6.5 Finding rate or time for compound interest

Occasionally we know how much we can afford to invest, as well as the future amount that we require at the end of the investment. This allows us to determine the interest rate required to ensure we reach our target investment (savings) goal. With this information we can 'shop' around to find the best financial institution that will provide that interest rate.

buy a car or Holiday

We must first find the interest rate per period, *r*, and convert this to the corresponding nominal rate per annum. This and finding the time or number of periods is difficult.

Your CAS has a finance function called **Finance Solver**. This can be used for compound interest calculations as shown in the worked examples in this section and in the future.

any calculation that isn't "simple" or "flat rate"

Notes on the use of the Financial Solver

Example of Finance Solver

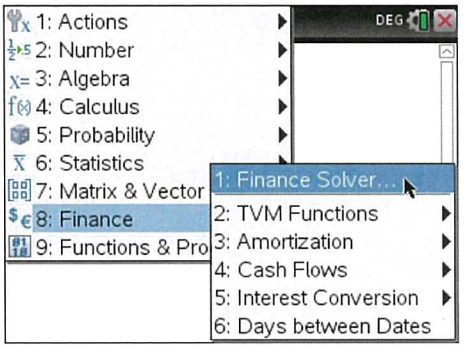
PV

Find the amount of interest earned if **$3200** is invested for **5 years** at **6% p.a. compounded quarterly** using the Finance Solver.

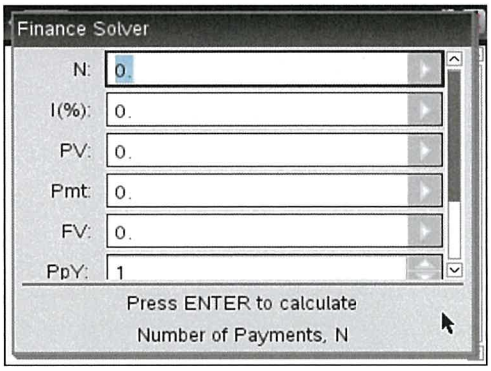
CpY.

On a calculator page

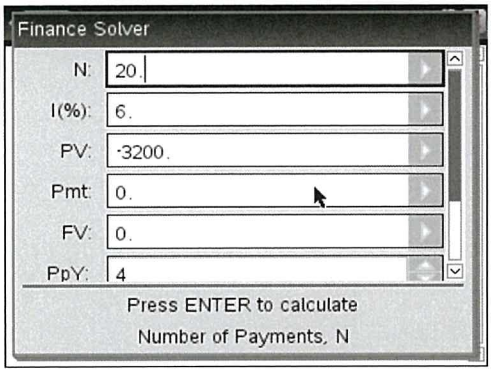
Press:
menu menu
8 Finance
1 Finance Solver



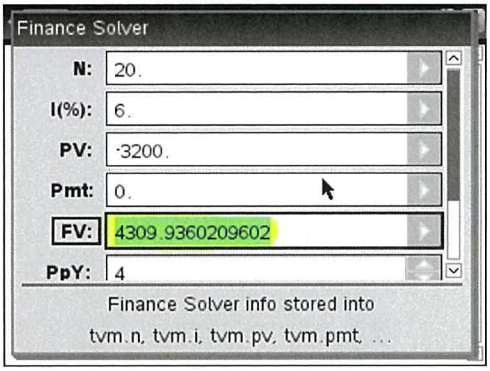
Complete the fields as shown.
N is the number of payments (20). 5 years × 4 quarters.
I(%) is the interest rate p.a. (6).
PV is the amount to be invested (-3200)*.
Pmt is the regular payment ($0).
FV is the future value of the investment (to be determined).
PpY is the number of payments per year (4).
CpY is the number of compounding period per year (4).
Press the tab key tab to move between fields.



Press the tab to return to the FV field and press enter.



The investment is worth $4309.94 after 5 years.



The interest earned is $4309.94 – $3200 = $1109.94.

