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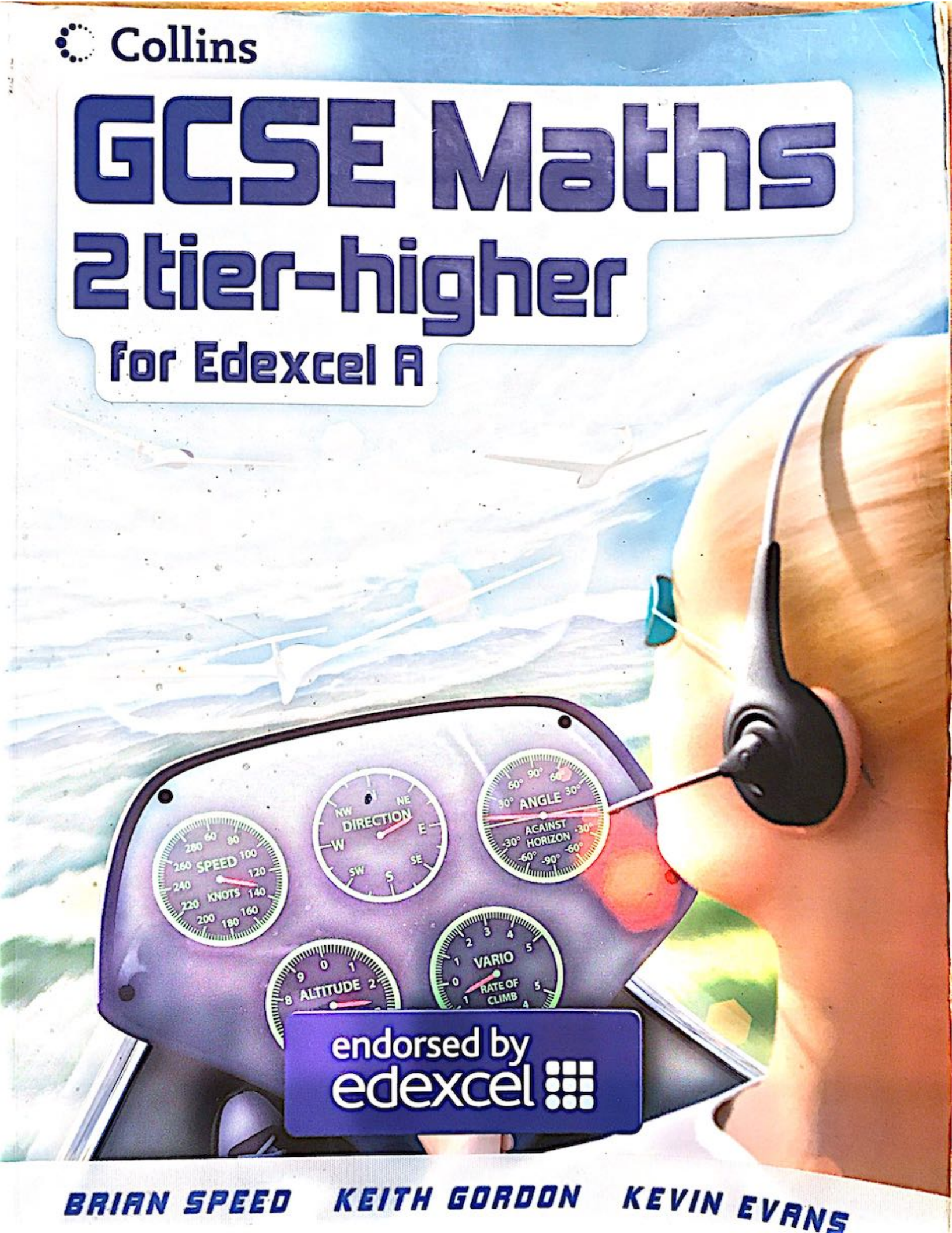
from Blue textbooks kept at back of M34

