D and SD

TM M decides a language $L \subseteq \Sigma^\wedge *$ iff for any string $w \in \Sigma^\wedge *$:

- M accepts w if $w \in L$
- M rejects w if w $\notin L$

A language is decidable (in D) iff there is a turing machine that decides it.

TM M semidecides a language $L \subseteq \Sigma^*$ iff for any string $w \in \Sigma^*$:

- M accepts w if $w \in L$
- M rejects w OR loops (not halt) if w $\notin L$

A language is semidecidable (in D) iff there is a turing machine that decides it.

D is closed under complement - If L is in D, then NOT L is in D.

SD is not closed under complement.

A language is in D iff both the language and its complement are in SD

A language is in SD iff it is Turing-enumerable

A language is in D iff it is lexicographically Turing-enumerable

To show in D:

- Make deciding TM
- Lexic. Enumeration
- L and $\neg L$ are in SD, then L is in D

To show not in D:

- Diagnolize Reduction

To show in SD

- Make semideciding TM
- Enumerable
- Unrestricted grammar

To show not in SD:

- Reduction

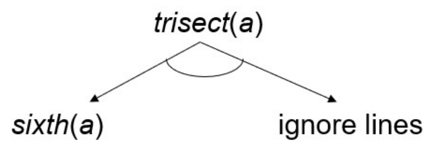
Using reduction to show undecidability:

Theorem: There exists no general procedure to solve the following problem:

> Given an angle *A*, divide *A* into sixths using only a straightedge and a compass.

Proof: Suppose that there were such a procedure, which we'll call *sixth*. Then we could trisect an arbitrary angle:

trisect(***a***: angle) =
1. Divide ***a*** into six equal parts by invoking *sixth*(***a***).
2. Ignore every other line, thus dividing ***a*** into thirds.



sixth exists $\rightarrow$ *trisect* exists.

Since we know trisect doesn't exist, we know that sixth doesn't exist