).
One dash marking each of the congruent sides.
One curved line marking each of the congruent angles (45°).

a) Draw a regular hexagon marking the congruent sides and congruent angles.



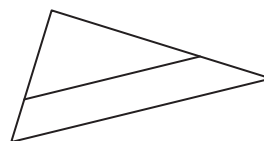
b) Draw a rectangle marking all congruent sides and diagonals.

c) Draw a rhombus marking all congruent sides and perpendicular diagonals.

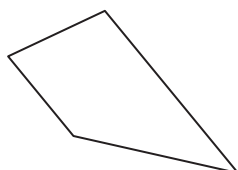
d) Draw an isosceles obtuse triangle marking the congruent sides and congruent angles.

e) Draw a regular pentagon marking the congruent sides and congruent angles.

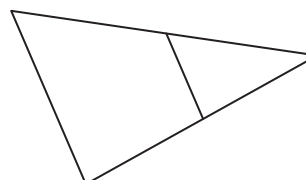
f) Use arrows to show the pair of parallel lines in this diagram.



g) Use arrows to show the pair of parallel lines in this diagram.

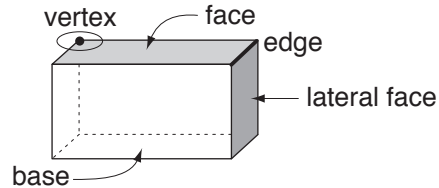


h) Use arrows to show the pair of parallel lines in this diagram.



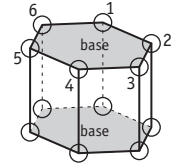
Skill 24.6 Classifying and describing the properties of 3D shapes.

- Count the number of:
 - faces
 - edges
 - vertices (points/corners)

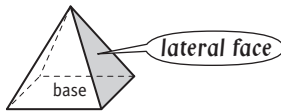


Q. How many vertices are there in a hexagonal prism?

A. Count the vertices, or corners in the prism:
six vertices in one base and six vertices in the other base
The answer is **12**



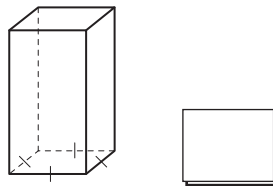
a) The base of a rectangular pyramid is a rectangle. What shape are the lateral faces?



b) The base of a pentagonal prism is a pentagon. What shape are the lateral faces?

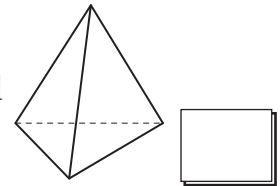
c) What is the name of this solid?

- A) triangular prism
- B) square prism
- C) square pyramid
- D) rectangular prism

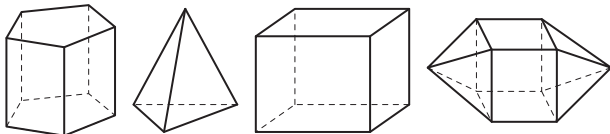


d) What is the name of this solid?

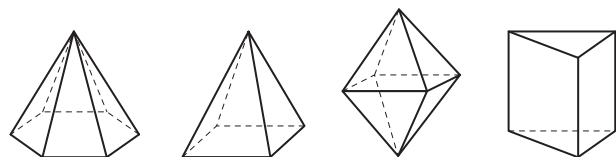
- A) triangular pyramid
- B) square pyramid
- C) rectangular pyramid
- D) triangular prism



e) Circle the shapes that are **not** prisms.



f) Circle the shapes that are **not** pyramids.



g) How many edges are there on a triangular prism?

h) How many edges are there on a cube?

i) How many vertices are there on a pentagonal pyramid?

j) How many faces are there on a square pyramid?

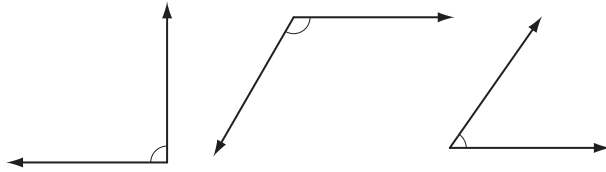
k) Sketch and name the three-dimensional shape that has two square faces and four rectangular faces.

l) Sketch and name the three-dimensional shape that has one rectangular face and four triangular faces.

