

# Edexcel GCSE

## Mathematics

# Higher Tier

## Number: Percentages

### Information for students

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The marks for individual questions and the parts of questions are shown in round brackets: e.g. (2). There are 21 questions in this selection.

### Advice for students

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Show all stages in any calculations.

Work steadily through the paper. Do not spend too long on one question.

If you cannot answer a question, leave it and attempt the next one.

Return at the end to those you have left out.

### Information for teachers

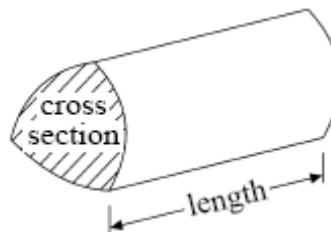
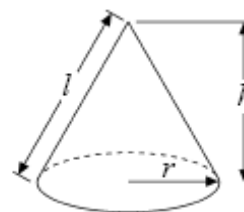
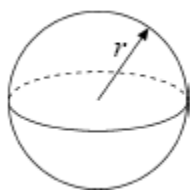
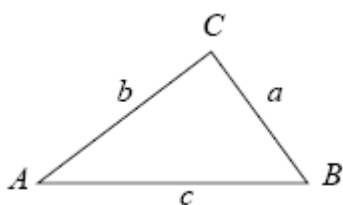
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The questions in this document are taken from the 2009 GCSE Exam Wizard and include questions from examinations set between January 2003 and June 2009 from specifications 1387, 1388, 2540, 2544, 1380 and 2381.

Questions are those tagged as assessing “Percentages” though they might assess other areas of the specification as well. Questions are those tagged as “Higher” so could have (though not necessarily) appeared on either an Intermediate or Higher tier paper.

## GCSE Mathematics

Formulae: Higher Tier

**You must not write on this formulae page.****Anything you write on this formulae page will gain NO credit.****Volume of prism** = area of cross section  $\times$  length**Volume of sphere**  $\frac{4}{3} \pi r^3$ **Volume of cone**  $\frac{1}{3} \pi r^2 h$ **Surface area of sphere** =  $4\pi r^2$ **Curved surface area of cone** =  $\pi r l$ **In any triangle ABC****The Quadratic Equation**The solutions of  $ax^2 + bx + c = 0$ where  $a \neq 0$ , are given by

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

**Sine Rule**  $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ **Cosine Rule**  $a^2 = b^2 + c^2 - 2bc \cos A$ **Area of triangle** =  $\frac{1}{2} ab \sin C$

1. A garage keeps records of the costs of repairs to its customers' cars. The table gives information about the costs of all repairs which were less than £250 in one week.

Cost, (£ $C$ )	Frequency
$0 < C \leq 50$	4
$50 < C \leq 100$	8
$100 < C \leq 150$	7
$150 < C \leq 200$	10
$200 < C \leq 250$	11

- (a) Find the class interval in which the median lies.

.....

(2)

There was only one further repair that week, not included in the table. That repair cost £1000.

Dave says 'The class interval in which the median lies will change.'

- (b) Is Dave correct? Explain your answer.

.....  
 .....

(1)

The garage also sells cars.  
It offers a discount of 20% off the normal price for cash.

Dave pays £5200 cash for a car.

(c) Calculate the normal price of the car.

£.....

(3)

(Total 6 marks)

2. Loft insulation reduces annual heating costs by 20%.  
**After** he insulated his loft, Curtley's annual heating cost was £520.

Work out Curtley's annual heating cost would have been, if he had not insulated his loft.

£ .....

(Total 3 marks)

3. Henry invests £4500 at a compound interest rate of 5% per annum.  
 At the end of  $n$  complete years the investment has grown to £5469.78.  
 Find the value of  $n$ .

.....  
 (Total 2 marks)

4. The table shows the number of computer games sold in a supermarket each month from January to June.

Jan	Feb	Mar	Apr	May	Jun
147	161	238	135	167	250

- (a) Work out the three month moving averages for this information.

..... (2)

In a sale, a supermarket took 20% off its normal prices.  
On Fun Friday, it took 30% off its sale prices.

Fred says, "That means there was 50% off the normal prices".

(b) Fred is wrong. Explain why.

(2)  
(Total 4 marks)

5. A company bought a van that had a value of £12 000  
Each year the value of the van depreciates by 25%.

(a) Work out the value of the van at the end of three years.

£ .....

(3)

The company bought a new truck.  
Each year the value of the truck depreciates by 20%.  
The value of the new truck can be multiplied by a single number to find its value at the end of four years.

- (b) Find this single number as a decimal.

.....  
(2)  
(Total 5 marks)

6. In a sale, normal prices are reduced by 20%.



Andrew bought a saddle for his horse in the sale.  
The sale price of the saddle was £220.

Calculate the normal price of the saddle.

