Geometry Supplement

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Contents

1. Definitions

- Two angles are said to be **complementary** if their measures add up to $90°$.
- Two angles are said to be **supplementary** if their measures add up to $180°$.
- Two or more points are said to be **co-linear** if they lie on the same line.
- An angle is said to be **right** if it measures to be $90^{\cdot}$.
- An angle is said to be **acute** if it measures strictly between $0^{\cdot}$ and $90^{\cdot}$.
- An angle is said to be **obtuse** if it measures strictly between $90^{\cdot}$ and $180^{\cdot}$.
- A **ray** is a portion of a line, it has one end point and one side that goes forever.
- A **quadrilateral** is a shape with 4 sides.
- A **polygon** is a shape with n sides. A polygon is said to be **regular** is all of its sides are congruent.
- A regular polygon with 5 sides is referred to as a **pentagon**
- A regular polygon with 6 sides is referred to as a **hexagon**
- A regular polygon with 7 sides is referred to as a **septagon**
- A regular polygon with 8 sides is referred to as a **octagon**
- A regular polygon with 9 sides is referred to as a **nonagon**
- A regular polygon with 10 sides is referred to as a **decagon**
- A **rectangle** is a quadrilateral with all 4 right angles.

- A **square** is a rectangle with all 4 sides congruent as well.
- A **parallelogram** is a quadrilateral with two pairs of opposite parallel sides.
- A **rhombus** is a parallelogram whose sides are all congruent as well.
- A **trapezoid** is a quadrilateral with one pair of parallel sides.
- A triangle is said to be **isosceles** if two of its sides are congruent.
- A triangle is said to be **right** if it has one right angle.

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2. Theorems

- The **Side-Side-Side (SSS)** congruence theorem:

  If all three sides of two given triangles are congurent, then the triangles are congruent.

- The **Side-Angle-Side (SAS)** congruence theorem:

  If the corresponding consecutive side, angle, and side of two given triangles are congruent, then the triangles are congruent.

- The **Angle-Angle-Side (AAS)** congruence theorem:

  If the corresponding consecutive angle, angle, and side of two given triangles are congruent, then the triangles are congruent.

- The **Angle-Side-Angle (ASA)** congruence theorem:

  If the corresponding consecutive angle, side, and angle of two given triangles are congruent, then the triangles are congruent.

- The **Hypotenuse Leg (HL)** congruence theorem:

  If the corresponding lengths of one leg and the hypotenuse of two given triangles are congruent, then the triangles are congruent.

- The **Isosceles Triangle** theorem:

  If the two sides of a triangle are congruent, then the corresponding angles are congruent as well.

- The **Triangle Inequality** theorem:

Given any triangle, the sum of any two sides are always greater than the length of the third side.

- The **Pythagorean** theorem:

  In any given right triangle, if a, b are the two short legs and c is the hypotenuse, then

  $$a^2 + b^2 = c^2$$

  always holds.

- The **Quadrilateral Opposite Sides** theorem:

  If both pairs of opposite sides of a quadrilateral are congruent, then the quadrilateral is a parallelogram.

- The **Quadrilateral Opposite Angles** theorem:

  If both pairs of opposite angles of a quadrilateral are congruent, then the quadrilateral is a parallelogram

- The **Quadrilateral Bisector** theorem:

  If the diagonals of a quadrilateral bisect each other, then the quadrilateral is a parallelogram.

- The **Quad parallel sides** theorem:

  If one pair of opposite sides of a quadrilateral is both parallel and congruent, then the quadrilateral is a parallelogram.

- The **Rhombus Diagonal** theorem:

  The diagonals of a rhombus are always perpendicular

- The **Angle sum** theorem:

  The sum of interior angles of any triangle always add up to 180°.

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3. Logic

Anytime you have a sentence in the form of

If ....., then.....

There are 3 sentences you can form using this and only one is logically equivalent to the given, and the other two are logically equivalent to each other. That means when one is true so is the other.

Given the *conditional* statement

If P, then Q,

the

- **Inverse** of the statement would be

  If NOT P, then NOT Q.

- **Converse** of the statement would be

  If Q, then P.

- **Contra-positive** of the statement would be

  If NOT Q, then NOT P.

So the contra-positive and the statement itself are logically equivalent. And so the inverse and converse are logically equivalent.

Example:

If I took a shower, then I am soaking wet.

The **Inverse** would be

If I did not take a shower, then I am not soaking wet.

The **Converse** would be

> If I am soaking wet, then I must have just taken a shower.

The **Contra-positive** would be

> If I am not soaking wet, then I did not just take a shower.

Now given the original statement is true, only this last one is also true, can you see that? And are the other two true necessarily?

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4. Volume and Surface area

Informal definitions:

- The **volume** of a surface is the amount of space it can fill up.
- The **surface area** os a surface is the amount of space there is to "walk on"

Here, V is volume, and S is surface area, r is radius, h is height, and w is width:

Volume

- $V_{\text{sphere}} = \frac{4}{3}\pi r^3$
- $V_{\text{cone}} = \frac{1}{3}\pi r^2 h$
- $V_{\text{cylinder}} = \pi r^2 h$
- $V_{\text{box}} = lwh$

Surface Area

- $S_{\text{sphere}} = 4\pi r^2$
- $S_{\text{cone}} = \pi r^2 + \frac{1}{2}(2\pi r)\sqrt{r^2 + h^2}$
- $S_{\text{cylinder}} = 2\pi rh + 2\pi r^2$
- $S_{\text{box}} = 2(lw + wh + lh)$

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5. Formulas

- Measure of **interior angles** of an $n-$gon is given by

$$\frac{(n-2)180}{n}$$

- Total measure of **interior angles** of an $n-$gon is given by

$$(n-2)180$$

- Measure of an **exterior angle** of an $n-$gon is given by

$$\frac{360}{n}$$

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