Collins

GCSE Maths

2 tier-higher

for Edexcel A



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BRIAN SPEED KEITH GORDON KEVIN EVANS

EXERCISE 2G

1 Express each of the following as a percentage. Give suitably rounded off figures where necessary.

a £5 of £20

b £4 of £6.60

c 241 kg of 520 kg

d 3 hours of 1 day

e 25 minutes of 1 hour

f 12 m of 20 m

g 125 g of 600 g

h 12 minutes of 2 hours

i 1 week of a year

j 1 month of 1 year

k 25 cm of 55 cm

l 105 g of 1 kg

2 John went to school with his pocket money of £2.50. He spent 80p at the tuck shop. What percentage of his pocket money had he spent?

3 In Greece, there are 3 654 000 acres of agricultural land. Olives are grown on 237 000 acres of this land. What percentage of agricultural land is used for olives?

4 During the wet year of 1981, it rained in Manchester on 123 days of the year. What percentage of days were wet?

5 Find, to one decimal place, the percentage profit on the following.

Item	*Retail price* (selling price)	*Wholesale price* (price the shop paid)
a CD player	£89.50	£60
b TV set	£345.50	£210
c Computer	£829.50	£750

6 Before Anton started to diet, he weighed 95 kg. He now weighs 78 kg. What percentage of his original weight has he lost?

7 In 2004 the Melchester County Council raised £14 870 000 in council tax. In 2005 it raised £15 970 000 in council tax. What was the percentage increase?

8 When Blackburn Rovers won the championship in 1995, they lost only four of their 42 league games. What percentage of games did they not lose?

9 In the year 1900 the value of Britain's imports were as follows.

British Commonwealth	£109 530 000
USA	£138 790 000
France	£53 620 000
Other countries	£221 140 000

a What percentage of the total imports came from each source?

b Add up the answers to part **a**. Explain your answer.

Using your calculator

You may have noticed that you can do the above calculation on your calculator without having to write down all the intermediate steps.

To add on the 6% each time just means multiplying by 1.06 each time. That is, you can do the calculation as

4 0 0 × 1 • 0 6 × 1 • 0 6 × 1 • 0 6 =

Or

4 0 0 × 1 • 0 6 x^y 3 =

Or

4 0 0 × 1 0 6 % x^y 3 =

You need to find the method with which you are comfortable and which you understand.

The idea of compound interest does not only concern money. It can be about, for example, the growth in population, increases in salaries, or increases in body weight or height. Also the idea can involve regular reduction by a fixed percentage: for example, car depreciation, population losses and even water losses. Work through the next exercise and you will see the extent to which compound interest ideas are used.

EXERCISE 2H

1 A baby octopus increases its body weight by 5% each day for the first month of its life. In a safe ocean zoo, a baby octopus was born weighing 10 kg.

a What was its weight after

i 1 day? **ii** 2 days? **iii** 4 days? **iv** 1 week?

b After how many days will the octopus first weigh over 15 kg?

2 A certain type of conifer hedging increases in height by 17% each year for the first 20 years. When I bought some of this hedging, it was all about 50 cm tall. How long will it take to grow 3 m tall?

3 The manager of a small family business offered his staff an annual pay increase of 4% for every year they stayed with the firm.

a Gareth started work at the business on a salary of £12 200. What salary will he be on after 4 years?

b Julie started work at the business on a salary of £9350. How many years will it be until she is earning a salary of over £20 000?

4 Scientists have been studying the shores of Scotland and estimate that due to pollution the seal population of those shores will decline at the rate of 15% each year. In 2006 they counted around 3000 seals on those shores.

a If nothing is done about pollution, how many seals will they expect to be there in

i 2007? **ii** 2008? **iii** 2011?

b How long will it take for the seal population to be less than 1000?

5 I am told that if I buy a new car its value will depreciate at the rate of 20% each year. I buy a car in 2006 priced at £8500. What would be the value of the car in

a 2007? **b** 2008? **c** 2010?

