FINDING THE TIME PERIOD

Often we wish to know **how long** we must invest money for it to grow to a specified sum in the future.

Example 20

For how long must Magnus invest \$4000 at 6.45% p.a. compounded half-yearly if it is to amount to \$10 000?

Formula solution:

Given $A = 10\,000$

$C = 4000$

$r = \dfrac{6.45}{2} = 3.225$

Using $A = C \times (1 + \frac{r}{100})^n$

$\therefore \quad 10\,000 = 4000 \times (1 + \frac{3.225}{100})^n$

$\therefore \quad 10\,000 = 4000 \times (1.03225)^n$

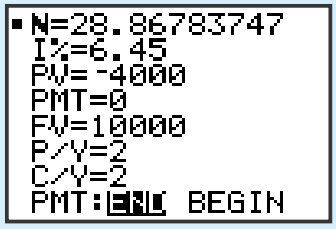
$\therefore \quad n = 28.9$ {using solver}

Thus, 29 half-years are required, i.e., 14.5 years.

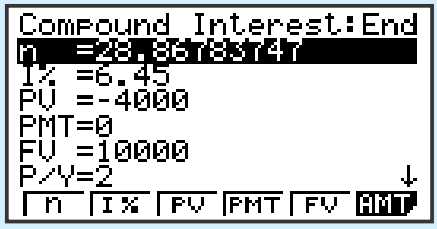
Graphics calculator:

To answer this using the TVM function on the calculator, set up the TVM screen as shown. We then need to find the number of periods required.

For **TI-83**:



For **Casio**:



$n = 28.9$, thus, 29 half-years are required, i.e., 14.5 years.

Note: We find the number of compounding periods and need to convert to the time units required. The appropriate time periods in the above example are years.

EXERCISE 13C.6

1 Your parents give you \$8000 to buy a car but the car you want costs \$9200. You deposit this money in an account that pays 6% p.a. compounded monthly. How long will it be before you have enough money to buy the car you want?

2 A couple inherit \$40 000 and deposit it in an account that pays $4\frac{1}{2}\%$ p.a. compounded quarterly. They withdraw the money as soon as they have over \$45 000. How long did they keep the money in that account?

3 A business deposits £80 000 in an account that pays $5\frac{1}{4}\%$ p.a. compounded monthly. How long will it take before they double their money?

4 An investor deposits \$12 000 in an account paying 5% p.a. compounded daily. How long will it take the investor to earn \$5000 in interest?

2 **a** **i** \$7.20 US **ii** $\div$ £210 **b** **i** \$12.60 US **ii** $\div$AUD \$944
c **i** \$23.40 US **ii** $\div$ 1027 euro

3 **a** $\div$ 1392 baht **b** $\div$ 388 pesos **c** $\div$ 12 pesos

4 **a** $\div$ 2837 rupees **b** $\div$ 363 rand **c** $\div$ 12 rand

EXERCISE 13A.4

1 **a** \$2486.80 US **b** 2813.20 Norwegian kroner
c \$18 759.95 NZ **d** 22 994.60 Thai baht **e** 110 830.85 Yen

EXERCISE 13B.1

1 **a** \$480 **b** \$1239.75 **c** \$6933.33 **d** 402.07 Yen

2 \$15 000 at 7% p.a. for 4 years is less by \$221.25

3 **a** \$2800 **b** £21 000 **4** \$124 444.45

5 **a** $3\frac{1}{3}$% p.a. **b** 8% p.a. **6** $\div$ 7.09% p.a.

7 20% p.a. **8** **a** $2\frac{1}{2}$ years **b** $6\frac{1}{2}$ years **9** 6 years

EXERCISE 13B.2

1 \$274.84 **2** 787.50 baht **3** \$1418.75 **4** \$1660

5 Accept the loan from Lesley (\$269.73 per month) compared to paying Rachel \$338.22 per month.

EXERCISE 13C.1

1 **a** \$5359.57 **b** \$7293.04 **c** £9300.65

2 **a** 113.40 euro **b** \$1170.25 **c** \$6663.24

3 **a** \$17 496 **b** \$2496

4 **a** 9663.60 kroner **b** 1663.60 kroner

EXERCISE 13C.2

1 \$9021.59 **2** \$301.25

3 **a** \$7650 **b** \$8151.65 **c** \$8243.80
Clearly, compounding quarterly is \$92.15 more than compounding half-yearly and \$593.80 more than simple interest.

EXERCISE 13C.3

1 £13 373.53 **2** \$546.01

3 **a** 4725 Yen **b** 4940.81 Yen **c** 4998.89 Yen
d 5028.61 Yen
e 5048.67 Yen - Clearly, interest compounded monthly gives the greatest return.

