

Newton's Mistake

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This is dealing with a math mistake which seems to go all the way back to Newton.

The relevant equation is:

$$n a = v^2/r \quad (1)$$

Lets check what n is:

we know $v = dr/dt$ and $a = dv/dt$

rearrange (1) to:

$$n r a = v^2 \quad (2)$$

left hand side (LHS) = $n r a$

right hand side (RHS) = v^2

now lets differentiate both sides

$$\text{diff LHS} = n (dr/dt) a + nr da/dt$$

now a is constant so $da/dt = 0$. and we have $dr/dt = v$ so subst this into LHS and we have

$$\text{LHS} = n v a + 0 = n v a$$

$$\text{diff RHS} = d(v^2)/dt = 2 (dv/dt) v$$

now $a = dv/dt$ so this becomes

$$\text{RHS} = 2av$$

Equate LHS and RHS

$$nva = 2av$$

$$\text{so } n = 2$$

So (1) is

$$2a = v^2/r$$

But when we check various physics texts as to what is being taught to students, many of them give $n = 1$. Which is a basic math mistake that seems to go all the way back to Newton. Newton did it wrong, and many physics texts rather than correct that mistake insist on writing it with the mistake that Newton made.

Basic calculus if $y = x^2$ differentiate gives $dy/dx = 2x$

note the "2"

Simple differentiation and many physics students are being taught to forget the "2".

i.e physics students are being taught to be bad at math.

c. RJAnderton2010-02-14