# Online HW 2: Proof by Pictures

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## Contents

# Lines in a Triangle

*Short-answer questions about lines in a triangle.*

Adjust the figures to fit the given conditions within **eyeball accuracy**. Enter the requested measurements.

**Problem 1** *Geogebra link:* https://tube.geogebra.org/m/q32gyaud

*In $\triangle ABC$ above, move point $D$ to make the following measurements.* ***Enter -1 if it is not possible.***

(a) *When $\overline{BD}$ is a median, $AD = \boxed{?}$.*

(b) *When $\overline{BD}$ is a angle bisector, $AD = \boxed{?}$.*

(c) *When $\overline{BD}$ is a perpendicular bisector, $AD = \boxed{?}$.*

(d) *When $\overline{BD}$ is a altitude, $AD = \boxed{?}$.*

Author(s): Brad Findell

# Measuring Interior Angles

*Short-answer questions involving angles in triangles.*

Geogebra link: `https://tube.geogebra.org/m/zrapvzpz`

**Problem 2** *Measure the interior angles of quadrilateral $ABCD$ above.*

(a) $m\angle A = \boxed{?}$ *degrees.*

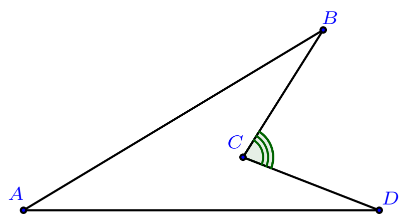
(b) $m\angle B = \boxed{?}$ *degrees.*

(c) $m\angle C = \boxed{?}$ *degrees.*

(d) $m\angle D = \boxed{?}$ *degrees.*

(e) $m\angle A + m\angle B + m\angle C + m\angle D = \boxed{?}$ *degrees.*

**Problem 3** *Use the measurements from the previous problem to answer the following questions:*



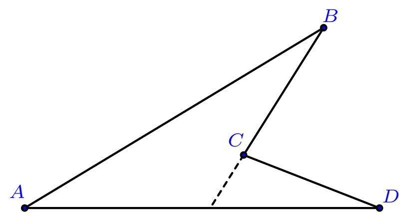

(a) *The marked angle should measure* $\boxed{?}$ *degrees.*

(b) $m\angle A + m\angle B + m\angle D = \boxed{?}$ *degrees.*

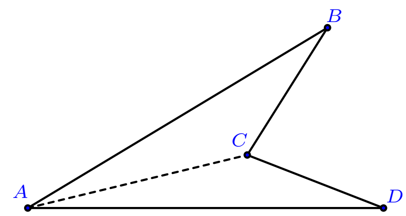
(c) *What do you notice?*

**Problem 4** *In order to reason about the sum of the interior angles, Bart and Brad each* triangulated *the figure as shown below.*

Author(s): Brad Findell




*Brad's triangulation*




*Bart's triangulation*

*Both Bart and Brad claim that because in a triangle the sum of the interior angles is* $\boxed{?}$ *degrees, and this quadrilateral is cut into* $\boxed{?}$ *triangles, the angle sum in this quadrilateral should be* $\boxed{?}$ *degrees. What is your judgment?*

***Multiple Choice:***

(a) *They are both correct.*

(b) *Only Brad is correct.*

(c) *Only Bart is correct.*

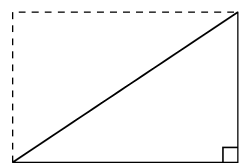
(d) *Neither of them are correct.*

*Explain your reasoning.*

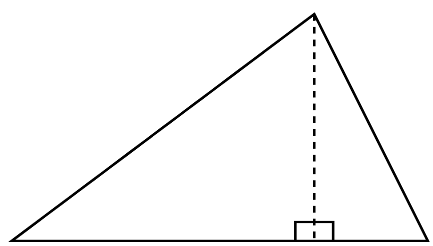
# Proof by Picture

*Short-answer proofs by pictures.*

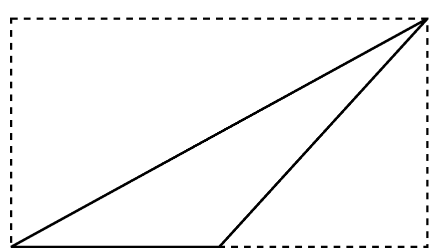
**Problem 5** *Explain how the following picture "proves" that the area of a right triangle is half the base times the height.*



**Problem 6** *Suppose you know that the area of a **right** triangle is half the base times the height. Explain how the following picture "proves" that the area of **every** triangle is half the base times the height.*



**Problem 7** *Now suppose that a student, say* Geometry Giorgio *attempts to solve a similar problem. Again knowing that the area of a right triangle is half the base times the height, he draws the following picture:*



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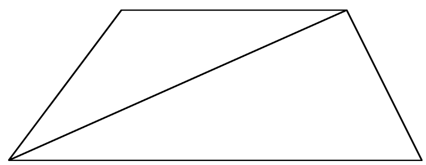
*Geometry Giorgio states that the diagonal line cuts the rectangle in half, and thus the area of the triangle is half the base times the height. Is this correct reasoning? If so, give a complete explanation. If not, give correct reasoning based on Geometry Giorgio's picture.*

**Problem 8** *Recall that a trapezoid is a quadrilateral with two parallel sides. Consider the following picture:*

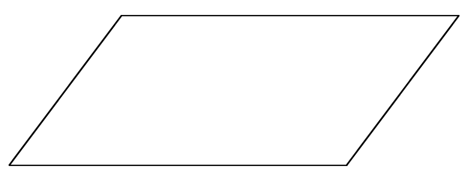


*How does the above picture prove that the area of a trapezoid is*

$$\text{area} = \frac{h(b_1 + b_2)}{2}$$

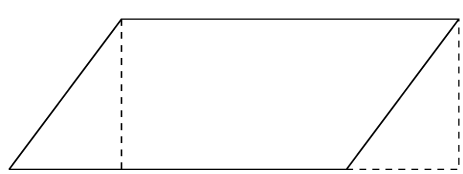
*where $h$ is the height of the trapezoid and $b_1$, $b_2$, are the lengths of the parallel sides?*

**Problem 9** *Look at the previous problem. Can you use a similar idea to prove that the area of a parallelogram*

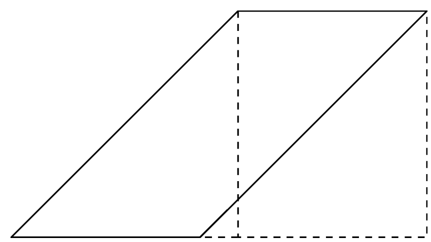


*is the length of the base times the height?*

**Problem 10** *Explain how the following picture "proves" that the area of a parallelogram is base times height.*



**Problem 11** *Now suppose that a student, say Geometry Giorgio attempts to solve a similar problem. In an attempt to prove the formula for the area of a parallelogram,* Geometry Giorgio *draws the following picture:*



*At this point Geometry Giorgio says that he has proved the formula for area of a parallelogram. What do you think of his picture? Give a complete argument based on his picture.*