# 1.4 /1.5 Proofs that are not valid (Concept #16)

**Example :1** **(Use reasoning to determine the validity of an argument)**
Sam is a high school student. All high school students dislike cooking. Therefore, Sam dislikes cooking. Where is the error in the reasoning?

Sam is a high school student…. TRUE Statement
All high school students dislike cooking …. This statement in invalid because it is based on a stereotype.

Therefore Sam dislikes cooking…… The conclusion is false because the second statement is false. Sam may like cooking.

Note: Stereotypes are generalizations based on culture, gender, religion or race. There are always counterexamples to stereotypes, so conclusions based on stereotypes are NOT VALID

**Example 2 : (Use reasoning to determine the validity of a proof)**

Bev Claims 3=4

***Bev's Proof:*** Suppose that: $a + b = c$ ← This is her premise

The statement can be written as: $\boxed{4a - 3a} + \boxed{4b - 3b} = \boxed{4c - 3c}$

After reorganizing, it becomes: $4a + 4b - 4c = 3a + 3b - 3c$ ← regroups so all coefficients of 4 are on one side and coefficients of 3 on the other

Using distributive property: $4(a + b - c) = 3(a + b - c)$ ↖ Factor out 3 + 4.

Dividing both sides by $(a + b - c)$: $4 = 3$

It appears that all of the work is correct, but there is an error:

From her premise
$a + b \overset{-c}{=} c^{-c}$
$a + b - c = 0$

In her last step since $a+b-c=0$ she divided both sides by "0".
We cannot divide by zero, therefore the proof is invalid.

**Example 3:** Liz claims she has proved that -5 = 5

***Liz's Proof:*** Assume the -5=5

Square both sides 25= 25 (True statement)

At first glance it might appear that this proof is valid however it is not. Liz's conclusion is built on a ___false___ assumption. This is called ___Circular___ reasoning. Circular reasoning is when an argument is incorrect because it makes use of the ___Conclusion___ to be proved.

Can't assume $-5=5$ this is a false statement, then argue the statement to be true, because the first statement of the proof is false the proof is invalid.

**Example 4:** Hossai is trying to prove the following number trick: Choose any number. Add 3. Double it. Add 4. Divide by 2. Take away the number you started with.

Each time Hossai tries the trick, she ends up with 5. Her proof, however, does not give the same result.

| **Hossai's Proof:** | | |
|---|---|---|
| | $n$ | Choose any number. ✓ |
| | $n + 3$ | Add 3. ✓ |
| | $2n + 6$ | Double it. ✓ |
| | $2n + 10$ | Add 4. ✓ |
| | $\boxed{2n + 5}$ | Divide by 2. error, have to divide both terms by 2 |
| | $n + 5$ | Take away the number you started with. |

Where is the error in Hossai's proof?

When he ~~did~~ divided by 2.

Retry the proof, with the error corrected:

| | |
|---|---|
| $n$ | Choose a # |
| $n + 3$ | Add 3 |
| $2n + 6$ | Double it |
| $2n + 10$ | Add 4 |
| $n + 5$ | Divide by 2 |
| $5$ | Take away the # you started with. |

### In Summary

**Key Idea**

- A single error in reasoning will break down the logical argument of a deductive proof. This will result in an invalid conclusion, or a conclusion that is not supported by the proof.

**Need to Know**

- Division by zero always creates an error in a proof, leading to an invalid conclusion.
- Circular reasoning must be avoided. Be careful not to assume a result that follows from what you are trying to prove.
- The reason you are writing a proof is so that others can read and understand it. After you write a proof, have someone else who has not seen your proof read it. If this person gets confused, your proof may need to be clarified.

1.5 Assignment (Concept #16)
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