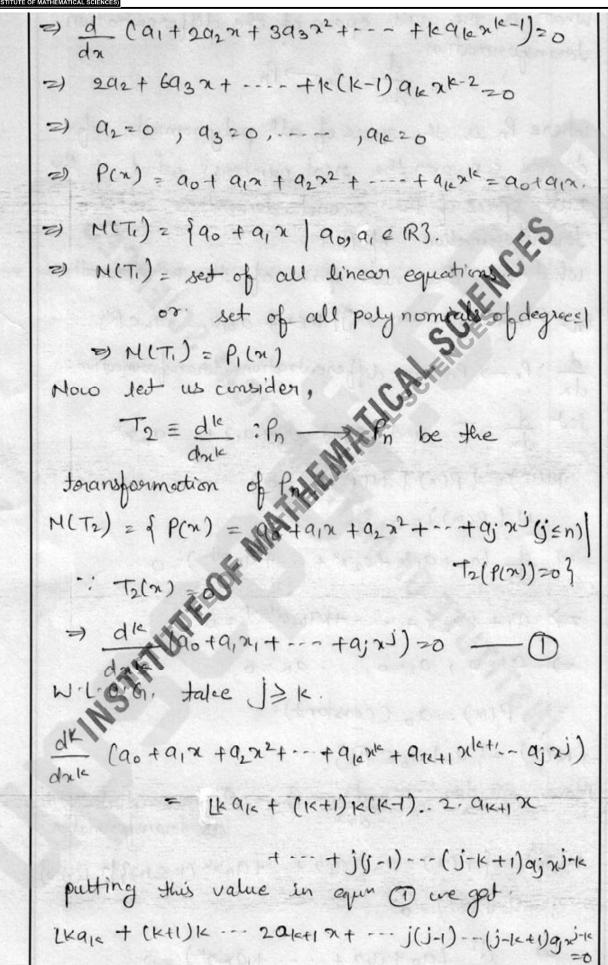


IAS MATHEMATICS (OPT.)-2010

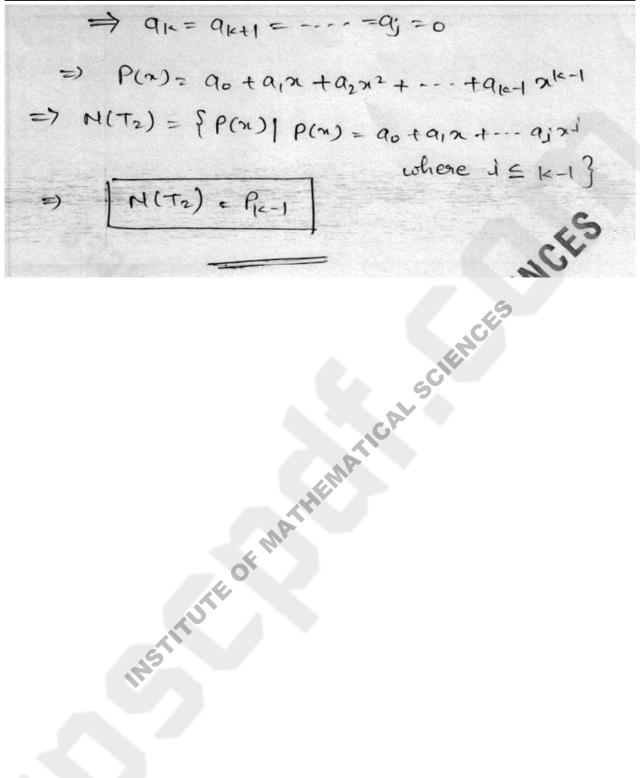
PAPER - I: SOLUTIONS

1(6)	What is the null space of the differentiation
2010	that is the null space of the differentiation toransposimation.
P-1	
	where In is the space of all polynomials of
-	degree < n over the real numbers? what is the
	null space of the second derivative as a
	toransposimation of Pn? what is the null space of the kthonivative? Pn = of a0+ a12+-+axxxx / K≤n + a019 Carc R3.
	what is the null space of the
Sol	
	$\frac{d}{dx}: P_n \rightarrow P_n$ is differentiation to an approximation. Let $\frac{d}{dx} = T$ and $p(x) = a_0 + a_1 x + \cdots + a_{le} x^{le}$
	Oct d -+ 1 september 100
	dn = 1 and p(n) = a+a12+ +a1ex
	MIT) = & PCO) MALPONES) = 03.
	M (P(n)) = ON A
	=) d lan + are + azx2 + + axx1e)=0
	=> a1+ can +++ + + 1 = 0
	=) 9/20, a2=0, a1c=0
	THP(n) = ao (constant).
	=> N(T) = 1 90 90 E R3.
	Now consider Ti=d2: Pn > Pn second doubletice as toransportmation.
	M(Ti) = { P(x) = a o + a, x + - + a cont (1 < m) T, P(x)=0}
	", T(P(x)) = 0
	$\Rightarrow \frac{d^2}{dx^2} \left(a_0 + a_1 x + \cdots + a_k x^k \right) = 0$









