

Higher Check In 5.03 - Discrete growth and decay

1. An employer agrees that he will increase salaries by 2% at the end of the first year of work, 4% after two years and 6% after three years. If a new employee's starting salary is £16 000, what will they be earning after three years?
2. Terry takes out a payday loan of £400 for the month of March at 0.7% compound interest per day. How much interest does he pay on his loan at the end of the month?
3. The value of a new laptop depreciates by 6% each month. John buys a new laptop for £850. What would be the secondhand value if he were to sell it after two years?
4. A collection of gold coins worth £1600 appreciates by 10% each year. What is the percentage appreciation of the coins after 5 years?
5. A ball is dropped from a height of 2 metres. After each bounce it rises to 85% of its previous height. How many times does it bounce before its height is less than 1 metre?
6. 'The price of a new car depreciates at 12% per year'. Illustrate this information in the form of an equation, specifying any variables that are used.
7. Describe a situation which could be illustrated by the formula $N = 1000 \times 1.02^t$.
8. A couple bought a house for £130 000 and sold it 6 years later for £164 000. Assuming the house appreciated at a constant rate, show that the house increased in value by approximately 4% each year.
9. Twins, Jayden and Taylor, are both given £1000 to invest on their 16th birthday. Both opt for a 10 year investment at 5% compound interest per year. Jayden does not withdraw any money whereas Taylor withdraws £200 on her 21st birthday. How many extra years would Taylor need to keep her money invested to get the same return (to the nearest pound) as Jayden?
10. A bank offers these two accounts.

Account A

4% simple interest per year for the first year and then £50 paid per year thereafter.

Account B

3% compound interest paid annually.

Brian wants to have £2000 in 7 years' time. Which account requires the smaller initial deposit and by how much?



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Extension

A furniture company has two different finance deals:

- Plan A: Pay nothing for the first two years, then 4% compound interest per year thereafter.
- Plan B: 2% compound interest per year is payable for the first two years, then 8% compound interest per year thereafter.

In each case the interest is calculated on the balance at the **start** of each year.

Edward wants to buy a new sofa suite costing £3700.

- a) If he can only afford £75 per month, calculate for each plan how long it will take him to pay for his sofa suite.
- b) If he does pay it back at £75 per month, calculate for each plan how much he will actually pay for his sofa suite.

Which deal would you choose?



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Answers

1. £17 991.17
2. £96.56
3. £192.53
4. 61%
5. 5 bounces (0.89 m)
6. $P = V \times 0.88^t$ where P is current price, V is original price and t is age of car in years.
7. Value of £1000 investment after t years at 2% compound interest per year.
8. $\sqrt[6]{\frac{164000}{130000}} = 1.03948\dots$
9. 4 years (accept 3.5 years)
10. Deposit in account B is smaller by £8.44

Extension

Plan A

	Start balance (£)	Payments (£)	End balance (£)
Year 1	3700	0	3700
Year 2	3700	0	3700
Year 3	3848	$12 \times 75 = 900$	2948
Year 4	3065.92	$12 \times 75 = 900$	2165.92
Year 5	2252.56	$12 \times 75 = 900$	1352.56
Year 6	1406.66	$12 \times 75 = 900$	506.66
Year 7	526.93	$7 \times 75 = 525$ 1×1.93	0

Plan B

	Start balance (£)	Payments (£)	End balance (£)
Year 1	3774	$12 \times 75 = 900$	2874
Year 2	2931.48	$12 \times 75 = 900$	2031.48
Year 3	2194	$12 \times 75 = 900$	1294
Year 4	1397.52	$12 \times 75 = 900$	497.52
Year 5	537.32	$7 \times 75 = 525$ 1×12.32	0

- a) Plan A will take 6 years and 8 months.
Plan B will take 4 years and 8 months.
- b) Plan A will cost £4126.93.
Plan B will cost £4137.32.



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Assessment Objective	Qu.	Topic	R	A	G
AO1	1	Calculate a variable percentage increase over time			
AO1	2	Calculate compound interest owed			
AO1	3	Calculate a constant rate of depreciation over time			
AO1	4	Calculate an overall percentage increase			
AO1	5	Use a constant rate of depreciation			
AO2	6	Express depreciation algebraically			
AO2	7	Interpret a percentage change represented algebraically			
AO2	8	Work out a compound percentage change			
AO3	9	Solve a problem involving compound interest			
AO3	10	Solve a problem involving simple and compound interest			

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