Skill 24.7 Classifying angles.

- Consider the definitions and properties of a variety of angles. (see Glossary and Math Facts)
*Hints: An angle can be classified according to its size (acute, right, obtuse, straight and reflex).
 Two angles can be classified according to their position in relation to one another (adjacent, supplementary, complementary or vertical).*

Q. Circle the obtuse angle.



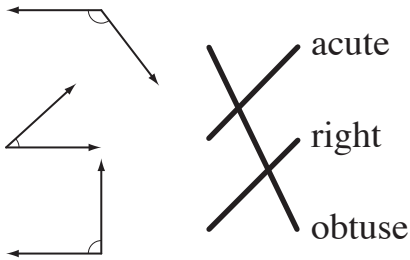
A.

right angle = 90°

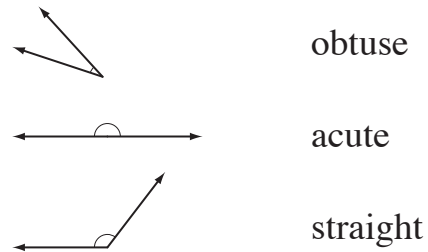
obtuse angle \rightarrow greater than 90°
less than 180°

acute angle \rightarrow less than 90°

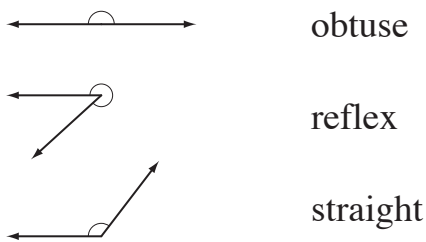
a) Match each angle to its description:



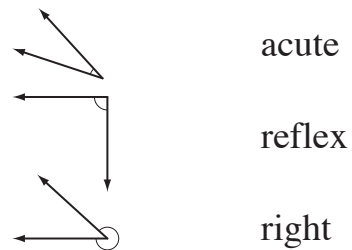
b) Match each angle to its description:



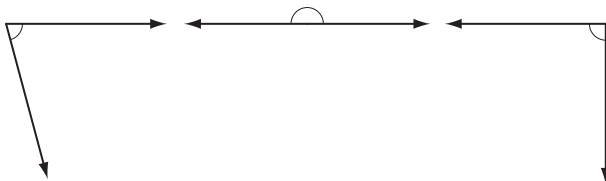
c) Match each angle to its description:



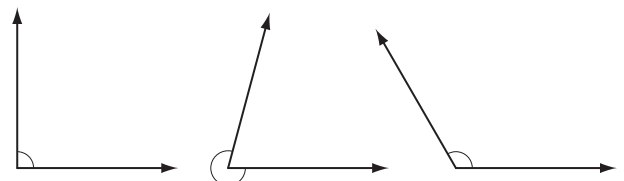
d) Match each angle to its description:



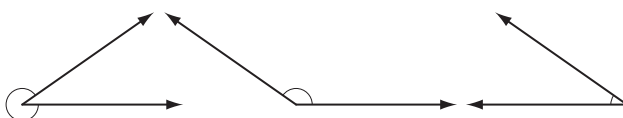
e) Circle the right angle.



f) Circle the reflex angle.



g) Circle the acute angle.



h) Circle the obtuse angle.



Skill 24.8 Classifying and describing the properties of triangles.

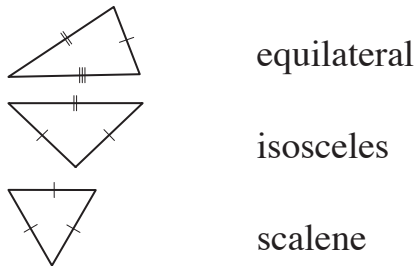
MMBlue 1 1 2 2 3 3 4 4
MMGreen 1 1 2 2 3 3 4 4

- Look for equal sides or equal angles.
- Look at the types of angles inside the triangle.

