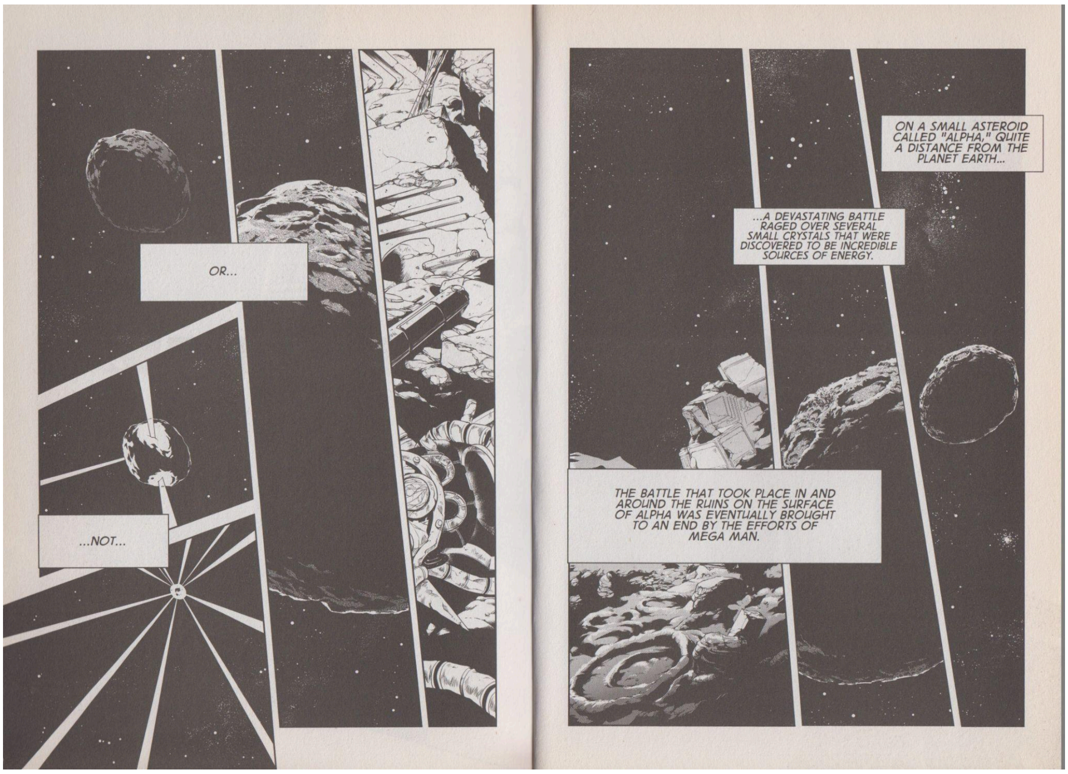
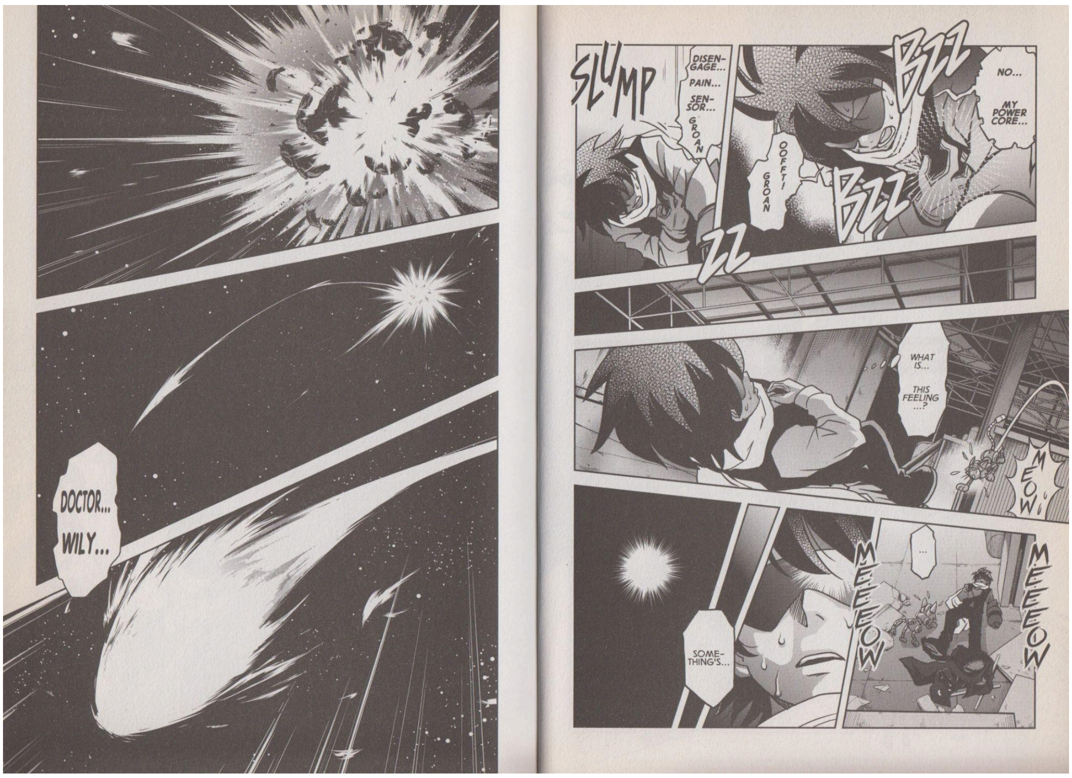
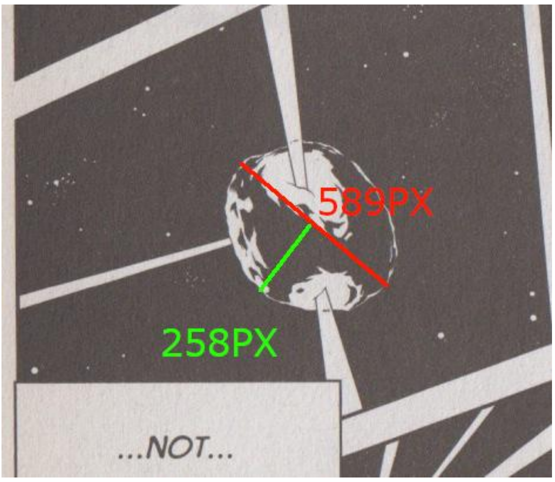
Hello, everyone! Mikhail here to give you all another Mega Man calc after some time. This time, I journey back into the Megamix/Gigamix mangas to calculate more accurately Duo destroying this huge asteroid called Alpha. There's no need for doing this, but I am bored, and when you put 2 things that I fucking adore (Mega Man in general and Calculus lol) together, that's when I get motivated.



