Escape Velocity

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A potential well helps to visualise what is going on with potential. We have a mass M - planet, star etc with a 1Kg test mass sitting on the surface. The potential is then the energy needed to push it right out to where the edges of the hill are flat - now since the hill is a 1/r curve it never completely 'flat-lines'. This is why we talk about 'energy needed to get to infinity.

Escape velocity is the velocity at which you'd need to throw a ball in order to get it completely out of the potential well.

$$\text{Grav. pot energy} = \frac{GM_{\text{planet}}m_{\text{ball}}}{r}$$

This is just as in GCSE where we dropped a ball and its GPE->KE.

So the increase in V comes from the initial KE (E_k) which we gave to the ball

$$\text{So: } \frac{GMm}{r} = \frac{1}{2}mv^2$$

$$\Rightarrow \frac{GM}{r} = \frac{1}{2}v^2$$

$$\Rightarrow v^2 = \frac{2GM}{r}$$

$$\Rightarrow v_{esc} = \sqrt{\frac{2GM}{r}}$$

Put in the numbers you get around:

$$v \simeq 11\,Km/s$$

(check it - put in the numbers)

ie very fast.