

# Compound Measures

## Level 2

Name: \_\_\_\_\_

Date: \_\_\_\_\_

# How to Guide

# Skills Check

Rate how confident you feel about the skills tested in this section:

Skill	Not a clue!	I know a little	I feel okay with this	I feel quite confident	I feel very confident
Calculate compound interest					
Carry out calculations with speed					
Carry out calculations with density					
Calculate rates of pay					

*When you have finished the booklet, use a different colour to mark your confidence levels again.*

## Compound Measures

### Introduction

These are some of the types of calculations that are new to the exam papers. In order to complete this guide, we recommend that you have completed the 'How to' Guides on formulae, percentage and money first.

# Compound Interest

Compound interest is calculated by taking the interest at a given point, adding it to the original amount to give a new value. You then find the interest on the new value and add that on to get the next new value and keep repeating as many times as needed. Always check whether you are finding just the interest or the amount after the interest has been added.

## Example

Find the final amount invested after compound interest is added to £4000 invested for 2 years at 5% per year.

## ANSWER

We first work out the interest at the end of year one.

$4000 \times 1.05 = 4200$  (we use 1.05 because it is 100% plus 5% written as a decimal)

OR  $4000 \times 5 = 20000$  then divide by 100 = 200

Add this to the original  $4000 + 200 = 4200$

We then use this figure of £4200 and add the 5% interest at the end of year 2.

$4200 \times 1.05 = 4410$

OR  $4200 \times 5 = 21000$  then divide by 100 = 210 and add this to the 4200 = 4410

The final answer is **£4410**

## Try it Out

**Question 1** - Use the example above to help you.

a) Find the final amount in the account when compound interest is added to £6000 invested for 2 years at 5% per year.

b) Find the compound interest on £2500 invested for 3 years at 5% per year.

c) Find the final amount in the account when compound interest is added to £4000 invested for 2 years at 3% per year.

# Compound Interest - Formula

The method above works well but it can be quite long. There is a formula you can use instead. You will often see the formula written in different ways, you can choose to use the version that you find easiest to remember. The formula gives you the final amount invested so if you need just the interest you need to subtract the original amount from the new value.

## Formula

$$V = P(1 + r)^n$$

V is the new value

P is the original amount invested

r is the rate of interest – this must be written as a percentage

n is the time period such as 3 years

## Example

Find the compound interest on £4000 invested for 2 years at 5% per year.

$$V = P(1 + r)^n$$

$$P = 4000$$

$$r = 5\% \rightarrow 0.05$$

$$n = 2 \text{ years}$$

$$V = 4000(1 + 0.05)^2$$

$$V = £4410$$

You may not be given the formula in the exam so if you want to use it you will need to memorise it

## Try it Out

### Question 2

a) Find the final amount in the account when compound interest is added to £500 invested at 7% over 2 years.

b) Find the final amount in the account when compound interest is added to £4500 invested at 1.2% over 5 years.

c) Dennis takes out a loan of £3000 with compound interest of 17% over a period of 6 years. How much would the interest be?

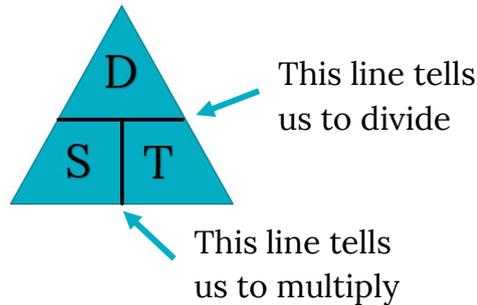
# Speed

If you have done the formula workbook, you'll know the formula for speed.