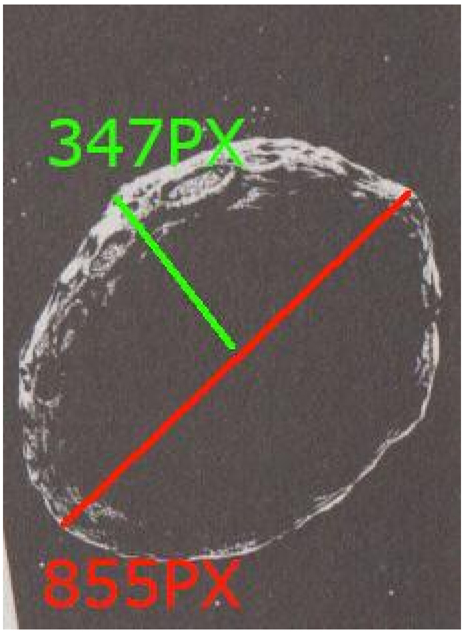


As stated here, it’s 200km long across. This means 2 things: one is that this asteroid is bound together mostly by gravity. And two is that this asteroid is not of a spherical shape (as we can clearly see in the pictures above). So, I am going to derive the formula to find the asteroid’s Gravitational Binding Energy assuming it’s an ellipsoid. So… here we go.

First step before getting into derivation hell, I shall find the 3 dimensions of this ellipsoid in terms of ‘r’- which is the length of Alpha. Keeping this in terms of ‘r’ will make things hella easy. So… Yeah!



589px = r
258px = 0.438r



855px = r
347px = 0.406r

So our 3 dimensions are… r, 0.438r, and 0.406r. Wonderful. We’ll be needing this. Now… how GBE is calculated is by assuming that shells are pulled from a central object of identical shape to infinity (like how a spherical shell is pulled from a sphere). So, with that in mind, I shall assume it's all in the shape of an ellipsoid with those 3 dimensions I mentioned!

So… let us do it.

$$m_{shell} = 4\pi(\frac{(0.406r^2)^{1.6}+(0.438r^2)^{1.6}+(0.177828r^2)^{1.6}}{3})^{1/1.6}\rho dr = 4\pi(0.3528r^2)\rho dr$$

$$m_{ellipsoid} = \frac{4}{3}\pi(0.177828r^3)\rho$$

Okay. I shall combine both of these using the gravitational potential energy equation.

$$dU = -G\frac{m_{shell}m_{ellipsoid}}{r} = -G\frac{(\frac{4}{3}\pi(0.177828r^3)\rho)\cdot(4\pi(0.3528r^2)\rho)}{r}dr$$

Now… This is my favorite part: Integration!

$$U = -G\int_0^R\frac{(\frac{4}{3}\pi(0.177828r^3)\rho)\cdot(4\pi(0.3528r^2)\rho)}{r}dr = -G\frac{16}{3}\pi^2\rho^2\int_0^R 0.0627r^4dr = -0.06688G\pi^2\rho^2R^5$$

Whew… That seemed a little tricky and tiresome. Now… we're almost done finding the equation.

Rho (the p looking symbol) is density, which is just mass divided by volume. Volume here is… that of an ellipsoid ofc. So…

$$U = -0.06688G\pi^2R^5(\frac{M}{(\frac{4}{3}\pi(0.177828r^3)})^2 = -\frac{0.12GM^2}{R}$$

Theeeeeeere we go… So now we simply… Plug in the values…

Mass: 2.011e18 kg

Gravitational Binding Energy: $-\frac{0.12\cdot(6.67\times10^{-11})\cdot(2.011\times10^{18})^2}{100,000} =$

325,138,750,767,281,400,592 Joules or 77.7 fucking Gigatons of TNT (**Island level+**)

Bro, we (IRL humanity) can deadass destroy this 200km asteroid if we mine all of the uranium in our planet and allocate it to nukes!