Problem 1 (P.1)

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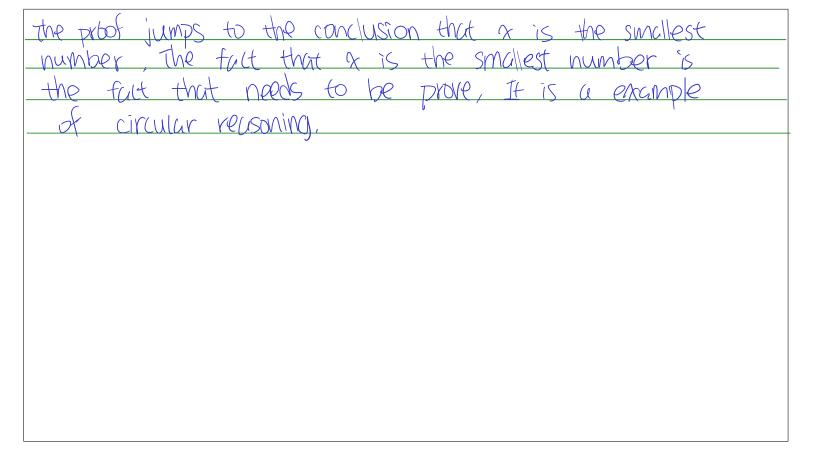
| a 7 R(Jake) N W(Jake) | |
|--------------------------------|----------------------------------|
| b w(Susan) → A(Jake) | |
| C YM (RM) V HM)) | |
| d 11 3x Hla | |
| | |
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| | |
| 1 Jake is a particular element | element declaration |
| 2 4x (P(x) V H(x)) | hypothesis |
| 3 R(Jake) V H(Jake) | Universal instantiation (1,2) |
| + YR(Jake) N W(Jake) | hypothesis |
| 5 YR(Jake) | simplification (4) |
| 6 H (Jake) | Disjunctive syllogism (3,5) |
| 7 | Existential generalization (1,6) |
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Problem 2 (P.2)

ASSUME that x and y are real numbers and x > 46 and y > 64Therefore, x + y > 110,

Assume that there exists a number cannot be written as a product of prime numbers

Problem 3 (P.3)



Problem 4.1 (P.4)

Assuming:

Assume that n is an integer

WTP (What To Prove):

line will prove that 9 n2 + 3 n + 6 is divisible by 6 for any integer n.

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Proof:
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since in is an integer, we have to consider two cases
case 1; n is odd
Since n > 3dd, n = 2k+1 for some integer k
Plugging in 2k+1 for n in 9n^2+3n+6, we get
9N^{2} + 3N + 6 = 9(2K+1)^{2} + 3(2K+1) + 6
= 9(4K^{2} + 4K + 1) + (6K + 3) + 6
                    = 36K^{2} + 36K + 9 + 6K + 3 + 6
                     = 36k^{2} + 42K + 18
                     = 6/6k^{2} + 7k + 3)
Since k is an integer, bk^2 + 1k + 3 is also an integer. Therefore, 9n^2 + 3n + 6 is divisible by 6 when n is odd.
Case 21 n is even
Since n is even , n = 2j for some integer j
Plugging in 25 for 1 in 9 n2 + 3 n + 6, we get
9n^{2} + 3n + 6 = 9(z_{1})^{2} + 3(z_{1}) + 6
                  = 9 (452)+ 65 +6
                  = 36j^{2} + 6j + 6
= 6(6j^{2} + j + 1)
Since j is an integer, bjz + j + 1 is also an integer.
Therefore, 9 n2 + 3 n + 6 is divisible by 6 when n is even.
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Conclusion:

The two cases cover all possible integers. Therefore, $9n^2 + 3n + 6$ is divisible by 6 for any integer n.

Problem 4.2 (P.4)



Proof by contradiction: Assume that there are 982 freshmen which need to be assigned to 320 housing units such that there is no freshman with more than 2 roommates.

WTP (What To Prove):

live will prove that there will be a freshman with at loast 3 roomates.

be a freshman with more than z roommates.

Proof:

Assume that there is no freshman with more than 2 roomates which means each housing units, then we have 320 housing units, then we have $3 \cdot 320 = 960$ Which wears we can accommodate at most 960 freshmen. However, we have a total of 992 freshmen which need to be assigned to 320 housing units. That means there will

Conclusion:

the fact that there is no freshman with more than 2 roommates contradicts with the fact that there will be a freshman with at loast 3 roommates.