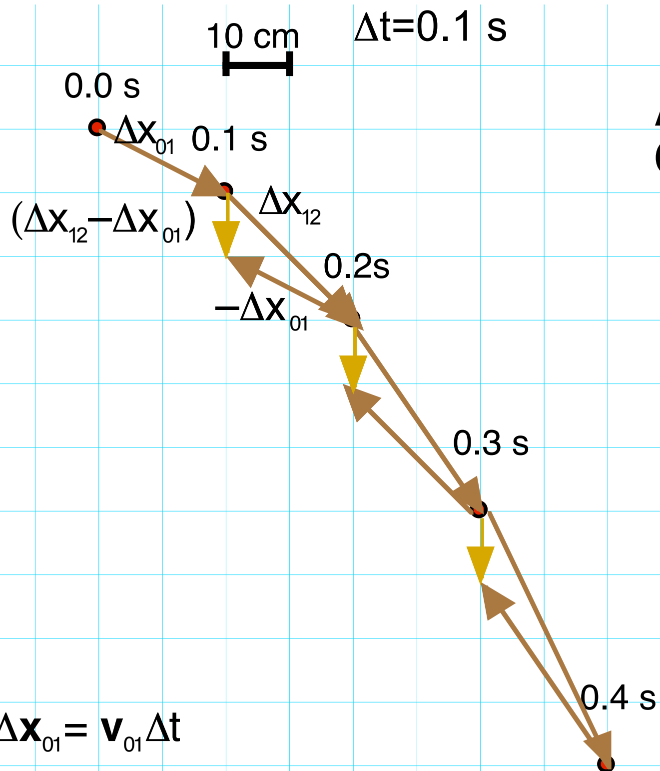
Projectile Motion

Analysis

Analysis of projectile Motion using Graphical Vectors. (Idealized case)



$\Delta\mathbf{x}_{01} = \mathbf{v}_{01}\Delta t$

$(\Delta\mathbf{x}_{12} - \Delta\mathbf{x}_{01}) = (\mathbf{v}_{12}\Delta\mathbf{t} - \mathbf{v}_{01}\Delta\mathbf{t}) = (\mathbf{v}_{12} - \mathbf{v}_{01})\Delta\mathbf{t} = \Delta\mathbf{v}_1\Delta\mathbf{t}$

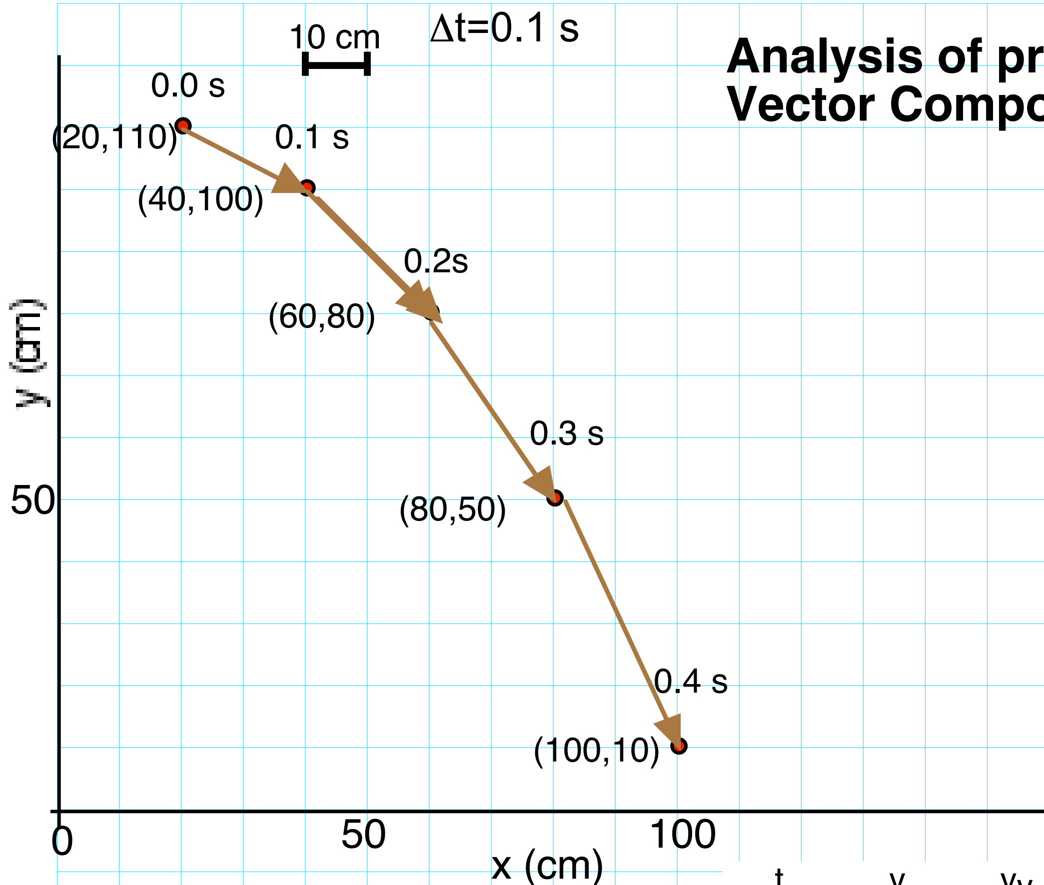
$\Delta\mathbf{v}_1\Delta t = (\mathbf{a}_1\Delta t)\Delta t$