Sides and angles	Triangle type
no equal sides/angles	scalene
two equal sides/angles	isosceles
three equal sides/angles	equilateral

Angles	Triangle type
all acute angles	acute
one right angle	right
one obtuse angle	obtuse

Q. Match each triangle to its description:



A.

no equal sides ⇒ **scalene**

two equal sides ⇒ **isosceles**

three equal sides ⇒ **equilateral**

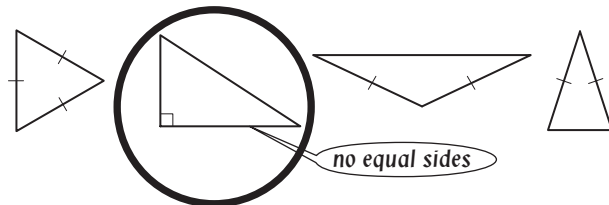
⇒

equilateral

isosceles

scalene

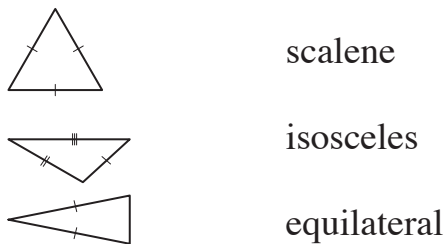
a) Circle the triangle that is **not** isosceles.



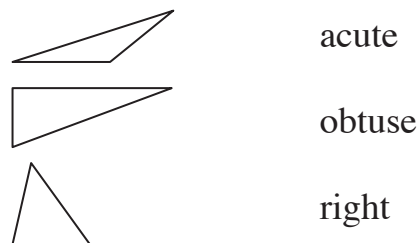
b) Circle the triangle that is obtuse.



c) Match each triangle to its description:



d) Match each triangle to its description:



e) I am a 2-dimensional shape with three sides. I have two of my sides of equal length. What am I?

- A) a square
- B) a right triangle
- C) an isosceles triangle
- D) an equilateral triangle



f) I am a 2-dimensional shape with three sides. I have an obtuse angle. What am I?

- A) an acute triangle
- B) a right triangle
- C) an equilateral triangle
- D) an obtuse triangle



Skill 24.9 Working with vertical angles and complementary angles.

- Use the properties:
 - the sum of complementary angles is 90° .
 - two vertical angles are congruent.

To find the size of an angle when its complementary angle/angles are given:

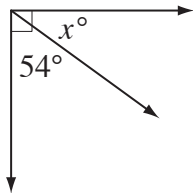
EITHER

- Subtract the given angles from 90° .

OR

- Write an equation involving the unknown angle x° .
- Solve the equation for x° .

Q. Find the value of x° .



A. x° and 54° are complementary: OR

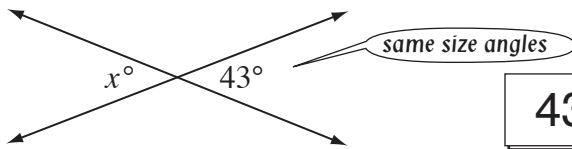
$$x^\circ = 90^\circ - 54^\circ = 36^\circ$$

$$x^\circ + 54^\circ = 90^\circ$$

$$x^\circ + 54^\circ - 54^\circ = 90^\circ - 54^\circ$$

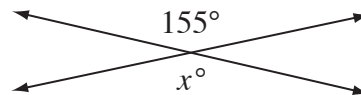
$$x^\circ = 36^\circ$$

a) Find the value of x° .

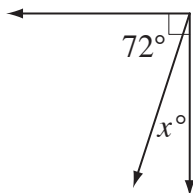


43°

b) Find the value of x° .



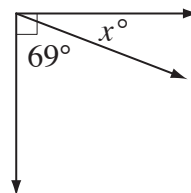
c) Find the value of x° .



$$x^\circ = 90^\circ - 72^\circ$$

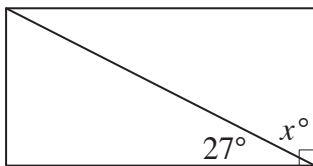
$$x^\circ = \boxed{}$$

d) Find the value of x° .



