	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
9.	(1) SUBSTITUTION METHOD:
Y	In substitution onethoof, we guess a bound or consider of the
	porbleon and then one onethermetical conduction to prove that
	our ques ci correct
→ .	It involves questing the form of the solution and then wing
- -	most hemselficed enderetion to find the constructs and show that the
	solution coorks. This onethod can be applied only order of is easy
-	to guess the form of the agreer.
> 7	The substitution operhoof can be used to establish eather appear or
	ower bounds on a recurrence.
	Now, the necessity actalogs be evenes
>	Example 1: Compoider the recurrence Ton) = 2T(1/2) +1
	we have to show that it asymptotically bound by allogn)
	Colution: The recurrence is T(n) = 27. (n/2) +n -(1)
1	Let quels the solution of recurrence is
	T(n) = O(n/ogn)
H	leire, we have to prove that Ton) Konlogn for an appropriate
	hoice of the constant cyo : ()
	T(n) & one chlogn =0
	T(1/2) & (1/2) 109(1/2) - @ (134 Induction)
5 4	peet eq n @ on eq n O
	T(n) €2 (c.(2) 109 (1/2))+1
(7) (7)	< cn log (1/2) + n = co
	= cn/ogn - cnlog 2 + on
	= cntogo - cn+n; (:10g2=1)
	Ton & Cologo, C>1

The state of the s	
Defined.	By mothernational enductions, we have to show that our
and the same of the same of	soleting holds for othe bacemony contigues
The same of the same of	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
	rect 1=01 x C. 1. (091=0) (5. (09 1=0)
	faces for any values of c, that could not hold
	By allowhoring defination, we need to brake
	(cn) < cn/09 n for n > no
	T(2) (C. 2. /092 . b. 1430 00 11 5006 . C.
	163 2 6.3. 1093. Man 30 11 20 11 20 11 131 . 1
	tere, n can't be 1.
-	out of can be 2 or 3.
	nes are can replace (TCI) by (TC2) and TC3) as the base
-	and the supplied the form of the first of the supplied of the
	nexal for C/2. That Ton & Cn/rgn holds
1100	ficiely (cn) = O(n/rep) as freet.
1	5 19 00 10 10 00 00 of the market of our of the
7 570	have to consider the recurrence Ton = T([]) +1
11000	were to show mach at as asked forte cally, present pr 0(1000)
	(Ch) = a(agh) was all to be ample the
101	T (na) < c. legg on bally contained at the
3.11	C. 169 (%)
NI	THE RELIGIOUS OF LAND
100	7 (n) 5 C. [od] -0 1) +1
430 30	(c. log(0/2)+) = clog n - clog 2+1 - clog n - e+1
9-	Tan = 0 (1)
	$T(n) = O(\log n)$
And the second s	Ton = O (log n) Exception of the comp
> Evan	The state of the s
Cal	ple 3: state that solution of Tins = 27 (7/2) +n is 0 (72)
Sera	The state of the s
	164) 1561 5 661 5
S III	T(1/6) & C(0/2) = 0000
	But Tan a part ear (1) do a
	From Sacration on recurrence refuetion
	\Rightarrow $T(n) < \frac{cn^2}{2} + n$
	700 (-2
	Tan (n2 2
	T(n) = O(n2)
	G 11 G G

-> Example 4: Consider the recurrence Ton) = 27 ([2]+16)+n
we have to show that at is asyonphotically bound by Ochlogn)
saloution: T(n) = O(n/ogn)
T(n) & c. n/gg, _ and an war a
$T(N_2) \leq c \cdot (\frac{\alpha}{2}) \log(\frac{\alpha}{2}) - 0$
put eg ? (1) in recurrence relation
T(n) < 2. [c[1] +16) 109[1] +16)]+n 2 (e. 2. 109[n)+16/4n
= cn log (2) +32+n = cn logn - cn log 2 +32+8
7 (n) (en + 1035) log 2 101 2 2000
= cn logn - cn +32+n = cn logn - (-1) n+32
o mais a posses & ch logn (for cy1) are
: 7cn) = 0 (n/ogn)
The section of the se
-> Example 5: Consider the recurrence
P 13 C M C M C M C M C M C M C M C M C M C
$T(n) = -\frac{1}{2}$
$T(n) = \begin{cases} 1 & \text{moso} \\ 2T(\lfloor \frac{n}{2} \rfloor) + n & \text{n} > 1 \end{cases}$
find the asymptotic bround on T.
Bolution: we gues the solution is O(n/ogn)
(3) 1) 15 17 (n) 15 cologo o (18) 10 11 15
$T(n/2) \leq c(n/2) \cdot log(n/2) = 0$
part eg n O ig recurrence relection
T(n) < 2 c [3] 109 [2] + n
11- 100 pol - 3 . ; Z= c= 38 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
< cn log n - cn log 2 + n
$\leq cn \log n - cn + n = cn \log n - n(c-1)$
$T(n) \leq cn \log n $
Hence our guen Tin) = O(n)rgn) es frue.
-> Example 6: show that solution of Ton=2T([1/2]) +n is
- (n/ogn). conclude that the solution is O(n/ogn)
Solution: Let the solution to T(n) is 2(010gn), then
we speed to prove T(n) >/ cn/ogn /5
put of o or recurrence relation.