*The principal value (PV) is entered as a negative value, because you give it to the bank. Hence the future value (FV) is a positive value to indicate it is given to you by the bank.

Worked Example 10

Find the interest rate per annum (correct to 2 decimal places) that would enable an investment of $3000 to grow to $4000 over 2 years if interest is compounded quarterly.

PV FV CpY.

Complete the fields as shown.

N is the number of payments (8=2 years x 4 quarters).

I(%) is the interest rate p.a. (***to be determined – clear cell***) ← delete

PV is the amount to be invested (–3000) - ***you give money to bank***

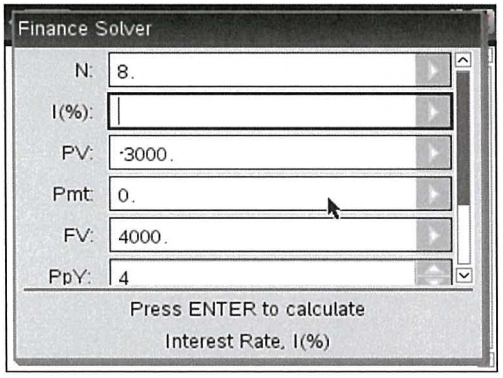
Pmt is the regular payment ($0).

FV is the future value of the investment ($4000).

PpY is the number of payments per year (4).

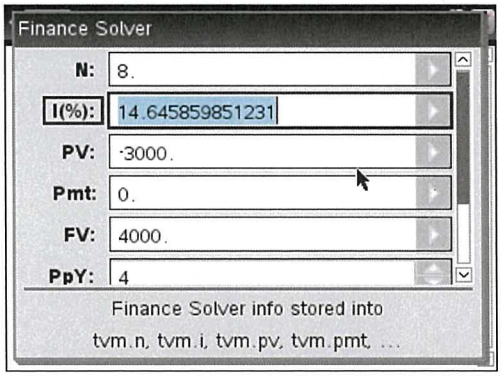
CpY is the number of compounding period per year (4).

Press the tab key [tab] to move between fields.



Press the [tab] to return to the I% field and press [enter].

An annual Interest rate of 14.65% p.a. is required (correct to 2 decimal places).



Finding time in compound interest

Typically these question will ask "how long" "after" etc.

To find *n*, the number of interest-bearing periods – the time period of an investment, we will use the Financial solver on the CAS.

More often than not, the value obtained for *n*, the number will be a decimal, indicating the investment time is between two integers.

The smaller integer doesn't allow enough time for the investment to have the required balance and the larger integer represents more than the required time.

(you go over goal. (You don't reach your goal.

Worked Example 11

How long will it take $2000 to amount to $3500 at 8% p.a. with interest compounded annually?

(PV (FV (I CpY = 1 per year.

Complete the fields as shown.

N is the number of payments (***to be determined – clear cell***)

I(%) is the interest rate p.a. (8%).

PV is the amount to be invested (–$2000) - ***money given away*** ↳ to bank.

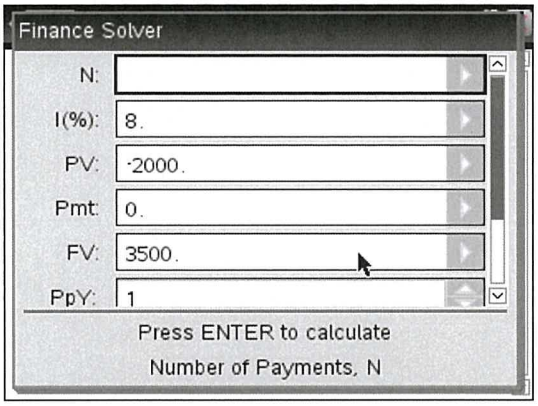
Pmt is the regular payment ($0).

FV is the future value of the investment ($3500).

PpY is the number of payments per year (1).

CpY is the number of compounding period per year (1).

Press the tab key [tab] to move between fields.



