Quantified statements worksheet

**Part One**

Assume:

* + the domain consists of integers
  + O(x) is “x is odd”
  + L(x) is “x < 10”
  + G(x) is “x>9”

What is the truth value of the following statements?

* 1. ∃ x [ O(x) ] **True x=3**
  2. ∀ x [L(x) → O(x) ] **False x=2**
  3. ∀ x [L(x) → ¬ G(x) ] **True**
  4. ∃ x [L(x) ∧ G(x)] **False for all values**
  5. ∀ x [L(x) ∨ G(x)] **True**
  6. ∃ x [L(x) ⟶ G(x)] **True x=20**

Assume:

* + the domain consists of integers
  + A(x) is “x<5”
  + B(x) is “x<7”

What is the truth value of the following statements?

* 1. ∃ x [ A(x) ] **True x=2**
  2. ∃ x [ A(x) ∧ B(x)] **True x=2**
  3. ∀ x [ A(x) ∧ B(x)] **False x=6**
  4. ∀ x [ A(x) → B(x) ] **True**
  5. ∀ x [ B(x) → A(x) ] **False x=**
  6. ∃ x [ A(x) ⟶ F ] **True x=**

**Part Two**

How do you write the negation of the following statements (use De Morgan’s laws for quantified statements):

* All Americans eat cheeseburgers

**Not all Americans eat cheeseburgers *or* There exists at least one American who doesn’t eat cheeseburgers.**

* There is a smart student at NMSU.

**There is not a smart student at NMSU.**

**Part Three**

How do you write the negation of the following statements?

* ∀ real numbers x, if x2 >= 1 then x> 0
* For every student at NMSU if they have been at NMSU for at least two years then they are classified as a Junior.

**Part Four**

How would you write these in English? Assume that the domain for x is all humans.

(∀ x) [ GoesToNMSU(x) → Smart(x) ]

(∀ x) [ GoesToNMSU(x) ∧ Smart(x) ]

(∃ x) [ GoesToNMSU(x) → Smart(x) ]

(∃ x) [ GoesToNMSU(x) ∧ Smart(x) ]