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General concept: manipulating  
equations, simplifying expressions,  
canceling out things, factoring things  
most fundamental concept

If you understand this concept  
well, you will be poised for suc-  
cess in math 243

ability of success: anything in Calc 1  
done with 12 variables, you need  
→ be comfortable with n  
x do it with 23 variables resp.

Exceptions are one-off units and  
last half of Calc 2. See 6/9  
lecture for more info

other sources gen.  
follow this too

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$a_1, a_2, a_3, \dots$  const.  
General remark.  $v_1, v_2, \dots$  vectors  
 $z, b, c, d, e, \dots, r, s, t$  are typically  
scalars

$u, v, w$  are vectors

$x, y, z$  up to the situation

Q: Some students may ask, who cares  
where things are coming from?  
Just give us the formulas to  
plug everything in

A: You may not care, but other  
also, your knowledge will be  
tiny changes. Many problems in  
math are small variations of  
given examples.

See 6/10 discussion for more com-  
mentary on this remark

general remark. If you miss class,  
download notes, and notice a remark  
in the notes is confusing, search the

Segment of the recording used to  
create the remark  
If that still  
leaves you confused, ask me by  
email writing what day & slide &  
remark quote you need help on

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General remark: choose your own  
variable names. As long as you  
can do the work to solve the  
problem and it is clear to  
anyone reading the work how  
the calculation is going, no  
problem. There is some personal  
preference on whether to use  
 $u$  &  $v$  for a problem that needs  
2 vectors or use  $v$  &  $w$   
for example

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General remark: don't worry

about whether a vector is  $v$  or  $w$  as long as it's defined clearly. Focus on computation mistakes and conceptual errors instead, like  $2(u+v) = 2u+v$  or taking  $\|\sqrt{v}\|$  or  $\|u\| = -\|u\|$

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ALL scratch work for exams and future quizzes must be uploaded

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Report typos & mistakes whenever you see them.

Dont hesitate if something  
seems to be broken

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Make sure to state bounds  
on my variables that  
you use for a paramet-  
rization or equation.

Bounds are part of the  
answer. If there are no  
constraints on the variables  
given, then we assume  
they can be any real num-  
ber. But if there should  
be constraints and you  
leave them off, then

your answer is wrong.

For example: line has no constraint, so leaving off saying "at any real number" is ok. But line segment does, so include it.

You can ignore derivative rules, just simplify everything into one vector, and only then take a derivative, going component by component. But then it

might be more algebra  
and more work because  
rules can simplify  
certain calculations.

Generalization of the  
previous remark: Know  
your rules for combin-  
ing multiple different  
operations on functions  
and vectors. Using these  
rules often leads to  
less work, less

calculations, less room for mistakes than manually simplifying everything as much as possible and only then taking the final operation in your calculation.

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Definitions are given without explanation & don't need justification, except perhaps an explanation of how people came across them & why they're useful.

Formulas are equations, inequalities, results etc. which follow from definitions

For example:  $f'(t) = \lim_{dt \rightarrow 0} \frac{f(t+dt) - f(t)}{dt}$

is  $\approx$  definition of  $f'$ , not a formula

$\frac{df}{dt} = f'(t)$  is  $\approx$  definition

of notation.

$\frac{d}{dt}(t^n) = nt^{n-1}$  is a

formula however

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When a problem says "find vector\ integral (derivative)\ equat.  
etc.", you must simplify

the answer as much as possible.

If answer to problem is a vector, you can leave a constant factored out or brought in, and either is fine in regards to the final form of the answer

If you're not at the end of a problem, you might save some trouble by leaving the constant outside.

If you want to check your work for unit vectors, check at the end the magnitude is

Actually 1.

For speed and convenience,  
sometimes I will write  
 $c, s$  to denote  $\cos, \sin$   
respectively.

Chain rule allows you to  
cancel differentials like  
 $dt, ds, dr$  etc. legally

For any rule or idea  
(you want to apply, but  
you are not sure if the  
rule/idea works because  
you haven't seen it covered)

plug in easy values like 0, 1 to make sure it makes sense. Plug in  $f = g$  if it depends on  $f & g$ , plug in basic vectors like  $(0, 0, 1)$ ,  $(1, 0, 0)$  etc.

About delays & deadlines: if deadlines are pushed back by 1-2 days for homeworks and quizzes, don't automatically blow off the extra time and then scramble at the end of the new

deadline to do something.  
Try to do the homeworks  
at the original deadline  
and consider extra time  
as a gift rather than  
something for granted  
that will happen every  
single homework

Some seemingly random  
problems like equation  
of sphere or intersection  
of plane & plane, line & plane,  
region & plane etc. are  
application of existing tools.

preparation for doing double  
and triple integrals in the  
last  $1/2$  of 2f3. More  
generally, geometry from the  
 $1/2$  half of 243 will come  
in at the last  $1/2$ .

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For 2 geometry problems  
when in doubt, draw the  
diagram of relevant objects.

Take useful 1D or 2D  
slice of the region

Still can draw 3D, but  
only abstractly

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bits with inverse trig  
expressions like

$\sin^{-1}\left(\frac{1}{6}\right)$ ,  $\tan^{-1}(3)$ ,  $\cos^{-1}\left(\frac{1}{4}\right)$

that have no nice closed form, you can leave them as is. Don't go for decimal values.

More generally: you don't need a calculator for this class to spit out decimal values (with exception of WebAssign problems requiring decimals, which will be rare), so anything can be simplified and fully given by pencil & paper

Be careful with cancelling

trig functions by doing  
inverses. For example:  
 $\tan^{-1}(\tan x) \neq x$  although  
 $\tan(\tan^{-1}x) = x$

Problems about  $K$ ,  $a$ ,  $v$ ,  $t$ ,  $\omega T$ ,  $\omega N$ ,  
arc length are generally all calc-  
ulation when it comes to their  
main difficulty. Students strug-  
gle with them not because  
of calculus, but because of  
algebra: square roots, cross  
products, simplifying sums

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Some problems have complicat-  
ed fractions as the final

answer. This is ok, doesn't mean you made a mistake. You could have a mistake but only for the same reasons you make mistakes on math problems in general.

However, if you have a complicated fraction in the middle of the problem and need to do something which makes that fraction even worse, like derivative or integral, stop right there and check your work.

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