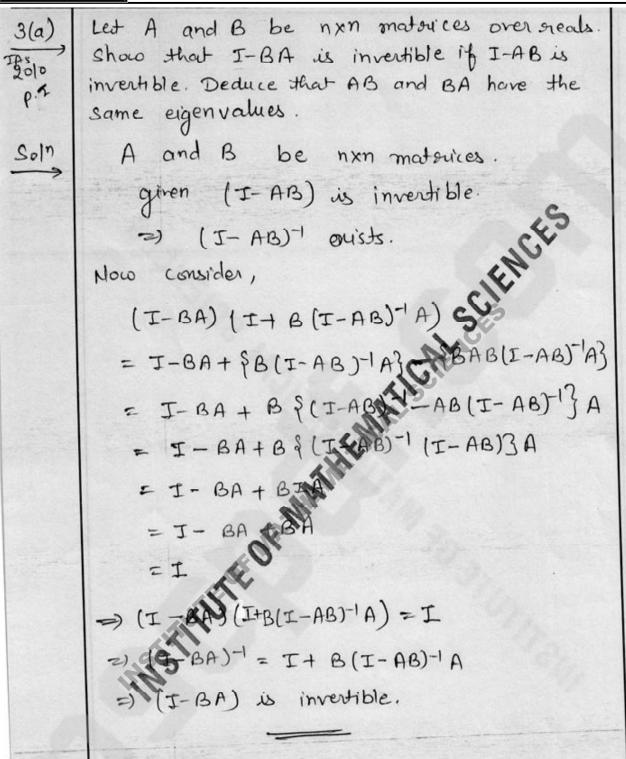
 $\mathbf{IMS}^{\!\scriptscriptstyle{\mathsf{M}}}$



Let M = [4 21], find the unique linear ·2(a) TA.S Jorans goomation T: R3 - R3 so that m is the 200 0.5 materia of T with nespect to the basis. B= SN=(1,0,0), N2=(1,1,0), V=(1,1,1)3 of 183 and B'= & w1 = (1,0), w2 = (1,1) of R2 Also find T(x, y, z). T: R3 - R2 a linear torans pooring Soln BI = { V1 = (1,010), V2= (1,110) 3(1,1,1)3 B2= \$ 101= (1,0), 102= (100) of 12 Given [T: B, B2] = 1 => T(V1) = T(1,000) = 4001 + 0.002 - 0 forom (i) TRV = 4(1,0) +0.102 = (4,0) - (1'v) from (1) T(V2) 2 2(1,0) + (1,1) = (3,1)-(V) (vi) T(V3) = 1(1,0) +3(1,1)=(4,1) - (vi) Crisis ER3 and :: B1 is basis of R3 =) J x1, x2, x3 s.t. (x14,2) = d1V1+ d2V2+ d3V3 -) (n,y2)= d, (1,0,0)+d2 (1,1,0)+d3 (1,1,1) =) (n1y12) = (d1+d2+d3) d2+d3, d3) =) d2 = Z d2+d3=y => d2=y-2 X1+ d2+ d3= x = 7 X1= x-y



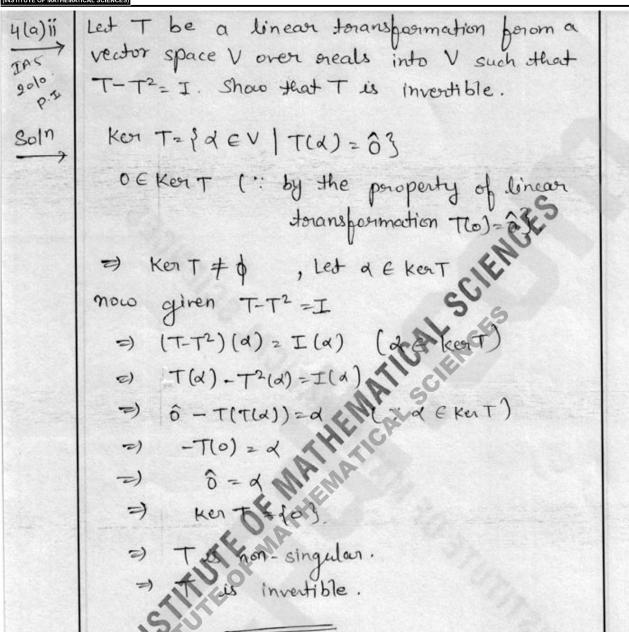






4(a)i	In the n-space, Rn, determine whether or
IAS	not the sei-ez, ez-ez, en-1-en, en-eig
2010.	is linearly independent.
Soln	Let A= ge1-ez, ez-ez, en-1-en, en-e, g.
Value of	Jet & d1, 22, dn ER s.f.
	×1(e1-e2) + ×2 (e1-e2) + + ×n-1 (en (en)
	+ <n (en-q)="000</th"></n>
	=7 (d,-dn)e,+ (d2-d1)e2+-+(dn-2)en-1
	+ (dn +dn-1)en=0
	Je e a 1160 — ①
	": de1, e2, e3, en3 standard basis of R"
	=) de, ez, ez en? Kinearly Independent.
	forom (i) - d1-d1=0, dn-1-dn-2=0
	and dn-dn-1=0
	=) $\alpha_1 = \alpha_3 == \alpha_{n-1} = \alpha_n = \alpha_n $
	5 0 (+ i = 1,2, -n)
	=) e1-e2, e2-e3, en-1-en, en-e13 is LI.





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