

28. Correct. The answer is true. Above ground costs are just the cost of finding the oil divided by the number of barrels found or K/R_o . To find above ground cost we need to allocate cost over time in the following way

Assume a constant production decline rate forever. If oil production declines at rate α then $Q_t = \alpha R_o e^{-\alpha t}$. To distribute costs over future production we want to compute a unit cost, which I will designate as $\$_o$. Cost at time t will be production times unit cost or $\$_o \alpha R_o e^{-\alpha t}$. Unit costs will then be the amount $\$_o$, which will make the discounted present value of total future costs equal to the initial capital costs for development or:

$$K = \int_0^{\infty} \$_o \alpha R_o e^{-\alpha t} e^{-r t} dt.$$

Solving for $\$_o$ gives us:

$$\$_o = (K/(R_o \alpha)) / \left(\int_0^{\infty} e^{-(\alpha - r)t} dt \right).$$

We can integrate the denominator to be:

$$\left[\frac{e^{-(\alpha - r)t}}{-(\alpha - r)} \right]_0^{\infty} = \left[\frac{e^{-(\alpha - r)t}}{-(\alpha - r)} - \frac{e^{-(\alpha - r)0}}{-(\alpha - r)} \right]$$

$$\left[\frac{e^{-(\alpha - r)t}}{-(\alpha - r)} \right]_0^{\infty} = \left[\frac{(0) * (-1)}{-(\alpha - r)} + \frac{(1)}{(\alpha - r)} \right]$$

$$\left[\frac{e^{-(\alpha - r)t}}{-(\alpha - r)} \right]_0^{\infty} = \frac{1}{(\alpha - r)}.$$

Substituting the denominator back into the solution for the unit cost ($\$_o$), we get

$$\$_o = (K/R_o) * (\alpha - r) / \alpha$$