# 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 .
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 B**

**Account A**

3% compound interest paid annually.

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

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

**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.

1. If he can only afford £75 per month, calculate for each plan how long it will take him to pay for his sofa suite.
2. 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?

Answers

1. £17 991.17
2. £96.56
3. £192.53
4. 61%
5. 5 bounces (0.89 m)
6.  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. 
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 |  | 2948 |
| Year 4 | 3065.92 |  | 2165.92 |
| Year 5 | 2252.56 |  | 1352.56 |
| Year 6 | 1406.66 |  | 506.66 |
| Year 7 | 526.93 |  | 0 |

Plan B

|  |  |  |  |
| --- | --- | --- | --- |
|  | Start balance (£) | Payments (£) | End balance (£) |
| Year 1 | 3774 |  | 2874 |
| Year 2 | 2931.48 |  | 2031.48 |
| Year 3 | 2194 |  | 1294 |
| Year 4 | 1397.52 |  | 497.52 |
| Year 5 | 537.32 |  | 0 |

1. Plan A will take 6 years and 8 months.

Plan B will take 4 years and 8 months.

1. Plan A will cost £4126.93.

Plan B will cost £4137.32.

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