

Angles, Lines and Polygons

Name: _____

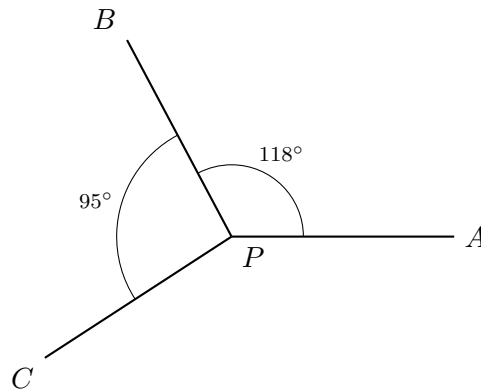
Date: _____

Concepts

- Angles
- Classifying Angles
- Classifying Polygons
- Congruent and Similar Figures
- Geometry (theory)
- Plane figures (theory)
- Polygons (theory)
- Regular Polygons
- Relationships Between Angles
- Similarity, Congruence, and Equivalence (theory)
- Special Lines (theory)

Angles

1. Three rails leave the same point P at a skatepark, along the rays PA , PB and PC .



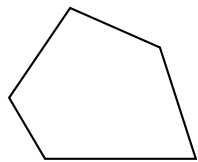
- Find $m\angle CPA$, the third angle around the point P .
- Classify each of the three angles around P .
- The rail PB is turned until $m\angle APB = 90^\circ$, and the rail PC is turned with it so that $m\angle BPC$ is still 95° . Only PA stays where it is. What is $m\angle CPA$ then?

Classifying Angles

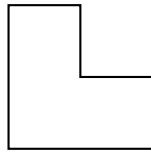
2. An angle measures x degrees, where $0 < x \leq 360$.
- For each class below, write the condition on x as an inequality or an equation: acute, right, obtuse, straight, reflex, full angle.
 - Bruno draws an angle whose measure is three times the smallest *whole* number of degrees that is obtuse. Give the measure of Bruno's angle and classify it.

Classifying Polygons

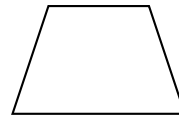
3. Three tiles from a metro-station floor are drawn below.



(a)



(b)



(c)

- Name each tile according to its number of sides.
- Say whether each one is convex or non-convex, and state the test you used. For the non-convex tile, say which vertex makes it so.
- Could any of the three be a regular polygon? Explain.

Congruent and Similar Figures

4. A logo is drawn as a triangle $\triangle ABC$ with $m\overline{AB} = 6$ cm, $m\overline{BC} = 10$ cm and $m\overline{CA} = 14$ cm. It is redrawn larger for a banner as $\triangle DEF$, with $\triangle ABC \sim \triangle DEF$ and $m\overline{DE} = 9$ cm.

- a) Find the ratio of similarity from $\triangle ABC$ to $\triangle DEF$.
- b) Find $m\overline{EF}$ and $m\overline{FD}$.
- c) In the small logo, $m\angle B = 47^\circ$. Give $m\angle E$ and justify your answer.

Geometry

5. Each of the four statements below uses a geometric term or symbol incorrectly. Rewrite each one so that it is correct, and say in a few words what the mistake was.

- a) “ $m\angle ABC = 6$ cm.”
- b) “ $\triangle PQR \sim \triangle STU$, so all six sides have the same length.”
- c) “These two lines are perpendicular, because they never meet.”
- d) “ $\overline{AB} \parallel \angle C$.”

Plane figures

6. A student's list contains: a disc, a cube, a regular octagon, a cylinder, a right trapezoid, a circle, a triangular prism.

- a) Sort the seven items into plane figures and solids.
- b) Among the plane figures, which ones are polygons? Justify your sorting with the definition of a polygon.
- c) Explain the difference between a circle and a disc.

Polygons

7. Complete the table below. In the last two columns, count the diagonals that can be drawn from *one* chosen vertex, and the number of triangles those diagonals cut the polygon into.

