

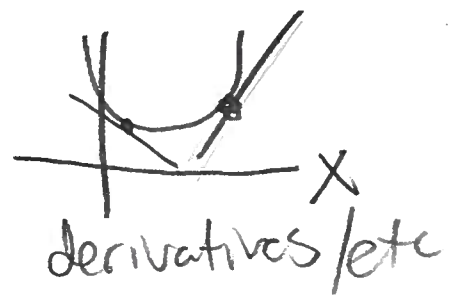
ABCD

[Dr. Tom Cuchta
http://tomcuchta.com]

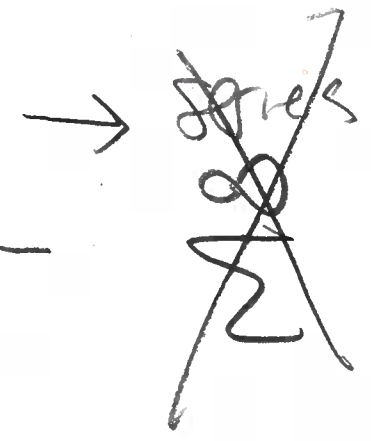
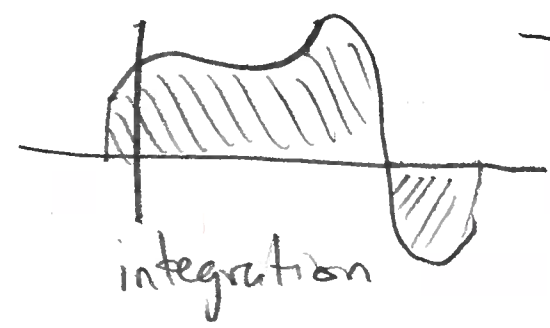
MATH 3503

What is calc 3?

CALC 1



CALC 1/2



Calc 3

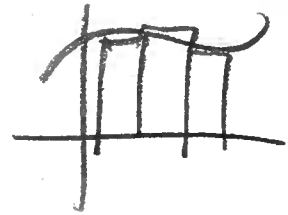
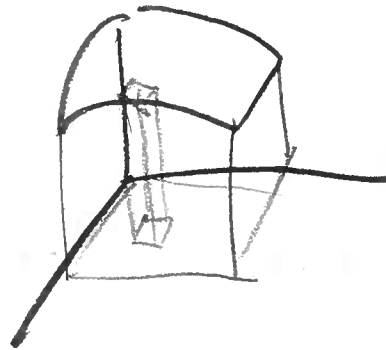
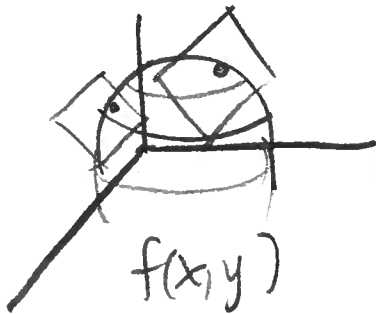
Repeat calc 1 in multiple dimensions \leftarrow # of things you track

$$f(x, y)$$

$$f(x_1, \dots, x_n)$$

$$f(t, x, y, z)$$

~~Red dots~~

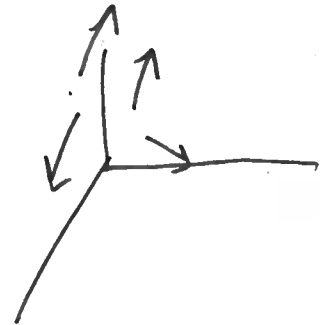
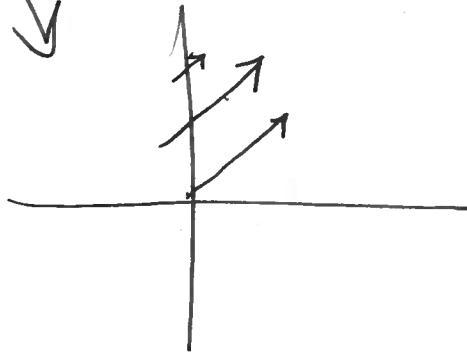


Vectors

Vectors are, ...

- ① computer sci ~ list/array
- ② physics ~ arrow in space/plane
- ③ ~~math~~ ~ ~~an element in a vector spaces~~ ← Linear algebra

$\langle 1, 7 \rangle$
 $[1, 7]$



Combining vectors

connect "tip to tail"

Addition	Geometric (phys)	
	Algebraic (SS)	$\langle 1, 5 \rangle + \langle -1, 3 \rangle = \langle 1+(-1), 5+3 \rangle$ componentwise add

number
↑
Scalar mult.

Geometric	$2(\uparrow) = \uparrow$	$\frac{1}{2}(\downarrow) = \downarrow$	$-(\uparrow) = \downarrow$
Algebraic	$2\langle a, b \rangle = \langle 2a, 2b \rangle$	$\alpha\langle x, y \rangle = \langle \alpha x, \alpha y \rangle$	

$vec + vec = vec$

$number \cdot vec = vector$

$vec \times vec$

dot prod
= number

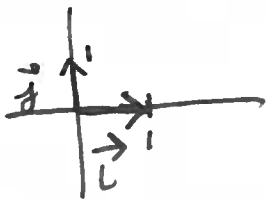
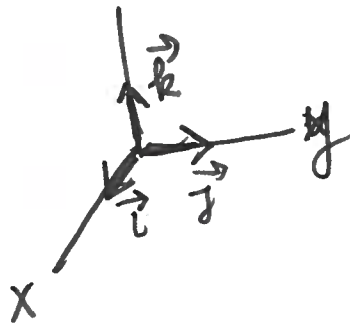
cross product
= vec

fails in most dim

Basis vectorsIN 2D

$$\vec{i} = \langle 1, 0 \rangle$$

$$\vec{j} = \langle 0, 1 \rangle$$

IN 3D

$$\vec{i} = \langle 1, 0, 0 \rangle$$

$$\vec{j} = \langle 0, 1, 0 \rangle$$

$$\vec{k} = \langle 0, 0, 1 \rangle$$

in \mathbb{R}^2

$$3\vec{i} - 2\vec{j} = \langle 3, -2 \rangle$$

"

$$3\langle 1, 0 \rangle - 2\langle 0, 1 \rangle$$

"

$$\langle 3, 0 \rangle + \langle 0, -2 \rangle$$

Algebra: Solve $3\vec{a} + 2\vec{x} = \vec{b}$ for \vec{x}

$$2\vec{x} = \vec{b} - 2\vec{a}$$

$$\vec{x} = \frac{\vec{b} - 2\vec{a}}{2}$$