Therefore
$\mathbf{a}_1 = (\Delta\mathbf{x}_{12} - \Delta\mathbf{x}_{01})/\Delta t^2$

Magnitude of |**a**|
$a = 10\text{ cm} / (0.1\text{ s})^2$
$= 1000\text{ cm/s}^2$

Direction of **a** is straight down.
(From the diagram)

Analysis of projectile Motion using Vector Components. (Idealized case)



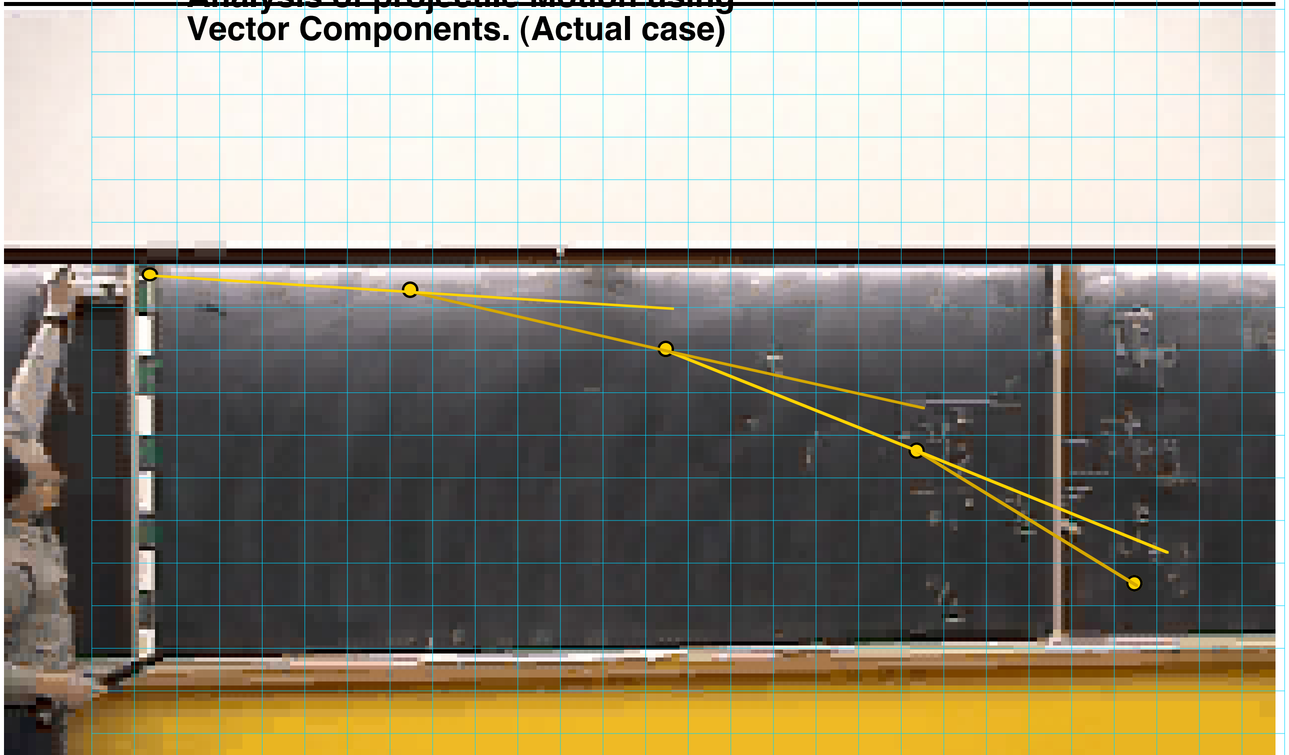
$V_x = \Delta x/\Delta t$
example:
(40 cm – 20cm)/0.1s = 200 cm/s

$V_y = \Delta y/\Delta t$
$a_y = \Delta V_y/\Delta t$
example:
[–2000 cm/s – (–100cm/s)]/0.1s = –1000 cm/s/s

t (s)	x (cm)	v_x (cm/s)	a_x (cm/s²)
0.0	20		
		200	
0.1	40		0
		200	
0.2	60		0
		200	
0.3	80		0
		200	
0.4	100		

t (s)	y (cm)	v_y (cm/s)	a_y (cm/s²)
0.0	110		
		–100	
0.1	100		–1000
		–200	
0.2	80		–1000
		–300	
0.3	50		–1000
		–400	
0.4	10		

Analysis of projectile Motion using Vector Components. (Actual case)



Tables of vector components for position, velocity and acceleration

	A	B	C	D	E	F	G	H
1	t (s)	x (cm)	vx (cm/s)	ax (cm/s/s)		y (cm)	vy(cm/s)	ay(cm/s/s)
2	0	12				97		
3			630				-40	
4	0.1	75		-300		93		-900
5			600				-130	
6	0.2	135		-300		80		-900
7			570				-220	
8	0.3	192		-400		58		-1100
9			530				-330	
10	0.4	245				25		
11								
12								