Financial mathematics - applications test

16 questions | 55 marks | 60 minutes

All amounts are Australian dollars. Use the stated classroom models; exclude fees, tax and other transactions unless given. Round final currency to cents unless asked otherwise.

Equivalent correct methods earn the corresponding marks.

1. A club buys an item for 80 dollars and marks it up by 25%. It then discounts the marked price by 10%. Find the sale price. [3 marks]

$80(1.25)(0.9) = 90.$

Answer: 90 dollars

2. A 360-dollar price includes a 20% increase from last year. Find last year's price. [2 marks]

$\frac{360}{1.2} = 300.$

Answer: 300 dollars

3. A fund starts at 2000 dollars. Compare 5% annual simple interest with 5% annual compound interest over 3 years. [5 marks]

(a) Calculate both totals. [3 marks]

$2000(1 + 0.05 \times 3) = 2300;\ 2000(1.05)^3 = 2315.25.$

Answer: 2300 dollars simple; 2315.25 dollars compound.

(b) Explain what creates the difference. [2 marks]

In simple interest the base remains 2000, but the compound base rises each year.

Answer: The compound model pays interest on earlier interest.

4. A model uses nominal 8% annually compounded quarterly. Write the one-year effective factor, then find the effective annual percentage to 2 decimal places. [3 marks]

Quarterly rate is $\frac{0.08}{4} = 0.02$. Subtract 1 from the annual factor and multiply by 100.

Answer: Factor $(1.02)^4 = 1.08243216$; 8.24%.

5. A device-value model retains 85% of its current value annually from 1200 dollars. Find its year-4 value to cents. [3 marks]

$1200(0.85)^4 = 626.4075.$

Answer: 626.41 dollars

6. Two 2000-dollar equipment models are proposed: A subtracts 250 dollars per year; B loses 15% of current value each year. [4 marks]

(a) Calculate their year-2 values. [2 marks]

$2000 - 2(250) = 1500;\ 2000(0.85)^2 = 1445.$

Answer: A: 1500 dollars; B: 1445 dollars.

(b) State a limitation of using model A after year 8. [2 marks]

$2000 - 250(8) = 0$; later results require a restricted or revised model.

Answer: It gives negative ordinary value beyond year 8.

7. A fund loses 30% of its value. Find the percentage increase needed to recover the original value, to 2 decimal places. [3 marks]

The required factor is $\frac{1}{0.7} = 1.428571\ldots$, an increase of $42.8571\ldots\%$.

Answer: 42.86%

8. A saving rule is $B_{n+1} = 1.02B_n + 100$, from $B_0 = 400$. [5 marks]

(a) Find the first three closes, rounding only the final result to cents. [3 marks]

$B_1 = 508;\ B_2 = 508(1.02) + 100 = 618.16;\ B_3 = 730.5232.$

Answer: 508 dollars; 618.16 dollars; 730.52 dollars.

(b) How much of the unrounded final balance is growth rather than starting money and deposits? [2 marks]

Contributions total $400 + 3(100) = 700$. Subtract from 730.5232.

Answer: 30.5232 dollars (30.52 dollars to cents).

9. A loan of 800 dollars adds 1% interest, then receives a 180-dollar payment each month. Find the balance after 2 months. [3 marks]

$L_1 = 800(1.01) - 180 = 628$; $L_2 = 628(1.01) - 180 = 454.28$.

Answer: 454.28 dollars

10. A 1200-dollar balance receives a 100-dollar deposit before 3% interest. A model instead assumes an end deposit. Find the two closes and their difference. [3 marks]

Before: $1300(1.03) = 1339$. End: $1200(1.03) + 100 = 1336$.

Answer: 1339 dollars before; 1336 dollars at the end; difference 3 dollars.

11. A balance starts at 1000 dollars, has 5% interest and a 100-dollar end deposit in year 1, then 4% interest and no deposit in year 2. [5 marks]

(a) Calculate the two closes. [2 marks]

$1000(1.05) + 100 = 1150$; $1150(1.04) = 1196$.

Answer: 1150 dollars; 1196 dollars.

(b) Why is $1000(1.05)^2 + 200$ not the stated model? [3 marks]

The assumptions change by period, so they must be represented individually.

Answer: It uses the wrong second-year rate and adds a deposit that does not occur.

12. The table has columns A = period, B = opening, C = decimal rate, D = end deposit and E = closing. Its headers occupy spreadsheet row 1; the two data rows shown are spreadsheet rows 2 and 3. Write the missing formulas for B3 and E3. [3 marks]

Supplied spreadsheet layout

A	B	C	D	E
1	1000	0.05	100	1150
2	missing	0.04	0	missing

Use the previous close as the opening; apply current-row rate then deposit.

Answer: B3 = E2; E3 = B3*(1+C3)+D3

13. A fee of 15 dollars is charged at each year end on a 1000-dollar balance earning 5% annually. Find the year-2 balance and compare with the no-fee result. [3 marks]

$B_1 = 1050 - 15 = 1035$; $B_2 = 1035(1.05) - 15 = 1071.75$. No-fee total is 1102.5.

Answer: 1071.75 dollars; 30.75 dollars less than no-fee.

14. A fee-free model starts at 2000 dollars and grows 5% annually. Find the first whole year at which the balance exceeds 2400 dollars. [3 marks]

Year 3 gives $2315.25 < 2400$; year 4 gives $2431.0125 > 2400$. The model increases each year.

Answer: Year 4

15. A spreadsheet repeats the initial 1000 dollars as the opening balance in every row despite showing positive compound interest. Explain the error and its effect. [3 marks]

The opening in each new row must equal the previous close. Reusing 1000 creates simple-style fixed interest rather than compound growth.

Answer: It prevents interest on previous interest.

16. Two savings models have the same rate but different deposits and fees. Explain why comparing only final balances cannot identify which model has the larger interest return. [4 marks]

Separate opening principal, deposits, withdrawals, fees and interest. Use matched assumptions or compare the relevant return measure explicitly.

Answer: Final balance includes contributions and fee effects, not just interest.