Polygon	Sides	Vertices	Diagonals from one vertex	Triangles formed
Pentagon	5			
Heptagon	7			
Decagon	10			

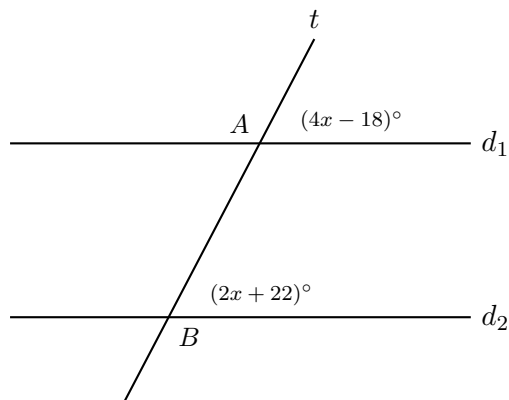
Then state, in words, the rule connecting the number of sides to each of the last two columns.

Regular Polygons

8. The floor of a gazebo in a municipal park is a regular octagon.
- a) Find the sum of the measures of its interior angles.
 - b) Find the measure of one interior angle, and classify that angle.
 - c) Eight identical triangular floor panels meet at the centre of the gazebo, one for each side. Find the angle each panel makes at the centre.

Relationships Between Angles

9. In the figure, $d_1 \parallel d_2$ and the line t cuts them at A and at B . The two marked angles are corresponding angles.



- Write and solve an equation to find x .
- Give the measure of each marked angle.
- Find the measure of the angle at B that lies above d_2 and to the *left* of t , and name the relationship you used.

Similarity, Congruence, and Equivalence

10. For each pair of plane figures, say which of the words *congruent*, *similar* and *equivalent* apply. More than one word may apply, or none.

- a) A rectangle 4 cm by 9 cm and a square of side 6 cm.
- b) Two squares, each of side 7 cm.
- c) A right triangle whose two sides forming the right angle measure 8 cm and 5 cm, and a right triangle whose two sides forming the right angle measure 10 cm and 4 cm.
- d) Two regular pentagons, one of side 3 cm and one of side 7.5 cm.

Then explain why congruent figures are always both similar and equivalent, while equivalent figures need not be similar.

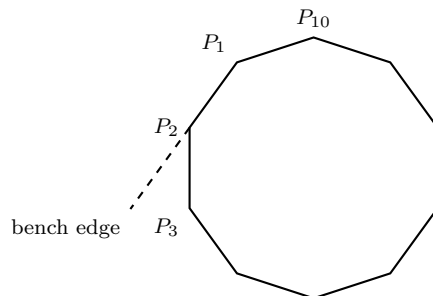
Special Lines

11. A triangular park $\triangle ABC$ has $m\overline{BC} = 30$ m, and the height drawn from A to the side $\overline{BC}$ measures 12 m. The median from A meets $\overline{BC}$ at M .

- a) Find the area of the park, and find $m\overline{BM}$.
- b) The median $\overline{AM}$ splits the park into $\triangle ABM$ and $\triangle AMC$. Find the area of each, and justify why the median always splits a triangle into two equivalent parts.
- c) Is the height from A always inside the triangle? Describe a triangle where it is not.

Synthesis — drawing on several sheets in this topic

12. A fountain rim is built as a regular decagon $P_1P_2P_3 \dots P_{10}$. The side $\overline{P_1P_2}$ is extended beyond P_2 to form the straight front edge of a bench, as shown.



- a) Find the measure of one interior angle of the decagon.
- b) Find the measure of the angle between the extended edge and the side $\overline{P_2P_3}$, and name the relationship you used.
- c) Classify both angles found in a) and b).

Want the harder problems and the worked solutions?

The *Challenge Problems* set and the *Answer Keys* for Angles, Lines and Polygons — with the reasoning written out in full — are available at tutorinmontreal.ca.