6 At the peak of the drought during the summer of 1995, a reservoir in Derbyshire was losing water at the rate of 8% each day. On 1 August this reservoir held 2.1 million litres of water.

a At this rate of losing water, how much would have been in the reservoir on the following days?

i 2 August **ii** 4 August **iii** 8 August

b The danger point is when the water drops below 1 million litres. When would this have been if things had continued as they were?

7 The population of a small country, Yebon, was only 46 000 in 1990, but it steadily increased by about 13% each year during the 1990s.

a Calculate the population in

i 1991 **ii** 1995 **iii** 1999.

b If the population keeps growing at this rate, when will it be half a million?

8 How long will it take to accumulate one million pounds in the following situations?

a An investment of £100 000 at a rate of 12% compound interest.

b An investment of £50 000 at a rate of 16% compound interest.

UAM **9** An oak tree is 60 cm tall. It grows at a rate of 8% per year. A conifer is 50 cm tall. It grows at a rate of 15% per year. How many years does it take before the conifer is taller than the oak?

UAM **10** A tree increases in height by 18% per year. When it is 1 year old, it is 8 cm tall. How long will it take the tree to grow to 10 m?

PROOF **11** Show that a 10% increase followed by a 10% increase is equivalent to a 21% increase overall.

2.8 Finding the original quantity (reverse percentage)

This section will show you how to:

- calculate the original amount after you know the result of a percentage increase or decrease

Key words

multiplier
original amount
unitary method

There are situations when we know a certain percentage and wish to get back to the **original amount**. There are two methods.

Method 1
The first method is the **unitary method**.

EXAMPLE 15

The 70 men who went on strike represented only 20% of the workforce. How large was the workforce?

Since 20% represents 70 people, then

1% will represent 70 ÷ 20 people [don't work it out]

so 100% will represent (70 ÷ 20) × 100 = 350

Hence the workforce is 350.

Method 2
Using a **multipler**.

EXAMPLE 16

The price of a refrigerator is decreased by 12% in a sale. The new price is £220. What was the original price before the reduction?

A decrease of 12% is a multiplier of 0.88.

Simply divide the new price by the multiplier to get the original price. 220 ÷ 0.88 = 250

So the original price was £250.

EXERCISE 2I

1 Find what 100% represents in these situations.

a 40% represents 320 g
b 14% represents 35 m
c 45% represents 27 cm
d 4% represents £123
e 2.5% represents £5
f 8.5% represents £34

2 On a gruelling army training session, only 28 youngsters survived the whole day. This represented 35% of the original group. How large was the original group?

3 VAT is a government tax added to goods and services. With VAT at 17.5%, what is the pre-VAT price of the following priced goods?

T shirt	£9.87	Tights	£1.41
Shorts	£6.11	Sweater	£12.62
Trainers	£29.14	Boots	£38.07

4 Howard spends £200 a month on food. This represents 24% of his monthly take-home pay. How much is his monthly take-home pay?

5 Tina's weekly pay is increased by 5% to £315. What was Tina's pay before the increase?

6 The number of workers in a factory fell by 5% to 228. How many workers were there originally?

7 In a sale a TV is reduced to a price of £325.50. This is a 7% reduction on the original price. What was the original price?

8 If 38% of plastic bottles in a production line are blue and the remaining 7750 plastic bottles are brown, how many plastic bottles are blue?

9 I received £3.85 back from the tax office, which represented the 17.5% VAT on a piece of equipment. How much did I pay for this equipment in the first place?

10 A man's salary was increased by 5% in one year and reduced by 5% in the next year. Is his final salary greater or less than the original one and by how many per cent?

11 A quick way of estimating the pre-VAT price of an item with VAT added is to divide by 6 and then multiply by 5. For example, if an item is £360 including VAT, it is approximately $(360 \div 6) \times 5 = £300$ before VAT. Show that this gives an estimate to within £5 of the pre-VAT price for items costing up to £280.