

Geometry

Name: _____

Date: _____

Concepts

- Angles of Depression and Elevation
- Equivalent Figures
- Equivalent Solids
- Finding Missing Measurements in Plane Figures Using a 2nd Degree Equation
- Finding Missing Measurements in Plane Figures by Solving a System of Equations
- Geometry (theory)
- Methods to Decompose Figures
- Missing Measurements in Solids (theory)
- Similarity, Congruence, and Equivalence (theory)
- Solids with the Same Area
- Tetrahedrons
- Thales' Theorem
- The Angles of a Circle
- The Minimum Conditions for Congruent Triangles
- The Minimum Conditions for Similar Triangles
- The Volume of Solids Using Algebra

Angles of Depression and Elevation

1. A delivery drone hovers motionless 48 m above a level field. Its camera is aimed at a landing marker on the ground at an angle of depression of 32° . How far is the marker from the point on the ground directly beneath the drone? Round to the nearest tenth of a metre.

Equivalent Figures

2. A trapezoidal window pane has parallel sides of 9 cm and 15 cm and a height of 6 cm. A rectangular pane 8 cm wide is to be cut so that it is equivalent to the trapezoid. What must the rectangle's length be?

Equivalent Solids

3. A right circular cylinder has a radius of 5 cm and a height of 12 cm. A cone with the same radius is to be equivalent to this cylinder. Find the cone's height.

Finding Missing Measurements in Plane Figures Using a 2nd Degree Equation

4. A rectangular herb bed is 5 m longer than it is wide and covers 84 m^2 . Find its dimensions.

Finding Missing Measurements in Plane Figures by Solving a System of Equations

5. A rectangular banner has a perimeter of 48 dm, and its length is 3 dm more than twice its width. Find its dimensions.

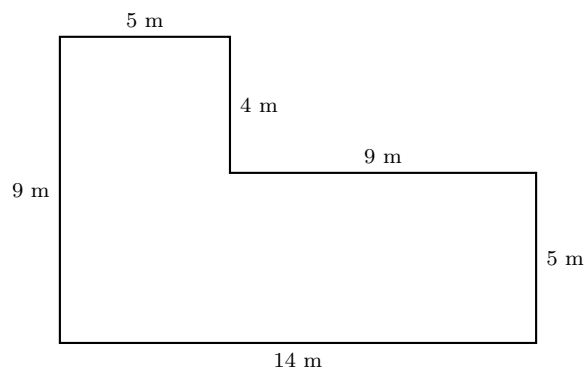
Geometry

6. Most geometry problems are solved by first recognizing *which* relation applies. For each situation below, name the property or theorem you would use, and state the one condition that must be verified before you are allowed to use it.

- a) Two transversals cut three lines, and three of the four consecutive segment lengths they determine are known.
- b) An angle whose vertex is on a circle intercepts an arc whose measure is known.
- c) A cable runs from the top of a mast to an anchor on level ground, and the angle it makes with the ground is known.
- d) A container of one shape is to be replaced by a container of a different shape holding exactly the same amount.

Methods to Decompose Figures

7. A workshop floor has the L-shape below. Find its area two different ways: once by adding two rectangles, once by subtracting a rectangle from a larger one.



Missing Measurements in Solids

8. A right circular cone involves three lengths: the radius r of the base, the height h , and the apothem (slant height) s .
- a) State the relation linking r , h and s , and justify it.
 - b) A technician knows only the *volume* and the *radius* of such a cone and must find its total area. Describe the order of the steps, naming which quantity must be found first and why the total area cannot be obtained directly.

Similarity, Congruence, and Equivalence

9. Decide whether each statement is *always*, *sometimes* or *never* true. Justify each answer with an argument or an explicit counterexample.
- a) Two congruent figures are equivalent.
 - b) Two equivalent figures are congruent.
 - c) Two similar figures whose ratio of similarity is $k = 1$ are congruent.
 - d) Two equivalent triangles have the same perimeter.

Solids with the Same Area

10. A cube has an edge of 6 cm. A right prism with a square base 4 cm by 4 cm has the same total area as the cube. Find the height of the prism.

Tetrahedrons

11. A tetrahedron has an equilateral triangular base of side 8 cm and a height of 15 cm. Find its volume, exactly and to the nearest hundredth of a cubic centimetre.

Thales' Theorem

12. Three parallel lines are cut by two transversals. On the first transversal the two consecutive segments measure 6 cm and 9 cm. On the second transversal, the segment corresponding to the 6 cm one measures 8 cm. Find the length of the remaining segment.

The Angles of a Circle

- 13.** In a circle of centre O , the chord AB subtends a central angle AOB of 104° .
- a) Point C lies on the major arc AB . Find $m\angle ACB$.
 - b) Find $m\angle OAB$.

The Minimum Conditions for Congruent Triangles

14. In triangles ABC and DEF it is known that $AB = DE = 7$ cm, $BC = EF = 9$ cm and $m\angle B = m\angle E = 54^\circ$.

- a) Name the minimum condition that establishes the congruence, and explain why the position of the angle matters.
- b) State the measure of DF if $AC = 8.2$ cm.

The Minimum Conditions for Similar Triangles

15. In triangles PQR and STU , $\frac{PQ}{ST} = \frac{QR}{TU} = \frac{3}{2}$ and $m\angle Q = m\angle T$.

- a) Name the minimum condition that establishes the similarity.
- b) Find PR if $SU = 14$ cm.

The Volume of Solids Using Algebra

16. A rectangular-based right prism has dimensions x , $x + 2$ and $x + 5$ centimetres.

- a) Express its volume as a polynomial in expanded form.
- b) Evaluate the volume for $x = 3$ cm and check the value directly.

Synthesis — drawing on several sheets in this topic

17. Road salt is dumped into a conical pile on level ground; the base of the pile is a circle of diameter 14 m. From a point on the ground 12 m from the *edge* of the pile, in the same vertical plane as the apex, the angle of elevation of the apex is 22° .

The municipality wants to move all of the salt into a rectangular-based bin measuring 12 m by 8 m, filled level to the top. How deep must the bin be? Round to the nearest hundredth of a metre.

Want the harder problems and the worked solutions?

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