# Geometry

Triangle Proofs

# Vocabulary

Proof:

A logical, step-by-step, explanation that shows the truth of a hypothesis guarantees the truth of the conclusion.

In proofs, our goal is to explain every step of the process, and show that each step is correct by supporting it with mathematical rules and definitions.

This is commonly done through a formal 2-column proof.  Less commonly, it can be done through an informal paragraph proof or flow proof.

# Proofs

**In addition to <u>ALL</u> of the definitions, properties, postulates, and theorems from Geometry, we will be incorporating the following algebraic properties into our work.**

**Algebraic Properties of Equality**

Let $a$, $b$, and $c$ be real numbers.

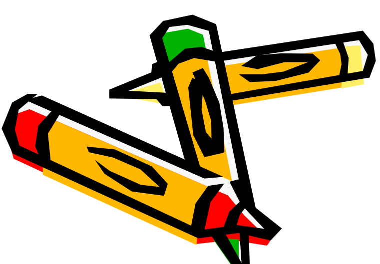
| | |
|---|---|
| **Addition Property of Equality** | If $a = b$, then $a + c = b + c$. |
| **Subtraction Property of Equality** | If $a = b$, then $a - c = b - c$. |
| **Multiplication Property of Equality** | If $a = b$, then $a \bullet c = b \bullet c$, $c \neq 0$. |
| **Division Property of Equality** | If $a = b$, then $\frac{a}{c} = \frac{b}{c}$, $c \neq 0$. |
| **Distributive Property** | $a(b + c) = ab + ac$ |
| **Substitution Property of Equality** | If $a = b$, then $a$ can be substituted for $b$ (or $b$ for $a$) in any equation or expression. |

# Proofs

**In addition to <u>ALL</u> of the definitions, properties, postulates, and theorems from Geometry, we will be incorporating the following algebraic properties into our work.**

**Reflexive, Symmetric, and Transitive Properties of Equality**

| | **Real Numbers** | **Segment Lengths** | **Angle Measures** |
|---|---|---|---|
| **Reflexive Property** | $a = a$ | $AB = AB$ | $m\angle A = m\angle A$ |
| **Symmetric Property** | If $a = b$, then $b = a$. | If $AB = CD$, then $CD = AB$. | If $m\angle A = m\angle B$, then $m\angle B = m\angle A$. |
| **Transitive Property** | If $a = b$ and $b = c$, then $a = c$. | If $AB = CD$ and $CD = EF$, then $AB = EF$. | If $m\angle A = m\angle B$ and $m\angle B = m\angle C$, then $m\angle A = m\angle C$. |

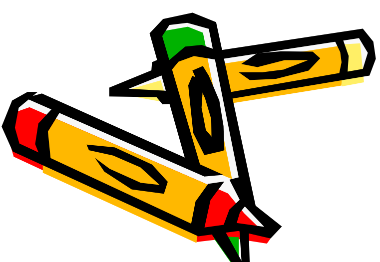


# Algebra Proof (2-column)

Given: $2(x + 5) = 30$ (This is our hypothesis)

Prove: $x = 10$ (This is our conclusion)

| Statements (what we do/say) | Reasons (how we know our statement is correct) |
|---|---|
| $2(X + 5) = 30$ | Given |
| $2x + 10 = 30$ | Distribution |
| $2x = 20$ | Subtraction property of equality |
| $x = 10$ | Division rule of equality |



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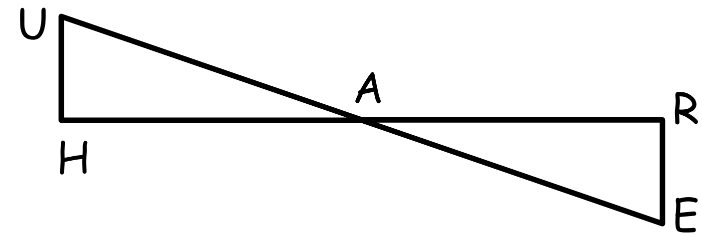
# Geometry Proof (2-column)

Given: UH // RE

A is the midpoint of UE

Prove: △UAH ≅ △EAR




| Statements | Reasons |
|---|---|
| UH // RE<br>A is the midpoint of UE | Given |
| UA ≅ EA | Definition of midpoint |
| ∠AUH ≅ ∠AER | Alternate Interior Angles<br>(using the given parallel lines) |
| ∠UAH ≅ ∠EAR | Vertical Angles |
| △UAH ≅ △EAR | ASA |
| | |

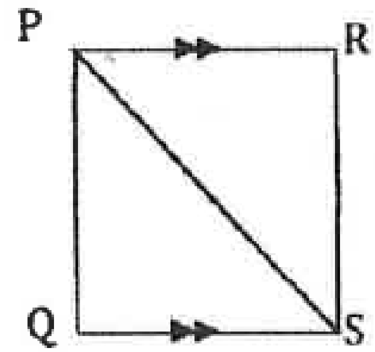
Use the given info

bring in new info

Everything is there – wrap it up

Given: $\overline{PR} \parallel \overline{QS}$, $\angle QPS \cong \angle RSP$

Prove: $\triangle PQS \cong \triangle SRP$




| Statements | Reasons |
|---|---|
| $PR \parallel QS$, $\angle QPS \cong \angle RSP$ | Given |
| $\angle RPS \cong \angle QSP$ | Alternate Interior Angle |
| $PS \cong PS$ | Reflexive |
| $\triangle PQS \cong \triangle SRP$ | ASA |