

Science is a way of gaining knowledge

How do we know things?

Instinct?

Revealed Knowledge?

Authority?

Reasoning

Inductive reasoning

Deductive reasoning

Deductive reasoning

Begin with generalities (postulates) that everyone agrees are true. Combine two or more generalities with "if" and "then" to make inferences about specific cases.

Examples:

Euclidean geometry

Deductive Reasoning

Strengths:

If your postulates are true and you have not made a logical error in combining them then your result is necessarily true (i.e. you can prove things).

Weaknesses:

It is extremely difficult to find postulates that everyone agrees are true.

Postulates are derived imagination not from nature

Complex deductive systems may be self contradictory

Inductive reasoning

Observe specific cases based on patterns observed derive general rules.

Examples:

When I asked Kelly for a date, Kelly said no.

When I asked Pat for a date, Pat said no.

When I asked Casey for a date, Casey said no.

Therefore I conclude that no one will go on a date with me.

Inductive Reasoning

Strengths:

Basic information is derived from observation and must be consistent with the real world.

It is easy to get people to agree on specific cases/events

Weaknesses:

Hasty generalizations

Biased Sampling

Can not prove general rules.

Scientific reasoning (hypothetico - deducutive model)

Step 1: Observation

Step 2: Develop a tentative explanation (theory) about how the universe works. (note this explanation may be based on observation, logic, common sense or the creativity of the scientist)

Scientific reasoning (hypothetico - deducutive reasoning)

Step3: Use deductive logic to create a hypothesis based on the tentative explanation. (The hypothesis is a statement that must be true if the explanation is correct)

Step 4: Collect data to test the hypothesis.

Scientific reasoning (hypothetico - deducutive reasoning)

Step 5: Reject or accept hypothesis

Step 6: re-evaluate explanation and other explanations

Step 7: Communicate your results