

IB Math Studies 1 BELL WORK

A nest of ants initially contains 500 individuals. The population is increasing by 12% each week.

- a** How many ants will there be after:
 - i** 10 weeks
 - ii** 20 weeks?
- b** Use technology to find how many weeks it will take for the ant population to reach 2000.

Chapter

5

Sequences and series

- A** Number sequences
- B** The general term of a number sequence
- C** Arithmetic sequences
- D** Geometric sequences
- E** Series
- F** Compound interest
- G** Depreciation

Syllabus reference: 1.7, 1.8, 1.9

F

COMPOUND INTEREST

When money is deposited in a bank, it will usually earn **compound interest**.

After a certain amount of time called the **period**, the bank adds money to the account which is a percentage of the money already in there. The amount added is called the **interest**.

It is called *compound* interest because the interest generated in one period will itself earn more interest in the next period.

Interest is commonly compounded:

- yearly
- half-yearly (2 times per year)
- quarterly (4 times per year)
- monthly (12 times per year)

For interest compounding k times per year, $FV = PV \times \left(1 + \frac{r}{100k}\right)^{kn}$

where: FV is the **future value** or final balance

PV is the **present value** or amount originally invested

r is the **interest rate per year** (as a %)

n is the **number of years**

k is the number of times compounded per year

\$5000 is invested for 4 years at 7% p.a. compound interest, compounded annually.
What will it amount to at the end of this period? Give your answer to the nearest cent.

$$FV = 5000 \left(1 + \frac{7}{100(1)}\right)^{4(1)}$$
$$5000(1.07)^4 = \$6553.98$$

Calculate the final balance of a \$10 000 investment at 6% p.a. where interest is compounded quarterly for two years.

$$PV = 10000$$

$$r = 6$$

$$k = 4$$

$$n = 2$$

$$FV = 10000 \left(1 + \frac{6}{100(4)} \right)^{4(2)}$$

$$10000 (1.015)^8$$

$$\$11264.93$$

INTEREST EARNED

The **interest earned** is the difference between the original balance and the final balance.

$$\mathbf{Interest = FV - PV}$$

How much interest is earned if €8800 is placed in an account that pays $4\frac{1}{2}\%$ p.a. compounded monthly for $3\frac{1}{2}$ years?

$$PV = 8800$$

$$r = 4.5$$

$$k = 12$$

$$n = 3.5$$

$$FV = 8800 \left(1 + \frac{4.5}{100(12)}\right)^{12(3.5)}$$

$$10265.72$$

$$10292.08$$

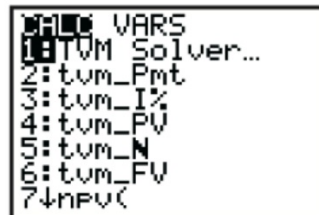
$$- 8800.$$

$$\text{€ } 1498.08$$

USING A GRAPHICS CALCULATOR FOR COMPOUND INTEREST PROBLEMS

TI-84 Plus

Press **APPS** , then select **1 : Finance...** and
1 : TVM Solver... .

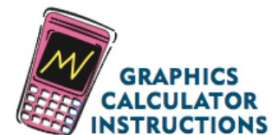
A screenshot of the TI-84 Plus TVM Solver menu. The screen shows a list of options: 1: TVM Solver... (highlighted), 2: tvn_Pmt, 3: tvn_I%, 4: tvn_PV, 5: tvn_N, 6: tvn_FV, and 7: ↓nPV(. The text is in a monospaced font typical of a calculator display.

```
1: TVM Solver...
2: tvn_Pmt
3: tvn_I%
4: tvn_PV
5: tvn_N
6: tvn_FV
7: ↓nPV(
```

The TVM Solver can be used to find any variable if all the other variables are given. For the **TI-84 Plus**, the abbreviations used are:

- N represents the **number of time periods**
- $I\%$ represents the **interest rate per year**
- PV represents the **present value** of the investment
- PMT represents the **payment each time period**
- FV represents the **future value** of the investment
- P/Y is the **number of payments per year**
- C/Y is the **number of compounding periods per year**
- $PMT : END BEGIN$ lets you choose between the payments at the end of a time period or at the beginning of a time period. Most interest payments are made at the end of the time periods.

The abbreviations used by the other calculator models are similar, and can be found in the **graphics calculator instructions** on the CD.



Holly invests 15 000 UK pounds in an account that pays 4.25% p.a. compounded monthly. How much is her investment worth after 5 years?

How much does Halena need to deposit into an account to collect \$50 000 at the end of 3 years if the account is paying 5.2% p.a. compounded quarterly?

For how long must Magnus invest €4000 at 6.45% p.a. compounded half-yearly for it to amount to €10 000?

Iman deposits \$5000 in an account that compounds interest monthly. 2.5 years later the account totals \$6000. What annual rate of interest was paid?