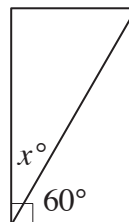
$$x^\circ = \boxed{}$$

e) Find the value of x° .



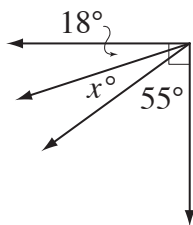
$$x^\circ = \boxed{}$$

f) Find the value of x° .



$$x^\circ = \boxed{}$$

g) Find the value of x° .



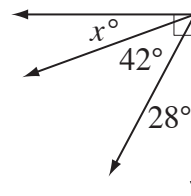
$$x^\circ + 18^\circ + 55^\circ = 90^\circ$$

$$x^\circ + 73^\circ = 90^\circ$$

$$x^\circ + 73^\circ - 73^\circ = 90^\circ - 73^\circ$$

$$x^\circ = \boxed{}$$

h) Find the value of x° .



$$x^\circ = \boxed{}$$

Skill 24.10 Working with supplementary angles.

- Use the property:
 - the sum of supplementary angles is 180° .

To find the size of an angle when its supplementary angle/angles are given:

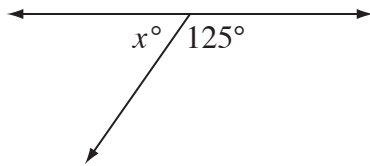
EITHER

- Subtract the given angles from 180° .

OR

- Write an equation involving the unknown angle x° .
- Solve the equation for x° .

Q. Find the value of x° .



A. x° and 125° are supplementary: OR

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

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

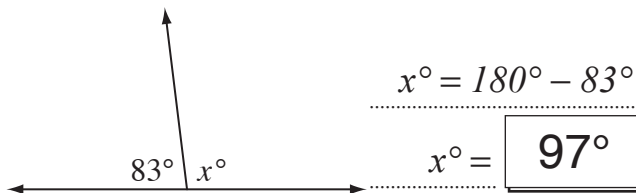
$$= 55^\circ$$

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

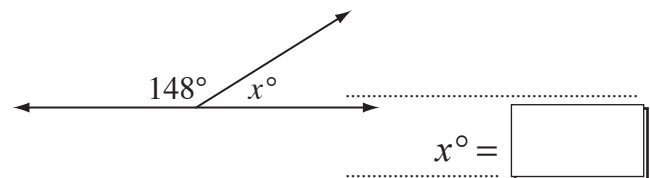
$$x^\circ + 125^\circ - 125^\circ = 180^\circ - 125^\circ$$

$$x^\circ = 55^\circ$$

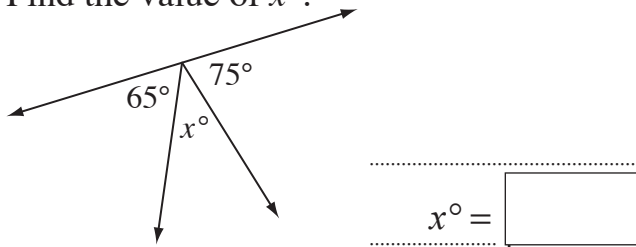
a) Find the value of x° .



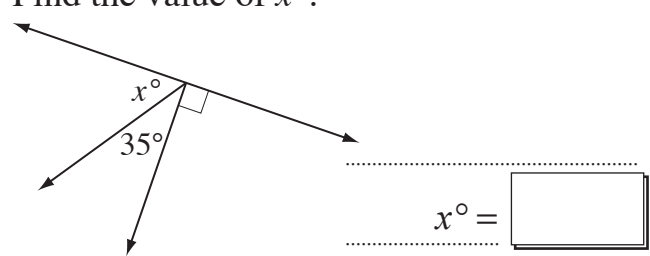
b) Find the value of x° .