4 Bank A balance $=$ \$157 149.29, Bank B balance $=$ \$155 344.23
Jai should invest with Bank A.

5 Simple interest earned $=$ 8960 euro
Interest compounded monthly $=$ 9760.78 euro
Interest compounded monthly is 800.78 euro more than simple interest.

EXERCISE 13C.4

1 \$6631 **2** \$4079.75 **3** \$4159.10

4 **a** 308.70 rupees interest **b** 636.36 rupees interest
c 1351.20 rupees interest Doubling the interest rate more than doubles the interest earned.

EXERCISE 13C.5

1 19 971.30 Yen **2** \$20 836.90 **3** \$80 000

4 80 162.65 baht **5** \$1564.95

EXERCISE 13C.6

1 $\div$ 28 months (2 years, 4 months) **2** 11 quarters (2.75 years)

3 159 months (13 years, 3 months)

4 2543 days (6 years, 353 days)

EXERCISE 13C.7

1 14.47% p.a. **2** 6.0% p.a. **3** 5.25% p.a.

4 Shares 13.05% p.a., house 9.48% p.a., i.e., the shares had the greater average annual percentage increase in value.

EXERCISE 13C.8

1 **a** \$1676.03 **b** \$1669.09 $\therefore$ **a** is more by \$6.94

2 **a** Monthly: \$863.16, half-yearly: \$859.58
b Monthly: \$1148.08, half-yearly: \$1143.33

3 **a** Derk should choose the 6.40% interest paid at maturity (i.e., annually).
b \$3200 **c** \$1808

EXERCISE 13C.9

1 A is effectively 5.47% p.a., B is effectively 5.41% p.a.,
$\therefore$ A is the better rate.

2 P is effectively 7.87% p.a., Q is effectively 7.90% p.a.,
$\therefore$ Q is the better rate.

3 **a** 4.95% p.a. **b** 5.01% p.a.
c 4.9% p.a. compounded monthly

4 **a** 8.06% p.a. **b** 8.11% p.a.
c 7.95% p.a. compounded half-yearly

5 12 times (monthly)

6 **a** 6.379% p.a. **b** 6.398% p.a. **c** 6.399% p.a. **d** 6.40% p.a.
e Take interest at maturity to receive \$2560 interest.

EXERCISE 13C.10

1 **a** 6.58% p.a. **b** 5.76% p.a. **c** 5.15% p.a. **d** 4.69% p.a.

2 **a** 7.51% p.a. **b** 4.30% p.a. **c** 4.97% p.a. **d** 3.62% p.a.

3 6.38% p.a.

EXERCISE 13D

1 **a**

Age (years)	*Depreciation*	*Book value*
0	\$0	\$15 000
1	\$2250	\$12 750
2	\$1912.50	\$10 837.50
3	\$1625.63	\$9211.87

b **i** \$2250 **ii** \$1912.50 **iii** \$1625.63

2 **a** \$53 393.55 **b** \$171 606.45

3 **a** \$16 588.80 **b** \$15 811.20 **4** $\div$ 24.79% p.a.

5 **a** $\div$ 18.37% p.a. **6** **a** \$175 702.59 **b** \$64 297.41

EXERCISE 13E

1 **a** \$267 **b** \$16 020 **c** \$4020 **d** \$11 704.53

2 **a** \$308.80 **b** \$11 116.80 **c** \$1616.80 **d** \$8817.04

3 **a** 2032.80 Yen **b** 5250 Yen

4 **a** \$7994 **b** \$5110.40
Becky should borrow from the Cash Credit Union as she pays \$2883.60 less in interest (although her monthly repayments are more.)

EXERCISE 13F.1

1 **a** \$66 354.49 **b** \$56 020.65 **c** \$10 333.84 **d** 3.44% p.a.

2 **a** \$22 444.54 **b** \$22 110.15 **c** \$334.39 **d** 0.50% p.a.

3 Decreased by \$20.49

4 **a** \$1343.92 **b** \$1806.11 **c** \$2427.26

EXERCISE 13F.2

1 **a** \$18 013.95 **b** \$15 876.55

2 **a** \$12 916.22 **b** **i** \$10 090.13 **ii** \$9156.55 **iii** \$8317.11

3 **a** \$7812.50 **b** **i** \$21 049.33 **ii** \$19 128.36

4 **a** \$3060.45 **b** \$2596.06
c Jon needed to invest at greater than the inflation rate (i.e., 4.2% p.a.).

REVIEW SET 13A

1 \$1199.90 US **2** 248.60 euro **3** $\div$ 5.43 years