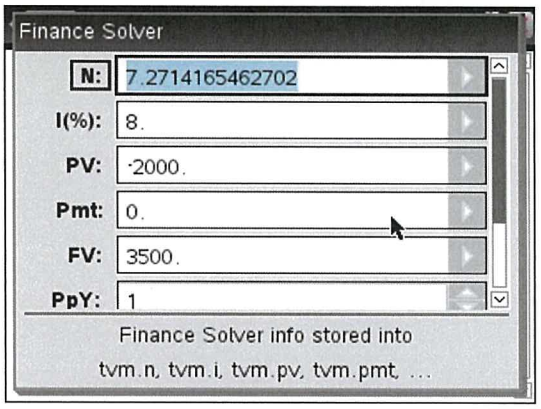
Press the [tab] to return to the N field and press [enter].

↕ clear if needed.

As the Interest is compounded annually, so *n* represents years. Round *n* up to the next whole year. *

Write your answer in words (answer the question)

"It will take 8 years for $2000 to increase to $3500."

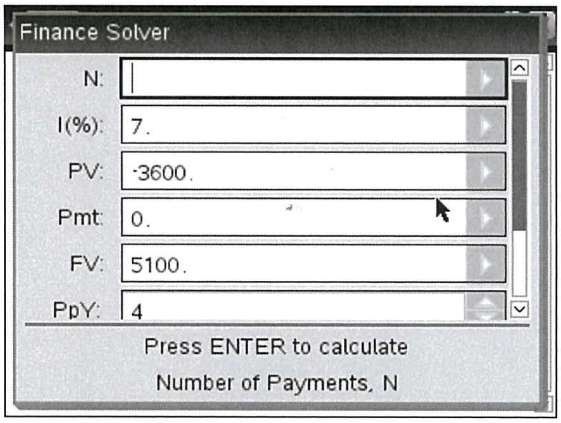


As discussed above, if we leave n=7.27years (or worse round it down to n=7 years) it won't be long enough time for the investment to have reached the $3500 balance required. So, we often to round-up to the nearest whole number (n=8) because after 8 years sufficient interest periods (iterations) will have occurred to surpass the $3500 balance required.

Worked Example 12

Calculate the number of interest –bearing periods, *n*, required and hence the time it will take $3600 to amount to $5100 at a rate of 7 % p.a., with interest compounding quarterly.

Complete the fields as shown.
N is the number of payments (***to be determined - clear cell***).
I(%) is the interest rate p.a. (7%).
PV is the amount to be invested (–$3600).
Pmt is the regular payment ($0).
FV is the future value of the investment ($5100).
PpY is the number of payments per year (4).
CpY is the number of compounding period per year (4).
Press the tab key [tab] to move between fields.



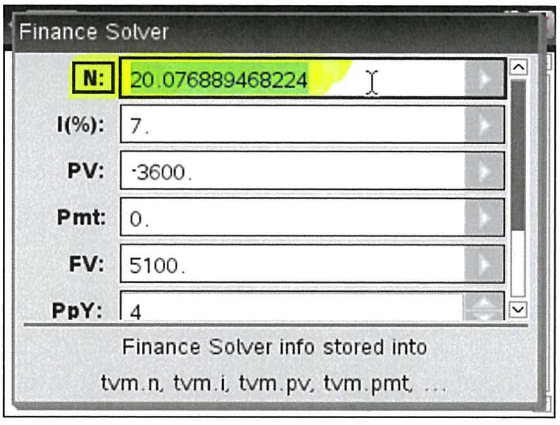
Press the [tab] to return to the N field and press [enter].

As the Interest is compounded quarterly, so *n* represents quarters. Round *n* up to the next whole quarter. So, n=21 quarters

Write your answer in words

"It will take 21 quarters or 5 ¼ years for $3600 to increase to $5100."

check if question is answered!!



* Note: the units of n (time) will vary depending on the question. This is the compounding period. ie WE11: n is years because the interest is compound annually. In WE 12, n is in quarters because the interest is compounded quarterly