Gravitational potential energy sign

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Gravitational energy or gravitational potential energy is the potential energy a massive object has due to its position in a gravitational field. It is the mechanical work done by the gravitational force to bring the mass from a chosen reference point (often an "infinite distance" from the mass generating the field) to some other point in the field, which is equal to the change in the kinetic energies of the objects as they fall towards each other. Gravitational potential energy increases when two objects are brought further apart and is converted to kinetic energy as they are allowed to fall towards each other.

In classical mechanics, two or more masses always have a gravitational potential. Conservation of energy requires that this gravitational field energy is always negative, so that it is zero when the objects are infinitely far apart.[2] The gravitational potential energy is the potential energy an object has because it is within a gravitational field.

Now, here"s an example of explanation (to be more precise - lack of explanation) regarding the GPE from one of the books:

Thus, when $r_A>r_B$, the magnitude is positive and therefore $U_A>U_B$. In other words: when the distance between the bodies is being increased - the gravitational potential energy of the system is also being increased.

Giving absolutely no explanation on why all of a sudden they put a minus sign into the integral.

... Calculating the work gravity is doing is no different from the calculation of the work done by an electric field, with two exceptions - instead of $q_1q_2/4 \pi \epsilon_0$ we should plug $G M m$, and we also should change the sign, because the gravitational force is always a force of attraction.

Now, this is not satisfying at all. So what if it is an attraction force? How this should influence our calculations, if the work is defined as $|F| |\Delta x| \cos \theta$, so the sign only depends on the angle between the path vector and the force vector? Why they put a minus sign? Is is just a convention or a must thing to do?

Some say the sign is important, others say the opposite. Some explain this as a consequence of that we bring the body from infinity to some point, while others say it is a consequence of an attractive nature of the gravitational force. All of that is really confusing me.

Also, in some of the questions like "what work is required to bring something from point A to point B in the field of gravitational/electric force", the books sometimes confuse U_A-U_B and U_B-U_A - as I

understand it - the work that I must do is always U_B-U_A. However the work that the force that is being created by the field do is always U_A-U_B, am I correct?

For your second example:

...we also should change the sign, because the gravitational force is always a force of attraction.

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