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TD 1 - Calculus

(1)

$$8 \mid 9^n - 1$$

Prove that $n \geq 1$ we have)

Verify

$$9^1 - 1 = 8 \quad \text{TRUE}$$

Assumption

$$8m = n+1$$

$$9^{n+1} - 1 = 9\,9^n - 1$$

(Do not know what to do next)

(2) Prove that for $n \geq 1$ we have

$$\sum_{i=1}^{n} 2^i = 2^{n+1} - 2$$

Verify $n = 1$

$$\sum_{i=1}^{1} 2^1 = 2^{1+1} - 2$$

$$2 = 2 \quad \text{TRUE}$$

Assumption for K

$$\sum_{i=1}^{K} 2^i = 2^{k+1} - 2$$

Prove for k+1

$$\sum_{i=1}^{k+1} 2^i = 2^{(k+1)+1} - 2$$

$$\sum_{i=1}^{k+1} 2 = 2^{k+2} - 2$$

(Do not know what to do next)

(3)

Verify for n=4

$n! > 2^4 = 4! > 2^4 = 24 > 16$ TRUE

Assumption for k

$k! > 2^k$ is TRUE

Prove for k+1

$(K+1)! > 2^{(K+1)}$

$1+K! > 2\ 2^K$

$1+k! > 2^K\ 2$ (Do not know what to do next)

(4) Binomial theorem (Binomial coefficient)

$$\sum_{k=0}^{n} \binom{n}{k} = \sum_{k=0}^{n} \binom{n}{0} = \frac{n!}{0!(n-0)!}$$

$$= \frac{n!}{0!\,n!} = \frac{1}{0!} = 1 //$$