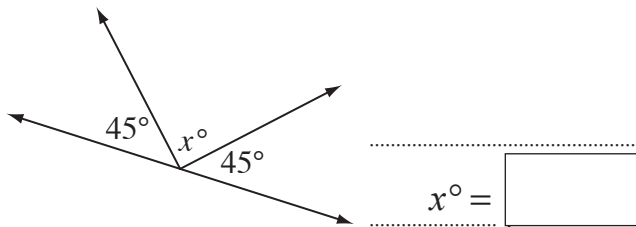
c) Find the value of x° .



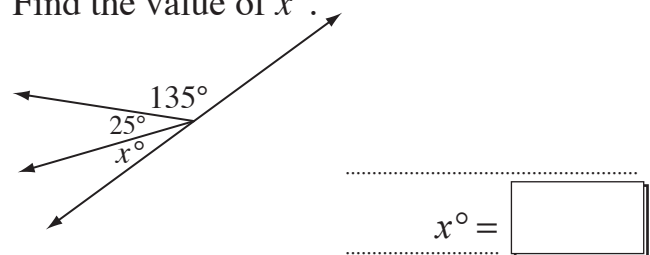
d) Find the value of x° .



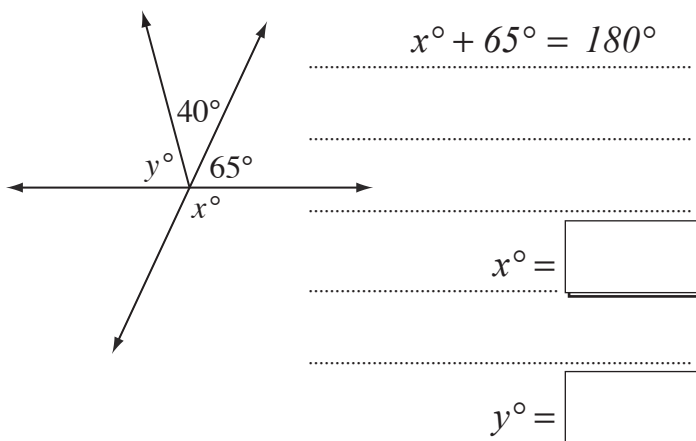
e) Find the value of x° .



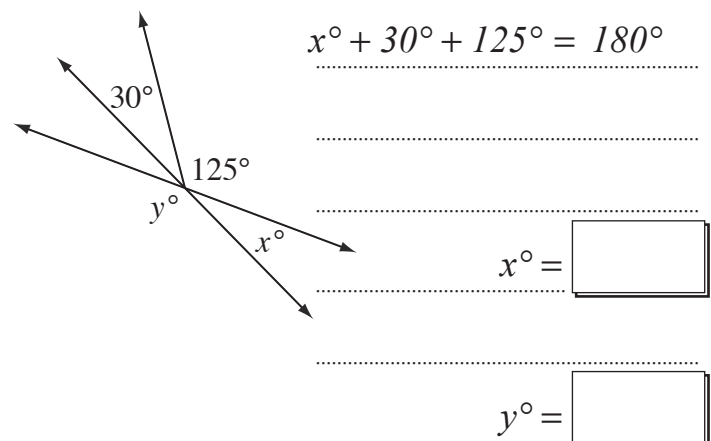
f) Find the value of x° .



g) Find the values of x° and y° .



h) Find the values of x° and y° .



Skill 24.11 Finding the size of angles inside a triangle.

- Use the property:
 - the sum of the interior angles of any triangle is 180° .

To find the size of an angle of a triangle when the other two angles are given:

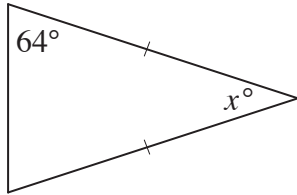
EITHER

- Subtract the sum of the given angles from 180° .

OR

- Write an equation involving the unknown angle x° .
- Solve the equation for x° .

