Problem type 1:

Let's say we have the following known problem and an unknown problem X. Assume you were able to prove the reduction below. Does that mean X **may** be decidable or undecidable or both? (no explanation necessary, just write decidable, undecidable, or both).

(See variants below)

a. **BYD/BYG**

Problem: $A_{TM}(\langle M, w\rangle)$ - the problem of determining if a turing machine M will accept string w.

Reduction: $A_{TM} \implies X$

Solution: Undecidable. ■

b. **BYA/BYE**

Problem: $A_{TM}(\langle M, w\rangle)$ - the problem of determining if a turing machine M will accept string w.

Reduction: $X \implies A_{TM}$

Solution: Both. ■

c. **BYB/BYH**

SAT: (**SAT(ϕ)**)

- INPUT: A conjunctive normal formula ϕ
- OUTPUT: True if there exists a truth assignment that let's ϕ evaluate to True, False otherwise

Reduction: $X \implies SAT$

Solution: Decidable. ■

d. **BYC/BYF**

SAT: (**SAT(ϕ)**)

- INPUT: A conjunctive normal formula ϕ
- OUTPUT: True if there exists a truth assignment that let's ϕ evaluate to True, False otherwise

Reduction: $SAT \implies X$

Solution: Both. ■