Proinctive Root

Sition many incongruent primitive monts does if have? 1. Question: Show that 2 is a promitive poot modulo 11.

An: "Given that," - 1 not daix stoom sufferning _ 1014

A number q is a primettive rooot moveled 11 000 min

Since 11 is prime, we need the order of 2 module 11 to be ((11)=10.

Compute powers of 2 mod 11: Down to word 201

$$2^{1} = 2$$
 $2^{2} = 4$
 $3 = 311 = (7) 2 (2) 2 = (4) 2$

23=8-1=(2) = stoon sitisming to redinun 2

24 = 16 = 5

25= 24.2=5.2=10

26= 10.2=20=9

27=9.2=18=7

28=7.2=14=3

29= 32=6

210=6.2=12=1

he reached 1 first at exponent 10. 80 the order of 2 mod 11 is $p = \varphi(1)$.

Therestore 2 is a princtive most modulo 11.

foinstive Root 2. How many in congruent primetive rooots does 4 have? Printan Am: Primettle mosts exist for n=2,4, pk on 2pkwith odd prime pr since 14=2.7, primetive The number of incongruent partners rooms modulo of compute: TAN G(K)=G(2)G(7)=1.6=6 So number of principle nots = 9(6) = 2 3 = 6e = 31 = (Am;) 01= 2:0= \$ toto = 80 26= 10.2=20=3 27=3.2=18=7· S = 1-15-1= 85 2 = 22 = 60 210=6.2=12=1 the proched 1 first appeared 10. 80 the order of & mod 11 is

installate 2 is a principle near modulo 11.

· (11) = 0

(i) Comboling mad-6 and (1), n = 0 (mod 1), n = 0 (mod 1). n = 0 (mod 1) let ordn (a) = k That means: ak= 1 (mod n) (1) combine 2 = 59 (mod 1) = 1-1 (xo) (1) = 8 (mod 1) Simplify: (a) $K \equiv 1 \pmod{n} = x + e = x$ Stept of all deviles & white (1 bom) 8 = Hence the food ordered divided each other! = 3 So, they are equal. 11= 51.8=11.00 ordin (a) = ordin (a1) So, 23 785 (mod 1123)

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Yes.

If a is a primetive root mad n, then ord $n(a) = \beta(n)$

from part (a), ord n (ar) = ord

Therefore, at is also a primetive north modulo n.

(Am)