:4	11 - 17(n) > 27 (LM/2) + n
49.	$\Rightarrow T(n) > 2 \left(\frac{C(n)}{2} \right) \log(n) + n$ $\Rightarrow T(n) > 2 \left(\frac{C(n)}{2} \right) \log(n) + n$
	>> T(n) >> cn/ogn - cn/og2 +0
	=> T(n) 7, cn logn - cn+n
4	
	7 (n) 7. (h) (d) (1) (1) (1)
Or.	$T_{A} = T_{A} = T_{A$
Mar 1.0	600 Beet For large roller of
	I call to the TAND LACE COLOR NO AVER 15 (USC
	so, $T(\eta) = \Theta(\eta \log \eta)$
جـ	Exerciple 7: Solve Ton) = 27 (Vm) + 1 by once fing a change of variable
	solution: Let on = logo
	$\eta = 2^m$
	n/2 = 21/2; charage stir sportage? (3 3/1000)
1 7	νη == 2 ^m /2
4	Thus, recurrence relation becomes
1	$T(2^m) = 2T(2^m/2) + 1$
	changing the recurrence T(2m) to S(m), we get
3.5	(S(m) = 2S(m/2)+1 - 0
	Let the solution to the recurrence is octogon
	5(m) (c. 10gm > 00m)
*	3(-0/2) X (log 10/2 - 2)
101 . 2	put eq 7 3 on eq i 0 , cy becomes
: 0	3(m) < 2. C. log on/2+1
3.0	<20 10g on - 20 10g 2 +1
41.5	(1-3) - 000 00 2 2 C 109 00 - 2 C +1 (: 109 2 = 1)
	2(m) {20 logon
	Scra) = 0 (10g an)
- 1	(2) = (0) (159) (00 m)
	Therefore, T(n) = O(log log n)
	SHALL STATE OF THE COLUMN STATE OF THE SHALL SHA
dh	Solve of by chaning various.
gales .	Solve et busialans
	Solve et by chaning variable. Scanned by Cam Scanner
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1	Solution: T(n) = 2T(Vn) + 109n - 0
170	suppose on = /ego o => on = 2m
	date to be to 1/2 = 20 /2 drive and or an to proceed from
	=> Un = 2 00/2 . 30 W. 2000
-	port the values on egn O, coe get
1	$T(a^{m}) = 2T(a^{m/2}) + m$
-	changing the recurrence T(2") to scon), we get
-	3 (m) = 25 (m/2) + on 2
4	Let the Solution of eqn (D is O(mlogon)
	S(m) = O(m/og m)
	(1) 8(00) (1) (2) on logon
4	S(m/2) < c. m / sy m - 3
-	part eq 1 3 in eq 1 2 ; ct be anges
-	3(m) €26. (m log m + m)
1.	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
	> scan) < contagon - contra 2 + m
	=> 8(m) < con 10g on - crn + on (: 10g 2 = 1)
	=> S(00) < Con 10000 - 00 (C-1)
	=> Scon) & cm logon;
	(1) (2) (3 (m)) = 0 (b) loyon) - 10 10 10 10 10 10 10 10 10 10 10 10 10
	> T(2m) = O(sgn log rgn)
7	T(n) = 0 (10g n 10g 10g n)
- >	Show that soldford to T(n) = 2T (17]+17) to is O(n/090)
	sul?: Given that Tin) = 27 (1 2 /+17) + n
	we guess that 30/4+000 is O(0/1090). They are have to prove that
	Ten) & cn. 109 on (0) 0+
	\$ 7(0) (de (2)
	=> T([n/2]) \(\tag{2} \) \(\langle \) \(\tag{2} \) \(\
	=> T(n) <2(C(2) log(2)+17)+n
	5 cn log (2) + 10/34 + 0
	< cn flog 0 - ch 10g 2 9 + 34 + 9
	(en logo - cn + 34+n
	≤ cn log n - m (1-1)+34
	S ch legn - b
	T(n) = O(n/09n)