$a_n = 2n+1$

$a_0 = 1$

$a_1 = 3$

$\vdots$

شعبان 27-01:08 م

Methods of proof

1- proof by contradiction

2- sequential reasoning

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$n^2 - 2$ is not divisible by 3

$n^2 - 2 \neq 3K$

$n = 3k$

$n = 3k+1$

$n = 3k+2$

شعبان 27-03:10 م

Case 1

$n = 3K$

$n^2 - 2 = (3k)^2 - 2 = 9K^2 - 2$

$= 3(3k)^2 - 2$

شعبان 27-03:12 م

Case 2 : $n = 3k+1$

$(3k+1)^2 - 2$

$9k^2 + 6k + 1 - 2$

$9k^2 + 6k - 1$

$3[3k^2 + 2k] - 1$

شعبان 27-03:13 م

$n = 3k+2$

$(3k+2)^2 - 2$

$9k^2 + 12k + 4 - 2$

$9k^2 + 12k + 2$

$3[3k^2 + 4k] + 2$

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H_2

م 27-03:16 نابعش

$$\{a_n\} \quad N$$

$$a_n = 3n+5 \quad n \geq 0$$

$$a_n = n$$

$$\sum_{n=0}^{k} a_n = 1+2+\cdots+k$$

$a_0 = 0$, $a_1 = 1$, $a_2 = 2$, …

م 27-01:14 نابعش

$$1+2+3+\cdots+(N-1)+N$$

$$N+(N-1)+(N-2)+\cdots+2+1$$

$$(N+1)+(N+1)+(N+1)\cdots$$

$$= N(N+1)$$

$$a+a = B \Rightarrow a = B/2$$

م 27-01:18 نابعش

$$1+2+\cdots+N = \frac{N(N+1)}{2}$$

$$a_{n+1} = a_n + r \quad \text{Basic}$$

$$a_{n+1} = a_n \times r$$

م 27-01:21 نابعش

$$\sum_{j=0}^{n} a^j = \frac{a^{n+1}-1}{a-1}$$

$$\sum_{j=l}^{n} a^j = \frac{\left(a^{n-l+1}-a^l\right)}{a-a^l}$$

م 27-01:24 نابعش

$$a_n = (-1)^n \quad n \geq 0$$

$$\sum_{n=0}^{N} a_n = 1-1+1-1+1$$

$$\sum_{n=0}^{N} a_n = \begin{cases} 1 & \text{if } N \text{ is even} \\ 0 & \text{if } N \text{ is odd} \end{cases}$$

م 27-01:27 نابعش

Logic:

if $x<4$ then $y>5$

TRUE

if $x \geq 4$ then $y \leq 5$

شعبان 27-01:30 م

$x>0 \wedge y>0 \rightarrow x+y>0$

$p \rightarrow q$

contrapositive: $\neg q \rightarrow \neg p$

$x+y \leq 0 \rightarrow x \leq 0$ OR $y \leq 0$

شعبان 27-01:47 م

prove that:

$x+y \geq 73 \rightarrow x>36 \vee y>36$

$p \rightarrow q \equiv \neg q \rightarrow \neg p$

$x \leq 36 \wedge y \leq 36 \rightarrow x+y<73$

$72<73$

شعبان 27-01:51 م

$\neg\neg p \equiv p$

$(p \vee q) \vee r \equiv p \vee (q \vee r)$

$p \vee (q \wedge r) \equiv (p \vee q) \wedge (p \vee r)$

$p \wedge (q \vee r) \equiv (p \wedge q) \vee (p \wedge r)$

شعبان 27-01:59 م

$p \wedge p \equiv p$

$p \vee p \equiv p$

$p \vee 0 \equiv p$ | $p \vee 1 \equiv 1$

$p \wedge 1 \equiv p$ | $p \wedge 0 \equiv 0$

شعبان 27-02:01 م

$p \rightarrow q \equiv \neg p \vee q$

$\neg(p \wedge q) \equiv \neg p \vee \neg q$

$\neg(p \vee q) \equiv \neg p \wedge \neg q$

شعبان 27-02:03 م

$$\neg p \vee q \equiv \neg\neg\underbrace{(\neg p \vee q)}_{\neg(p \wedge \neg q)}$$

Domain: {students at the university}

P(X): student x is intelligent

شعبان 27-02:06 م

All students are intelligent

$\in D$ $\exists x$

$\forall x \in D: P(x)$

$\forall x \in \mathbb{N}: P(x)$

$P(x): x \geq 0$

شعبان 27-02:11 م

$P(x): x \geq 0$ $-3 \geq 0$ [false]

$\forall x \in \mathbb{R}: P(x)$ (FALSE)

$\exists x \in \mathbb{R}: P(x)$ [TRUE]

counterexample

$-3 \in \mathbb{R} \wedge P(-3)$ false

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$\forall x\, P(x)$

$\neg(\forall x\, P(x)) \equiv \exists x\, \neg P(x)$

$\neg(\exists x\, P(x)) \equiv \forall x\, \neg P(x)$

شعبان 27-02:23 م

Give the converse of

1) $q \rightarrow r$

2) if I am smart then I am rich

3) if $x^2 = x$ then $x=0 \vee x=1$

4) if $2+2=4$ then $2+4=8$

شعبان 27-02:27 م

$p \rightarrow r$

1) $\neg r \rightarrow \neg p$

2) if I am not rich then I am not smart

3) if $x \neq 1 \wedge x \neq 0$ then $x^2 \neq x$

4) if $2+4 \neq 8$ then $2+2 \neq 4$

شعبان 27-02:35 م

<u>Exaple</u>.

[$\forall n \in \mathbb{N} : n^3 < 3^n$

$P(n) : n^3 < 3^n$

$n=0 \quad 0<1 \quad T$

$n=1 \quad 1<3 \quad T$

$n=2 \quad 8<9 \quad T$

$n=3 \quad 3^3<3^3 \quad F$)

شعبان 27-02:39 م

$\forall x \in \underline{\mathbb{R}} \quad (x+1)^2 \geq x^2$

$x=-1 \quad 0 \ngeq 1$

$x=-2 \quad 1 \ngeq (-2)^2$

شعبان 27-02:44 م