Re: Positive/Negative after taking the square root

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- *From*: tommy1729 <tommy1729@xxxxxxxxx>
- *Date*: Wed, 28 Nov 2007 13:00:08 EST

Joe wrote :

> I'm not totally mathematically inept, but I find

I'm

> getting confused
> by the following:
>
> I'm confused as to what happens to the +/− in the
> following examples:
>
> As a simple example, integrate x^2
>
> int{x^2 dx}
>
> Let x^2 = u, then dx = du/(2x) and du = 2x, dx =

+/−

> 2sqrt{u}
>
> Then the integral becomes
> =int{u/(+/−)2sqrt{u} du}
> = +/− int{1/2sqrt{u} du}
> = +/− 1/3u^1.5
> = +/ 1/3x^3 (substitute back in for u)
>
> This is obviously not correct, and the correct

answer

> is in taking
> only the positive square root when representing dx
> interms of u and
> du. However, is there a mathematical/logical

reason

for discounting
the negative root? After all, if y^2 = x, then y =
+/−sqrt{x}

A related problem I encountered when deriving the
derivative of
arcsin:

y = arcsinx
x = siny

I have y' = 1/cosy, and wish to write y in terms of

x

Now, sin^2y + cos^2y = 1

siny = x

thus x^2 + cos^2y = 1

cos^2y = 1−x^2

cosy = +/− sqrt{1−x^2}

Thus

y1 = +/− 1/sqrt{1−x^2}

Obviously, again this is incorrect. The correct
answer is obtained by
discounting the negative root − again, what is the
mathematical/
logical reason for this?

There are two common mistakes made here that lead to
the confusion:

One: The expression u^2 = v does NOT imply u = +/−
sqrt(v). This abuse of notation doesn't really even
mean anything mathematically, and it only serves to
create ambiguity. What it DOES imply is |u| = sqrt(v)
or equivalently sgn(u)*u = sqrt(v).

agreed.

> Two: You cannot make a substitution u for x which has
> u' = 0 for some x; in general if you make such a
> substitution the result is not valid. This subtle
> condition may or may not be covered in your calculus
> class, but the reasoning behind it will be clear when
> you take analysis.

can you give examples of that ?

is this about avoiding integral from 0 to 0 ?

i assume here you mean for the given example ...

but this is no longer true for single−valued right ?

also ; can this be used to prove or disprove there are zero's on a line or strip ? (RH :p)

> To resolve problem 1 take the proper expression
> sgn(x)*x = sqrt(u) and perform the substitution, then
> we have formally dx = 2*sqrt(u)/sgn(x)*du.

this indeed works.

To

> resolve problem 2, we need to demand that x =/= 0 on
> the interval of integration [a,b], i.e. a and b are
> of the same sign. Thus the integral becomes:
>
> int[a,b]{x^2dx}
> = int[a^2,b^2]{sgn(x)*u/(2*sqrt(u))du}
> = int[a^2,b^2]{sgn(x)*u/(2*sqrt(u))du}
> = sgn(x)*int[a^2,b^2]{u/(2*sqrt(u))du}
> = sgn(x)*1/3*sqrt(u^3)
> = sgn(x)*1/3*sqrt(b^6)−sgn(x)*1/3*sqrt(a^6)
> = sgn(x)*1/3*(|b^3|−|a^3|)
> = 1/3*(b^3−a^3)
>
> which is the correct evaluation as expected.

regards
tommy1729
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