

# Percentages

## ***Learning objectives***

*By the end of this topic, you should be able to:*

- *calculate compound interest;*
- *calculate appreciation;*
- *calculate depreciation;*
- *reverse percentages;*

## Key Words

**Appreciation** is when a value **increases**.

**Depreciation** is when a value **decreases**.

**Before, originally, at the start** - backward percentages

### Example 1

£5000 is invested in a bank for 10 years. 2% interest is paid annually. Calculate the compound interest at the end of 10 years.

$$\frac{100\% + 2\%}{100} = 1.02$$

$$1.02^{10} \times 5000 = \text{£}6094.97$$

$$6094.97 - 5000 = \text{£}1094.97$$

## Example 2

A house was valued at £125,000 and sold 2 years later.

It increased in value by 4% in the first year and by 7% in the second year.

Calculate the value of the house when it was sold.

$$\frac{100\% + 4\%}{100} = 1.04$$

$$= 1.07$$

$$1.04 \times 1.07 \times 125000 = \pounds 139100$$

### Example 3

£640 is placed in a bank for 4 years. 3.5% interest is paid annually.  
How much is in the bank at the end of the 4 years?

$$\frac{100\% + 3.5\%}{100} = 1.035$$

$$1.035^4 \times 640 = £734.41$$

3.5% decrease

$$\frac{100\% - 3.5\%}{100} = 0.965$$

### Example 4

The sale price of a bicycle after it has been reduced by 20% is £135.20. Calculate the original price of the bike.

non-cal

$$\begin{array}{l} \div 8 \\ \times 10 \end{array} \quad \begin{array}{l} 80\% = 135.20 \\ 10\% = 16.90 \\ 100\% = \underline{\underline{\pounds 169}} \end{array}$$

8  $\sqrt{135.20} \begin{array}{l} 16.90 \\ \underline{135.20} \end{array}$

$\div 8$   
 $\times 10$

cal

$$\frac{100\% - 20\%}{100} = 0.8$$

$$\frac{135.20}{0.8} = \underline{\underline{\pounds 169}}$$

**Q11:** A Painting which cost £500000 appreciated by 12% last year and 9% this year. Calculate the value of the painting now.

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**Q12:** A car worth £15000 loses 8% of its value a year. What is it worth by the end of 7 years? Give your answer to the **nearest penny**.

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**Q13:** A motorbike was bought for £3200. It depreciated by 20% in the first year and 12% in the second year. How much is it worth now? Give your answer to the nearest pound.

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**Q14:** A collector bought an antique vase for £600. The vase increases in value by 3% in the first year. It decreased in value by 2% in the second year. It decreased in value by 3% in the third year. What is the vase worth after 3 years? Give your answer to the **nearest penny**.

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**Q16: Appreciation**

An antique valued at £3541 appreciates by 11%.

What is it worth now? Give your answer to the **nearest penny**.

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**Q17: Appreciation**

A house was valued at £215000 and sold 2 years later.

In the first year it increased in value by 24% and 17% in the second year.

Calculate the value of the house when it was sold. Give your answer to the **nearest pound**.

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**Q18: Depreciation**

A car valued at £2027 depreciates by 10%.

What is it worth now? Give your answer to the **nearest penny**.

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**Q19: Depreciation**

A yacht was bought new for £86000.

Over the course of 3 years it depreciated by 8%, 12% and 17%.

Calculate the value of the yacht now. Give your answer to the **nearest pound**.

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**Q20: Increase/Decrease by a Percentage**

A collector bought an antique vase for £400.

The vase increases in value by 3% in the first year.

It decreases in value by 4% in the second year.

It decreases in value by 3% in the third year.

What is the vase worth (in £'s) after 3 years? Give your answer to the **nearest penny**.

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**Q23:** Undoing a percentage increase

The population of an island increased by 16% this year to 82592.  
Calculate the population on the island last year. Give your answer to the **nearest whole number**.

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**Q24:** Undoing a percentage decrease

A school role has dropped this session by 10% to 1134.  
Calculate the school role last session. Give your answer to the **nearest whole number**.

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**Q25:** Undoing percentages

The Smith's gas bill was £816.96 this year.

- a) This was 20% increase on last year. How much did they pay last year? Give your answer to the **nearest penny**.
- b) Last year's bill was 8% less than the previous year. How much did they pay for gas the previous year? Give your answer to the **nearest penny**.

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## Answers

**Q11:** £ 610400

**Q12:** £ 8367.70

**Q13:** £ 2253

**Q14:** £ 587.47

**Q16:** £3930.51

**Q17:** £311922

**Q18:** £1824.30

**Q19:** £57789

**Q20:** £383.65

**Q23:** 71200 ( $82592 \div 1.16$ )

**Q24:** 1260 ( $1134 \div 0.90$ )

**Q25:**

a) £680.80

b) £740.00

## Exam Questions

1. A TV is reduced by 15% in a sale. It originally cost £600. How much does it cost now?
2. A house was valued at £180 000. It appreciated in value by 2.4% in the first year. Depreciated in 1.3% in the second year. How much was the house worth at the end of the second year?
3. The number of bacteria in a petri dish is increasing at a rate of 3% every hour. If there are 12 000 bacteria at the start then how many will there be in 4 hours?
4. A bank offers interest at a rate of 3.8% per annum on savings. Calculate the compound interest on an investment of £600 over three years.
5. A house appreciated in value by 2% over the course of a year. At the end of the year it was worth £117 300. How much was the house worth at the start of the year?