Derivation of dividend growth

Use the knowledge that infinite geometric series sum:

$$S_\infty = a + ar + ar^2 + \dots ar^\infty$$

becomes:

$$^{*} S_\infty = \frac{a}{(1-r)}$$

(check calculus notes to see this)

* common derivation

Dividend discount model

$$P_0 = \frac{D_1}{(1+i)} + \frac{D_2}{(1+i)^2} + \dots \frac{D_\infty}{(1+i)^\infty}$$

using "i" as discount rate

D's grow @ constant g

$$\Rightarrow P_0 = \frac{D_1}{(1+i)^1} + \frac{D_1(1+g)}{(1+i)^2} + \frac{D_1(1+g)^2}{(1+i)^3} + \dots$$

$$\Rightarrow P_0 = \frac{D_1}{(1+i)^1} + \frac{D_1}{(1+i)} \cdot \frac{(1+g)}{(1+i)} + \frac{D_1}{(1+i)} \cdot \frac{(1+g)^2}{(1+i)^2} + \dots$$

now use $S_\infty = \frac{a}{(1-r)}$ let $\frac{D_1}{1+i} = a$ and $\frac{1+g}{1+i} = r$

$$P_0 = \frac{D_1/(1+i)}{1-[(1+g)/(1+i)]} = \frac{D_1/(1+i)}{[1+i-(1+g)]/(1+i)}$$

$$= \frac{D_1/\cancel{(1+i)}}{(i-g)/\cancel{(1+i)}} = \frac{D_1}{i-g} = \frac{D_0(1+g)}{(i-g)}$$