Q. Find the value of x° .

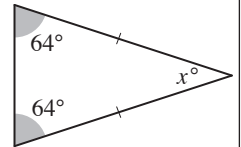


A. *Isosceles triangle* \Rightarrow base angles are equal:

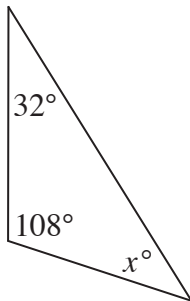
$$\begin{aligned} x^\circ &= 180^\circ - (64^\circ + 64^\circ) \\ &= 180^\circ - 128^\circ \\ &= 52^\circ \end{aligned}$$

OR

$$\begin{aligned} x^\circ + 64^\circ + 64^\circ &= 180^\circ \\ x^\circ + 128^\circ - 128^\circ &= 180^\circ - 128^\circ \\ x^\circ &= 52^\circ \end{aligned}$$



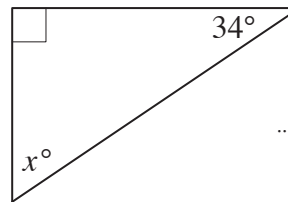
a) Find the value of x° .



$$\begin{aligned} x^\circ &= 180^\circ - (32^\circ + 108^\circ) \\ &= 180^\circ - 140^\circ \end{aligned}$$

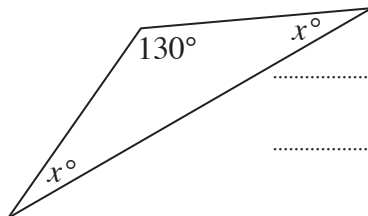
$$x^\circ = \boxed{40^\circ}$$

b) Find the value of x° .



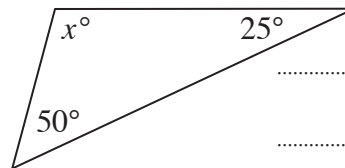
$$x^\circ = \boxed{}$$

c) Find the value of x° .



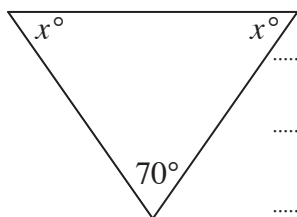
$$x^\circ = \boxed{}$$

d) Find the value of x° .



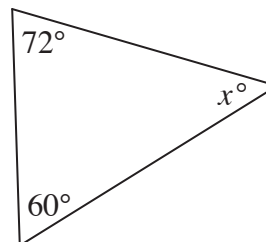
$$x^\circ = \boxed{}$$

e) Find the value of x° .



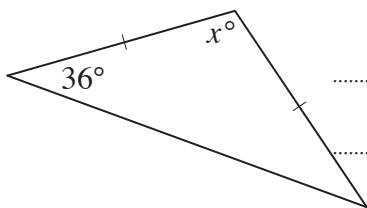
$$x^\circ = \boxed{}$$

f) Find the value of x° .



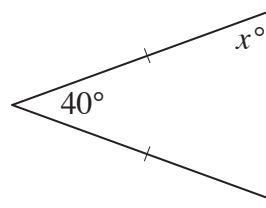
$$x^\circ = \boxed{}$$

g) Find the value of x° .



$$x^\circ = \boxed{}$$

h) Find the value of x° .



$$x^\circ = \boxed{}$$

Skill 24.12 Finding the size of angles inside a quadrilateral.

MMBlue 11 22 33 44
MMGreen 11 22 33 44

- Use the property:
 - the sum of the interior angles of any quadrilateral is 360° .

To find the size of an angle of a quadrilateral when the other three angles are given:

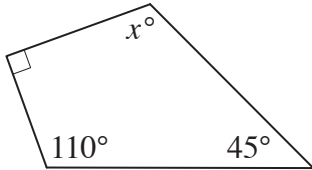
EITHER

- Subtract the sum of the given angles from 360° .

OR

- Write an equation involving the unknown angle x° .
- Solve the equation for x° .

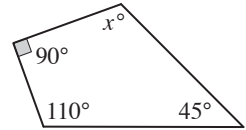
Q. Find the value of x° .



