SCORE: / 30 POINTS

Use truth tables to determine if the following argument form is valid or invalid. SCORE: / 8 POINTS MARK THE CRITICAL ROWS CLEARLY, AND STATE WHETHER THE ARGUMENT IS VALID OR INVALID.

$\therefore p \oplus r$			¹ / ₂ point for correct truth v				
	~			~ ~ ~		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	
p	<i>q</i>	r	$\sim r$	$q \lor \sim r$	$p \to (q \lor \sim r)$	$\sim q$	$p \oplus r$
Т	Т	Т	F	Т	Т	F	F
Т	Т	F	Т	Т	Т	F	Т
Т	F	Т	F	F	F	Т	F
Т	F	F	Т	Т	Т	Т	Т
F	Т	Т	F	Т	Т	F	Т
F	Т	F	Т	Т	Т	F	F
F	F	Т	F	F	Т	Т	Т
F	F	F	Т	Т	Т	T	F
ts for h	aving all	combin	ations		2 ¹ / ₂ points for correct trut] h	1 point for correct
f truth values for p, q, r					values for $p \rightarrow (q \lor \sim r)$	1	truth values for $p \oplus r$

Let $S = \{x \in Z \mid x \neq 0\}$. Let T be the relation from S to S defined by xTy if and only if xy = 1. Is T a function? Why or why not?

SCORE: / 3 POINTS

T is not a function, because for $x = 2 \in S$, there is no $y \in S$ such that xy = 12 points (also valid if you used any other non-zero integer for x except ± 1) 1 point ie. 2(0.5) = 1, but $0.5 \notin S$, since $0.5 \notin Z$

Write the negations of the following statements in English. Do not use statement variables in your final answer.

"If this number is odd, then its square is odd." [a]

> not (not "This number is odd" or "its square is odd") not (not "This number is odd") and not "its square is odd" "This number is odd and its square is not odd"

2 points SUBTRACT 1/2 point if you wrote "its square is even"

"My heart is heavy, but my spirit is not broken." [b]

> not ("My heart is heavy" and "my spirit is not broken") not "My heart is heavy" or not "my spirit is not broken" "My heart is not heavy or my spirit is broken" 2 points

SCORE: / 4 POINTS



Let $p = "x < 5"$. Let $q = "x = 5"$. Let $r = "x > 3"$.	Let $s = "x = 3"$.
Write the <u>negation</u> of " $3 < x \le 5$ " <u>symbolically</u> using the statement variable	es above.
Your final answer may use the negation of statement variables, but must n	tot use the negation of compound statements.
$\sim (r \land (p \lor q)) \qquad 1\frac{1}{2} \text{ points}$	
$\sim r \lor \sim (p \lor q)$ $\sim r \lor (\sim p \land \sim q)$ 1½ points	
Rewrite the following statements in English using the wording indicated.	SCORE: / 4 POINTS
[a] Rewrite "If my code crashes, then a core dump is created" using "is n	ecessary for".
"A core dump being created is necessary for my code to cras	sh" 2 points
[b] Rewrite "The tide is high or I'm holding on" using "if/then".	
"If the tide is not high, then I'm holding on"OR"If I'm not2 points2 points	holding on, then the tide is high"
Suppose x is a specific number. Consider the statement "If $x^2 < 1$, then x^3	$+ x \ge 0$ ". SCORE: / 2 POINTS
[a] Write the contrapositive of the statement. <u>Do not use statement vari</u>	<u>ables in your final answer.</u>
"If $x^3 + x < 0$, then $x^2 \ge 1$ " 1 point	
[b] Write the inverse of the statement. Do not use statement variables in	n your final answer.
"If $x^2 \ge 1$, then $x^3 + x < 0$ " 1 point	

Use the Rules of Inference to deduce the conclusion from the hypotheses. SCORE: ____/ 6 POINTS STATE THE RULES USED (or "GIVEN") FOR EACH STEP. YOU MAY USE THE ABBREVIATIONS IN THE TABLE.

$w \rightarrow \sim b$	$k \wedge \sim m$	GIVEN ¹ / ₂ point
$k \wedge \sim m$	$\therefore k$	SPEC 1 point
$b \lor m$	$\therefore \sim m$	SPEC 1 point
$\therefore \sim w \wedge k$	$b \lor m$	GIVEN ¹ / ₂ point
	$\therefore b$	ELIM 1 point
	$w \rightarrow \sim b$	GIVEN ¹ / ₂ point
	∴~ <i>w</i>	MT 1 point
	$\therefore \sim w \wedge k$	CONJ ¹ / ₂ point