2023
FINANCE

Questions ○ Memos ○ Diagnostic Report

THE ANSWER SERIES
Your Key to Exam Success

FINANCE (48%): DBE NOVEMBER 2023

QUESTION 6 48%

45%

6.1 Patrick deposited an amount of R18 500 into an account earning r% interest p.a., compounded monthly. After 6 months, his balance was R19 319,48.

6.1.1 Calculate the value of r. (3)

6.1.2 Calculate the effective interest rate. (2)

Memo

6.1 **P** = R18 500 ; **i** = $\frac{r}{12}$% ; **n = 6** ; **A** = 19 319,48

6.1.1 **A = P(1 + r)^n** ➡ $19\,319{,}48 = 18\,500\left(1+\frac{i}{12}\right)^6$

$$\therefore \left(1+\frac{i}{12}\right)^6 = \frac{19\,319{,}48}{18\,500}$$

$$= 1{,}04429....$$

$$\therefore 1+\frac{i}{12} = \sqrt[6]{1{,}04429....}$$

$$= 1{,}00725....$$

$$\therefore \frac{i}{12} = 0{,}00725$$

$$\therefore i \simeq 0{,}087$$

$$\therefore \mathbf{r} \simeq \mathbf{8{,}70\%} \blacktriangleleft$$

6.1.2 $\mathbf{1 + i_{eff} = \left(1+\frac{i_{nom}}{m}\right)^m}$

$$\therefore 1 + i_{eff} = \left(1+\frac{0{,}087}{\mathbf{12}}\right)^{12}$$

$$\therefore 1 + i_{eff} = 1{,}09055...$$

$$\therefore \mathbf{i_{eff}} = 0{,}09055...$$

$$\simeq \mathbf{9{,}06\%} \blacktriangleleft$$

Common Errors and Misconceptions

(a) In **Q6.1** many of the candidates who did not solve for the value of r, did not use the value of n as 6. Generally, candidates found it difficult to deal with months if they were not a multiple of 12. Some candidates used n = $\frac{1}{2}$ while many used 72 months.

(b) In **Q6.1** it was a common error for candidates not to divide the rate by 12 in the formula to calculate the nominal interest rate correctly.

6.2 Kuda bought a laptop for R10 000 on 31 January 2019. He will replace it with a new one in 5 years' time on 31 January 2024.

63%

6.2.1 The value of the old laptop depreciates annually at a rate of 20% p.a. according to the straight-line method. After how many years will the laptop have a value of R0? (2)

Memo

6.2.1 The value of the laptop decreasing to R0:

P = R10 000 ; **n?** ; **i** = 0,2 ; **A** = R0

A = P(1 – in) ➡ $0 = 10\,000(1 - 0{,}2n)$

$\therefore 0 = 1 - 0{,}2n$

$\therefore 0{,}2n = 1$

$\therefore n = \frac{1}{0{,}2}$

$\therefore$ **n = 5 years** ◄

Common Errors and Misconceptions

(c) Many candidates used **the incorrect formulae** in **all questions** related to *financial mathematics*.

In addition, the candidates commonly did not use their **calculator** correctly to calculate the final answer.

6.2.2 Kuda will buy a laptop that costs R20 000. In order to cover the cost price, he made his first monthly deposit into a savings account on 28 February 2019.

He will make his 60th monthly deposit on 31 January 2024. The savings account pays interest at 8,7% p.a., compounded monthly.

Calculate Kuda's monthly deposit into this account. (4)

Memo

6.2.2 New laptop:

$\mathbf{F_v}$ = R20 000 ; **n** = 60 ; $\mathbf{i} = \frac{8{,}7\%}{12} = \frac{0{,}087}{12}$

$\mathbf{F_v} = \frac{x\left[(1+\mathbf{i})^{\mathbf{n}} - \mathbf{1}\right]}{\mathbf{i}}$ ➡ $20\,000 = \frac{x\left[\left(1 + \frac{0{,}087}{12}\right)^{60} - 1\right]}{\frac{0{,}087}{12}}$

$\therefore x = 267{,}2611\ldots$

$\therefore$ **x = R267,27** ◄ . . . *R267,26 will give a value just short of R20 000*

Common Errors and Misconceptions

(d) In **Q6.2.2** many candidates used the ***present*** *value* formula **rather than** the ***future*** *value* formula.

33%

6.3 Tino wins a jackpot of R1 600 000. He invests all of his winnings in a fund that earns interest of 11,2% p.a., compounded monthly. He withdraws R20 000 from the fund at the end of each month. His first withdrawal is exactly 1 month after his initial investment. How many withdrawals of R20 000 will Tino be able to make from this fund? (5)

Note

n is the number of withdrawals made.

Memo

6.3 $\mathbf{P_v}$ = R1 600 000 ; $\mathbf{i} = \frac{11,2}{12}\%$; x = 20 000 ; **n?**

$$\mathbf{P_v} = \frac{x\left[1-(1+\mathbf{i})^{-\mathbf{n}}\right]}{\mathbf{i}}$$

$$\therefore\ 1\,600\,000 = \frac{20\,000\left[1-\left(1+\frac{11,2\%}{12}\right)^{-n}\right]}{\frac{11,2\%}{12}}$$

$$\therefore\ 80 = \frac{\left[1-\left(1+\frac{0,112}{12}\right)^{-n}\right]}{\frac{0,112}{12}}$$

$$\left(\times\frac{0,112}{12}\right) \quad \therefore\ \frac{56}{75} = 1-\left(1+\frac{0,112}{12}\right)^{-n}$$

$$\therefore\ \left(1+\frac{0,112}{12}\right)^{-n} = 1-\frac{56}{75}$$

$$\therefore\ -n = \log_{\left(1+\frac{0,112}{12}\right)}\frac{19}{75}$$

$$= -147,79\ldots$$

$$\therefore\ \mathbf{n} = 147,79\ldots$$

∴ **He can make 147 withdrawals of R20 000** ◄

Note

n < 148 and so the 148th withdrawal cannot be made yet.

Common Errors and Misconceptions

(a) Most candidates in **Q6.3 did not use *logarithms* correctly**, and if they did, the candidates rounded their answer of n = 147,8 to n = 148. This indicated a misconception of the number of withdrawals of R20 000 that could have been made.

QUESTION 6: Suggestions for Improvement

(a) **Learners need deeper insight** into the relevance of each of the **formulae** and under which **circumstances** each formula can be used. The **variables** in each formula must be explained. More practice in Financial Mathematics is necessary so that learners can identify when to use the different formulae.

(b) Teachers should demonstrate all the steps required when using a calculator. This should be done **repetitively** in class with every example done in Financial Mathematics. In formal assessment tasks at school, learners should be penalised for rounding off early.

(c) The difference between **compound interest**, **future value and present value annuities** must be thoroughly explained.

(d) The correct **Financial Mathematics language** should be used in class and learners should read the question with understanding.

(e) Teachers need to emphasise – and learners need to practise – using different compounding periods for time intervals other than in years.