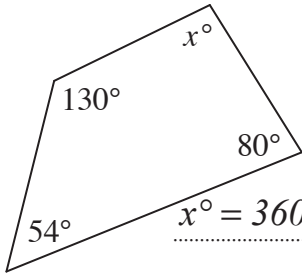
$$\begin{aligned} \mathbf{A.} \quad x^\circ &= 360^\circ - (90^\circ + 110^\circ + 45^\circ) \\ &= 360^\circ - 245^\circ \\ &= \mathbf{115^\circ} \end{aligned}$$

OR

$$\begin{aligned} x^\circ + 90^\circ + 110^\circ + 45^\circ &= 360^\circ \\ x^\circ + 245^\circ - 245^\circ &= 360^\circ - 245^\circ \\ x^\circ &= \mathbf{115^\circ} \end{aligned}$$

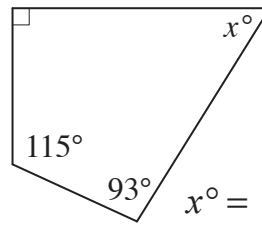


a) Find the value of x° .



$$\begin{aligned} x^\circ &= 360^\circ - (130^\circ + 54^\circ + 80^\circ) \\ &= 360^\circ - 264^\circ = \mathbf{96^\circ} \end{aligned}$$

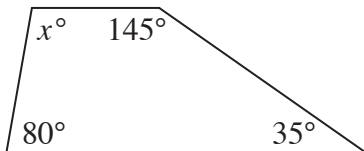
b) Find the value of x° .



$$x^\circ =$$

=

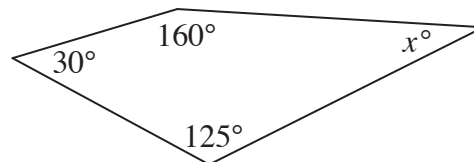
c) Find the value of x° .



$$x^\circ =$$

=

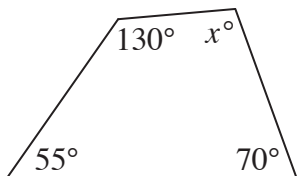
d) Find the value of x° .



$$x^\circ =$$

=

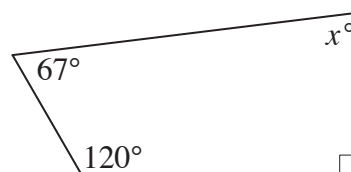
e) Find the value of x° .



$$x^\circ =$$

=

f) Find the value of x° .



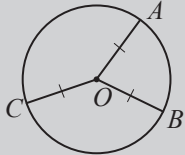
$$x^\circ =$$

=

Skill 24.13 Describing the properties of circles.

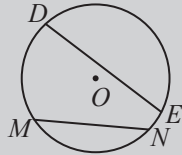
- Consider the definitions and properties of radius (plural radii), chord, diameter, tangent and circumference of a circle. (see Glossary and Math Facts)

Radius - joins the center with any point on the circle

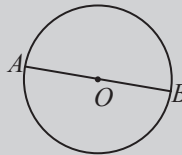


$OA = OB = OC$

Chord - joins any two points on the circle



Diameter - a chord passing through the center

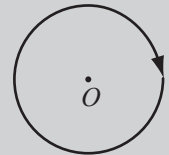


$AB = 2OA$

Tangent - a line touching the circle in one point

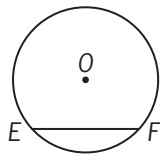


Circumference - the distance around the circle



Q. What is \overline{EF} in this diagram?

- A) diameter
- B) tangent
- C) chord
- D) radius



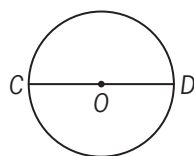
A. \overline{EF} joins two points on the circle & does not pass through the center \Rightarrow **chord**

a) Match each diagram to its description:

b) Match each diagram to its description:

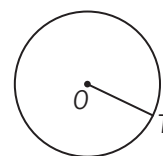
c) What is \overline{CD} in this diagram?

- A) tangent
- B) diameter
- C) radius
- D) circumference

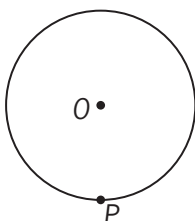


d) What is \overline{OT} in this diagram?

- A) chord
- B) tangent
- C) diameter
- D) radius



e) Draw the diameter passing through P .



f) Draw the radius passing through S .