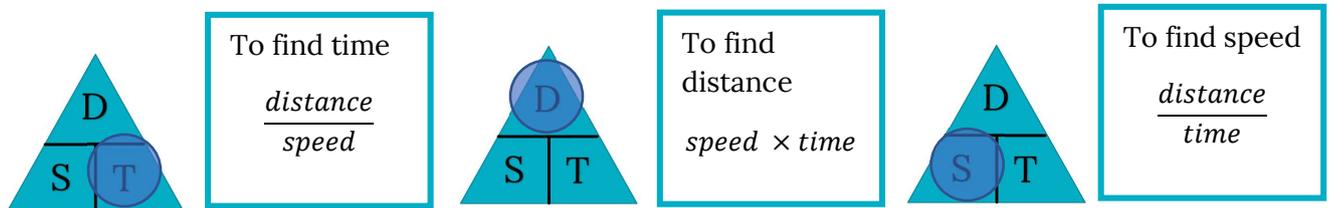
**Speed**

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

Many people remember the formula as a triangle



The idea of the triangle is to cover us the part you want to find and the lines tell you what to do



You must pay attention to units. For example:

$$\text{speed} = \frac{\text{distance in } m}{\text{time in secs}} = \text{speed in m/s or metres per second}$$

$$\text{speed} = \frac{\text{distance in } km}{\text{time in hrs}} = \text{speed in km/h or km per hour}$$

You must not use mixed units. For example, 1 minute 30 seconds must be converted either all to minutes as 1.5 mins or all to seconds as 90 secs

## Try it Out

### Question 3

a) A van travels 179 miles in 2 hours. What is its average speed?

b) Joe travels at an average speed of 65 km/h for 3.5hrs. How far does he travel?

c) Usain Bolt's average speed when he broke the 100m world record was 37.58km/h. How long did it take him to complete the race in **seconds**?

Don't forget  
to put units  
on your  
answers

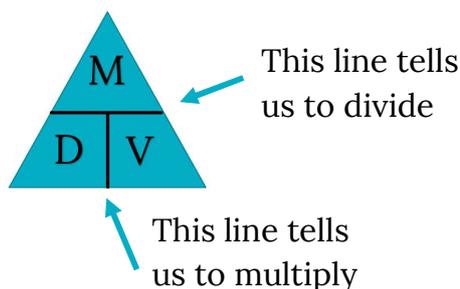
# Density

If you have done the formula workbook, you'll know the formula for density.

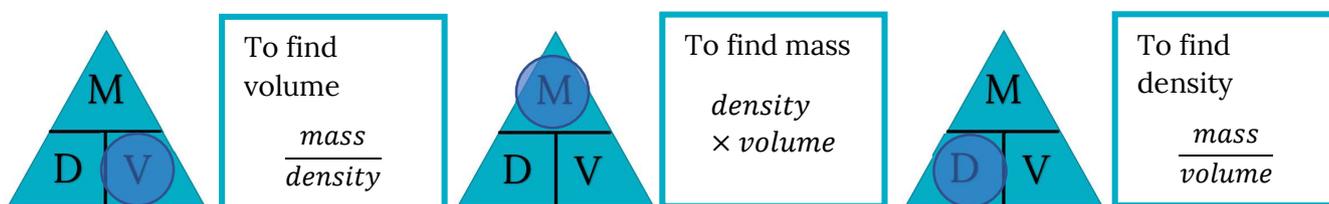
Density

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

Many people remember the formula as a triangle

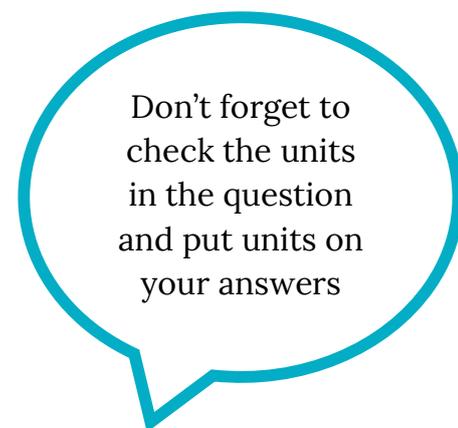


The idea of the triangle is to cover us the part you want to find and the lines tell you what to do



