since when and cakulus PROB LEC 4 , Nove so many marker? 71 VAL 91 Ase This We · WU LATE - MY BAD " next wk" More pinero; this wik - collectus -> Wenney / Zee / Dinuerns / --· Broks i Risks -TODAY "TRANSFORMATION OF THUDAY " COVARIANT DER'V · r(3) (where connection) OPEN HOND IN CONTROL SING SING CONTROL IN COM PLEAD KEY POINTS FROM LAST TIME " EQUIVALENCE PRINCIPLE: GRANITY = ACCELERATED FRAME > in free folling frame, no growity CLOCAL, INGRETIAL RRAME WE DENOTED COORDS AS Y" METRIC IN FREE FAIL IS SPECIAL FOL: 9m=VW WE STARTED TO PLESH OUT THE PHYSICS IN ANY OTHER FRAME, X F WWD BE SAME FRAME, CURVY OWORDS OR NON-INERTIAL OBSERVER

EQ RIDE OPERATOR OF TOWER OF TERROR

CHANGE IN COORDS TY de de free fall/LIF CHRISTOPPEL SYMBOLS APPINE CONNECTION NOTE: The are not TENBORS

Why? the 2nd derivative - not Innear



(L1) L = 3hg 3x12 3x12 3x2 3x2 3x2 3x8 3 (3xx 3xx 3xx) CHAIN RULE 2×2 | 3×2×1 3×2 + 3×2 3×2×2 ] printer other  $\left[ \frac{1}{1} \right]_{h}^{h} = \frac{3x_{a}}{3x_{1b}} \frac{9Aq}{9x_{a}} \frac{9x_{a}}{9x_{3}} \frac{9x_{3}}{9x_{4}} \frac{9x_{1b}}{9x_{4}} \frac{9x_{1b}}{9x_{4}}$ R

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*	ONE USEFUL INTERP/OBS: THE OVNK APPEARS
	TO BE RELATED TO THE FACT CHAT
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CHEDIES WAY.

Wends 4% IN FACT, WE MIGHT AS WELL SEE THIS CONSIDER A VECTOR VM

transf low: As x > x', the vector V"
transforms to V"

VIM =  $\frac{\partial x'^{H}}{\partial x'^{U}}$  VV

ROTH PUNCTIONS OF X'

OBSERVE:

-IM VIK = 3x1 3x1 3x6 3x6 Log 3xx VN

8 n

 $\frac{3\times \sqrt{3}}{3\times \sqrt{3}} \frac{3\times \sqrt{3}}{3\times \sqrt{3}} \sqrt{3}$   $\frac{3\times \sqrt{3}}{3\times \sqrt{3}} \frac{3\times \sqrt{3}}{3\times \sqrt{3}} \sqrt{3}$ 

concers cas! (note ver p sym.)

So AS A RESULT (despond primes)
Dry = (axr + V v o )
is covaerant (is a terson)
Dhrn ->   3xin 3xin D'rin
transforms the way its indices want to
will generalize to more complicated tersors
w whites

	NOW LET'S STEP BACK A BIT I GO BACK TO OUR "TOWER OF TERROR" EXAMPLE
	nice coords: $y^{\alpha} \leftarrow v_{0}$ and inextial frame gen coords: $x^{\mu} \leftarrow g$ rise apprator
l'wa	WE AROUGO THIFT @ A GNEW POINT IN  SPACETIME (= an event), can cook up  y? coors As A punction or x?,  green T: ? g. proper time  me  aure' evidently growity was in these objects
	THESE OBJECTS CAN BE RELATED  By Dys Dys Dxv VxB
	DIFFERENTIATE Jam. (Know this brings out I's!)
	Show (Short Dx, Dhe Dxegon) Nap Short Dx Dxegon) Nap
	* : warning - 1m not obviously allowed to do this!

er vertriebt vijz ver er vertreept verdig verdigenverstigen, de bindichter gegenge op uit je de j	TO WE HAVE FOUND:
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	SIMPLY GROVE the I's -
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	pave 6 to 100
	WRITING 2+ 2- 3/3xm
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Men 3-4 Newtonian Umit

FOW: 75×1 + L 2× 3× 3× = 0

NEWTON / NON-REL UMIT -> how "velocity"

AX/SE «1

WEAK, PIECES

 $\frac{3x^{\mu}}{3x^{2}} + \frac{1}{100} \left( \frac{3x^{\mu}}{3x} \right)^{2} \qquad i=1,2,3$ 50 M →  $+27 \times \frac{3}{37} \times \frac{3$ 

Tro = 1/2 grv (20 90 + 20 90 - 2 v 900)

NOWTONIAN GRAVITY WES IN HERE. 30516 '80 9° - JOR = JOF paras shourd navist

WEAK PLEUD LIMIT

SPACETIME IS ALMOST MUNDOWSKI

USAONE OFFICE :

PUS BARK INTO GOM:

$$= \frac{35}{37} \frac{35}{37} = \frac{1}{27} \frac{7}{100} = =$$

$$\frac{3^2 \times}{3t^2} = -\frac{1}{2} \nabla h_{oo} = -\nabla \Phi$$

1cceleration

$$\frac{1}{2} \left[ N_{oo} = 2 + \frac{1}{2} + \frac{1}{2} \right] = 2 + \frac{1}{2} + \frac{1}{2} = \frac{1}{2} + \frac{1}{2} = \frac{1$$

exergise:
WHAT HAPPENS
TO SIGNS
IN EXIST
COAST MECRIC?

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	TIME DILATION IN A GROW RIEW not nec on free toll
	OUNCIC IN SOME FRAME
	magran. field
	in MICE FRAME (free fall / LOC. WERT.)
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	TIME BOWN Traces ( Nows 3xx 3xx)
	IN ASS OF GRAN. AS 000 5 PSY NICE FRAME (MONIFOCTURET Spec.)
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got: dt = goo [-gio dxi + 1 (gio gio - 915 goo)]
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to get time for
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height of tower.
48W NE
(SAL SYM GRAN FLEUD, Eg. NEWTONIAN,
S= -CRAJECTORY IS ECRAJEHT RADIAZ)
<b>3</b> c#
BUT: Jat is wer some one constant
FOR EACH PHOTON/ CREST
So TWE SERACTURA BOW
CHESTS IS WARPECTED BY
PROFNELTION FROM 2->1

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Oghe Plan: dtz = DT/1900(x2)
@ the too: dt1 = DT/Ng-(x)
then the ratio of abs. Requereres  To Jan (ra)  To Jan (ra)
emitted @ 1  PROTENT OBS @ 1  Newtonian limit: West Field, \$ CC 1
$\frac{72-7}{2(102+71)} = \frac{1}{1+4} + \frac{1}{1+$
Smith in weak field limit.