

# Worksheet on present and future values

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## 1 Revision on simple and compound interest

In a previous work sheet we encountered the formula:

$$f = p(1 + r)^y \quad (1.1)$$

Where  $f$  is the future value of an amount  $p$  invested for  $y$  years at an annual interest payment at the rate of  $r\%$ .

If the interest is paid  $n$  times a year then for a single year we have:

$$f = p(1 + r/n)^n \quad (1.2)$$

Suppose that you wished to compare two interest rates over the same period but where the interest was paid at different intervals. For example imagine two banks one of which pays interest semi-annually and an other which pays interest quarterly. In order to make this comparison it is useful to convert to an equivalent annual rate. That is the rate which would give the same compound return at the end of the year as the rate we are comparing. It follows that:

$$p(1 + r/n)^n = p(1 + r_a) \quad (1.3)$$

Where  $r_a$  is known as the effective annual rate.

Rearranging this we can eliminate  $p$  and have:

$$r_a = (1 + r/n)^n - 1 \quad (1.4)$$