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Q1:

(a) Every student taking this module like mathematics

predicates: P(x) = "Every x taking this module like mathematics"

quantifier: For all the student who taking this module like mathematics

logical operator: Every student who is taking mathematics ⟶ Every student likes mathematics

mathematical operator: ∀ For all the student who taking this module like mathematics

(b) Every student taking this module has taken exactly 2 mathematics modules in Trinity

predicates: P(x) = "Every x taking this module has taken exactly 2 mathematics modules in Trinity"

quantifier: For all the student who taking this module has taken exactly 2 mathematics modules in Trinity

logical operator: Every student who is taking mathematics ⟶ Every student has taken exactly 2 mathematics modules in Trinity

mathematical operator: ∀ For all the student who taking this module has taken exactly 2 mathematics module in Trinity

(c) There is a student taking this module who has never been on campus

predicates: P(x) = There is a x taking this module who has never been on campus

quantifier: There exist a student taking this module who has never been on campus

logical operator: There is a student taking this module ⟶ This student has never been on campus

mathematical operator: ∃ There is a student taking this module who has never been on campus

(a) negation: Not all the student taking this module like mathematics

predicates: P(x) = Not all of the x taking this module like mathematics

quantifier: There exists some student taking this module like mathematics

logical operator: All the student taking mathematics ⟶ some of the student like mathematics

mathematics operator: - For all the student taking this course like maths

(b) negation: Not all the student taking this module has taken exactly two mathematics modules in Trinity

predicates: $P(x)$ = Not all the x taking this module has taken exactly two mathematics modules in Trinity

quantifier: There exist some student taking this module has taken exactly two mathematics modules in Trinity

logical operator: All the student taking mathematics $\longrightarrow$ some of the student has taken exactly two mathematics modules in Trinity

mathematical operator: - For all the student who taking this module has taken exactly 2 mathematics module in Trinity

(c) negation: There isn't a student taking this module who has never been on campus

predicates: $p(x)$ = There isn't a x taking this module who has never been on campus

quantifier: There is no such a student taking this module what has never been on campus

logical operator: There is a student taking this module $\longrightarrow$ This student has been on campus

mathematical operator: - There is a student taking this module who has never been on campus

Q2: x is an even integer

set $x = 2k$ (k is an integer)

then $x^2 + x = (2k)^2 + 2k = 4k^2 + 2k$
$= 2(2k^2 + k)$

$2k^2 + k$ is an integer

hence $2(2k^2+k)$ is an even integer

so $x^2 + x$ is an even integer

Q3: (a) If n^2+2n+7 is odd, then n is even

Contraposition:

If n is odd, then n^2+2n+7 is even

proof: set $n = 2k+1$ (k is an integer)

$n^2+2n+7 = (2k+1)^2 + 2(2k+1)+7$
$= 4k^2+4k+1 + 4k+2+7$
$= 4k^2+8k+10$
$= 2(2k^2+4k+5)$

$2k^2+4k+5$ is an integer
So $2(2k^2+4k+5)$ is an even integer
hence n^2+2n+7 is even

(b) n^2+2n+7 is odd $\leftrightarrow$ n is even

because (n^2+2n+7 is odd $\rightarrow$ n is even) is already been proofed

so now I am going to proof:

n is even $\rightarrow$ n^2+2n+7 is odd

set $n = 2k$ (k is an integer)

$n^2+2n+7 = 4k^2+4k+7$
$4k^2$ is an even integer as $4k^2 = 2(2k^2)$
$4k$ is an even integer as $4k = 2(2k)$
7 is odd and
even + even + odd = even + odd
= odd
so $4k^2+4k+7$ is odd
hence n^2+2n+7 is odd

Q4: (a) $f(x) = \frac{x}{x+3}$

If the real function $f(x)$ is an even function

then $f(x) = f(-x)$

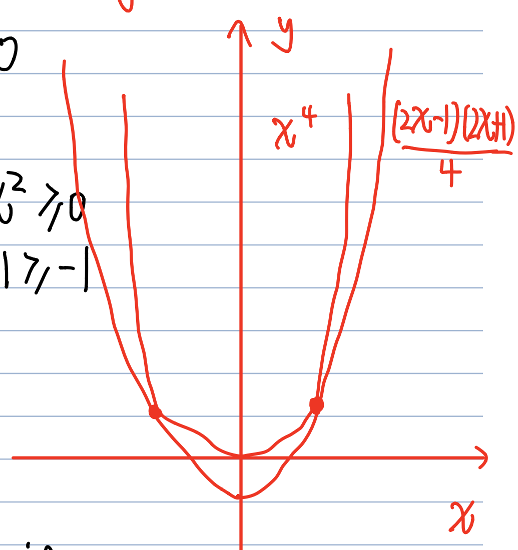
$\frac{x}{x+3} = \frac{-x}{-x+3}$

$x(3-x) = -x(x+3)$
$x(x-3) = x(x+3)$

$x-3 = x+3$

because $x-3 \neq x+3$
hence this statement is false

graphs:



(b) $x^4 \geqslant \frac{(2x-1)(2x+1)}{4}$
$\Updownarrow$
$4x^4 \geqslant (2x-1)(2x+1)$
$\Updownarrow$
$4x^4 \geqslant 4x^2-1$

$(x^2)^2 = x^4 \geqslant 0$
$4x^4 \geqslant 0$

meanwhile: $4x^2 \geqslant 0$
$4x^2-1 \geqslant -1$

$x^2 \geqslant 0$

As we all know $0 \geqslant -1$

Hence $4x^4 \geqslant 4x^2-1$

So x^4 larger or equal than $\frac{(2x-1)(2x+1)}{4}$ if and only if $x \in R$