A planet has twice the mass of earth. How much larger would the radius of the planet have to be for the gravitational field strength at the planet surface to be same as on earth surface?

Newton's Law of Universal Gravitation states that there is a gravitational force between any two masses that is equal in magnitude for each mass, and is aligned to draw the two masses toward each other. The formula is:

$$F = G\frac{m_1 m_2}{r^2}$$

where m_1 and m_2 are the two masses, G is the gravitational constant, and r is the distance between the two masses.

If one of the masses is much larger than the other, it is convenient to define a gravitational field around the larger mass as follows:

$$\vec{g} = -G\frac{M}{r^2}\hat{r}$$

where M is the mass of the larger body, and $\hat{r}$ is a unit vector directed from the large mass to the smaller mass. The negative sign indicates that the force is an attractive force.

So, for Earth:

$$\vec{g} = -G\frac{M}{r^2}\hat{r}$$

And for planet:

$$\vec{g} = -G\frac{(2M)}{(x * r)^2}\hat{r}$$

Therefore:

$$\frac{M}{r^2} = \frac{(2M)}{(x * r)^2}$$

And x equals:

$$x = \sqrt{2}$$

Answer: $\sqrt{2}$ times