You must pay attention to units. For example:

$$\text{density} = \frac{\text{mass in kg}}{\text{volume in cubic metres}} = \text{density in kg/m}^3$$
$$\text{speed} = \frac{\text{mass in grams}}{\text{volume in cubic centimetres}} = \text{density in g/cm}^3$$



## Try it Out

### Question 4

a) An object has a mass of 400kg and a volume of 1890cm<sup>3</sup>. What is its density?

b) A container is filled with 1kg of oil. It has a density of 0.924g/cm<sup>3</sup>. What is its volume?

c) A cube has sides of 5cm. The density of the cube is 3.2g/cm<sup>3</sup>. What is the mass of the cube?

# Rates of Pay

You will have already worked with some rates of pay when doing the guide on money. There are a few pieces of terminology that may be useful to you.

## Key Vocabulary

**Time and a half** – you are paid your normal hourly rate plus half of that rate again. If your normal pay is £9.85 per hour, then when you are paid time and a half you halve the hourly rate ( $9.85 \div 2 = 4.925$ ) and add this on to the normal hourly rate ( $9.85 + 4.925 = 14.775$  which is £14.78). You could also multiply the normal rate by 1.5 to get the new rate ( $9.85 \times 1.5 = 14.78$ )

**Time and a quarter** – you are paid your normal hourly rate plus a quarter of that rate again. To calculate this, you would divide your normal pay by 4 and then add this amount to your hourly rate or you could multiply the normal rate by 1.25.

**Double time** – you are paid double your normal hourly rate.

**Income tax** – at the minute the government charge either 20%, 40% or 45% income tax on money you earn. For most people, you are allowed to earn £12,500 before you are charged any tax. You would not be expected to memorise these figures.

### Example

Hanif has to pay income tax at 20% on his earnings above £12,500. His annual salary is £28,400. How much tax does he pay per year?

### ANSWER

He only pays tax on the money he earns over £12,500 so subtract this from his salary  $28400 - 12500 = 15900$

Find 20%

$15900 \times 20 = 31800$  divide by 100 = 3180

OR

$15900 \times 0.2 = 3180$

He pays £3,180 in tax

## Try it Out

### Question 5

a) Josh earns £11.25 per hour and time and a half on Saturdays and Sundays. In one week, he does 27 hours during the week and 6 hours over the weekend. How much does he earn that week?

b) Stuart has to pay income tax at 20% on his earnings above £12,500. His annual salary is £32,800. How much tax does he pay per year?

# Mixed Questions

a) Find the compound interest on £7800 invested for 4 years at 2% per year.

b) Debbie worked for ten hours and was paid £125 of overtime at time and half. What is her normal hourly rate?

c) In Formula 1, Lewis Hamilton set the lap record at the track at Silverstone by travelling around the 5.9km track at 242.7km/h. How long did it take him to go around the track? Choose suitable units for your answer.

d) An object has a mass of 650kg and a volume of 2224cm<sup>3</sup>. What is its density?

e) James takes out a loan of £12,000 at a compound interest rate of 15.5%. How much interest will he have paid after 6 years?

f) A tanker has a volume of  $30\text{m}^3$  and is filled with petrol. Petrol has a density of  $748.9\text{ kg/m}^3$ . What is its mass?

g) Find the final amount in the account when compound interest is added to £5800 invested at 10% over 9 years.

h) Celia is paid double time for any hours she works after 1800. She is normally paid £8.68 an hour. This week she worked:

Monday 0830-1730

Tuesday 0930-1930

Wednesday 0800-1600

Thursday 0800-1800

Friday 0930-2000

How much will she be paid in total that week?

i) A cuboid has dimensions of length 1.2m, width 0.7m and height 0.5m. The density of the cuboid is  $12.5\text{g/cm}^3$ . What is the mass of the cuboid? NOTE: Check your units.