£.....  
(Total 3 marks)

7. Bill invests £500 on 1st January 2004 at a compound interest rate of  $R\%$  per annum. The value, £ $V$ , of this investment after  $n$  years is given by the formula

$$V = 500 \times (1.045)^n$$

- (a) Write down the value of  $R$ .

$$R = \dots\dots\dots \quad (1)$$

- (b) Use your calculator to find the value of Bill's investment after 20 years.

$$\text{£} \dots\dots\dots \quad (2)$$

(Total 3 marks)



8. Bill buys a new machine.  
The value of the machine depreciates by 20% each year.

(a) Bill says 'after 5 years the machine will have no value'.  
Bill is **wrong**.  
Explain why.

.....  
.....  
.....

(1)

Bill wants to work out the value of the machine after 2 years.

(b) By what single decimal number should Bill multiply the value of the machine when new?

.....

(2)

(Total 3 marks)

9. Bytes is a shop that sells computers and digital cameras.

In 2003, Bytes sold 620 computers.

In 2004, Bytes sold 708 computers.

(a) Work out the percentage increase in the number of computers sold.  
Give your answer to an appropriate degree of accuracy.

..... %

(4)

In a sale, normal prices are reduced by 14%.

The sale price of a digital camera is £129.86

(b) Work out the normal price of the digital camera.

£ .....

(3)

The table shows the number of digital cameras Bytes sold each month in the first six months of 2005.

Month	January	February	March	April	May	June
Number of digital cameras sold	30	19	20	15	27	39

The first 3-month moving average for this data is 23

(c) Work out the **second** 3-month moving average for this data.

.....

(2)

(Total 9 marks)

10. Hajra's weekly pay this year is £240  
This is 20% more than her weekly pay last year.

Bill says 'This means Hajra's weekly pay last year was £192'.

Bill is wrong,

- (a) Explain why.

.....  
.....

(1)

- (b) Work out Hajra's weekly pay last year.

£.....

(2)

(Total 3 marks)

11. This item appeared in a newspaper.

**Cows produce 3% more milk**

A farmer found that when his cow listened to classical music the milk it produced increased by 3%.

This increase of 3% represented 0.72 litres of milk.

Calculate the amount of milk produced by the cow when it listened to classical music.

..... litres  
(Total 3 marks)

12. The price of all rail season tickets to London increased by 4%.

- (a) The price of a rail season ticket from Cambridge to London increased by £121.60  
Work out the price before this increase.

£ ..... (2)

- (b) After the increase, the price of a rail season ticket from Brighton to London was £2828.80  
Work out the price before this increase.

£ .....

(3)

(Total 5 marks)

13. Gwen bought a new car.  
Each year, the value of her car depreciated by 9%.

Calculate the number of years after which the value of her car was 47% of its value when new.

.....

(Total 3 marks)

14. In a sale, normal prices are reduced by 25%.  
The sale price of a saw is £12.75

Calculate the normal price of the saw.

£ .....  
(Total 3 marks)

15. The value of a car depreciates by 35% each year.  
At the end of 2007 the value of the car was £5460  
Work out the value of the car at the end of 2006

£ .....  
(Total 3 marks)

16. Toby invested £4500 for 2 years in a savings account.  
He was paid 4% per annum compound interest.

(a) How much did Toby have in his savings account after 2 years?

£ .....

(3)

Jaspir invested £2400 for  $n$  years in a savings account.  
He was paid 7.5% per annum compound interest.

At the end of the  $n$  years he had £3445.51 in the savings account.

(b) Work out the value of  $n$ .

.....

(2)

(Total 5 marks)

17. In a sale, normal prices are reduced by 12%.  
The sale price of a DVD player is £242.

Work out the normal price of the DVD player.

£ .....  
(Total 3 marks)

18. A garage sells cars.  
It offers a discount of 20% off the normal price for cash.

Dave pays £5200 cash for a car.

Calculate the normal price of the car.

£ .....  
(Total 3 marks)



19. In a sale, normal prices are reduced by 15%.  
The sale price of a CD player is £102

Work out the normal price of the CD player.

£.....  
(Total 3 marks)

20. Mario invests £2000 for 3 years at 5% per annum **compound** interest.

Calculate the value of the investment at the end of 3 years.

£.....  
(Total 3 marks)

21. Toby invested £4500 for 2 years in a savings account.  
He was paid 4% per annum compound interest.

How much did Toby have in his savings account after 2 years?

£ .....  
(Total 3 marks)

01. (a)  $150 < C \leq 200$  2

M1 use of cum freq to find the cost of the 20<sup>th</sup> or 20.5<sup>th</sup> car

OR  $\frac{1}{2} \Sigma f$  or  $\frac{1}{2} (\Sigma f + 1)$ <sup>th</sup> car

A1 eg 150 to 200, 150 – 200

(b) No, because the 21<sup>st</sup> value is in the same interval 1

*B1 20.5<sup>th</sup> or 21<sup>st</sup> value in same interval consistent with 'a'*  
*OR*

*Refers to the median value being low in the interval*  
*(statement to be mathematically correct)*

(c) 6500 3

$$80\% = 5200$$

$$\frac{5200}{80} \times 100$$

*MI for (100 - 20) % = 5200*

*MI for  $\frac{5200}{"80"} \times 100$*

*Al cao*

[6]

02. 650 3

$$80\% = 520$$

$$\frac{520}{80} \times 100$$

*MI for (100 - 20)% = 520*

*MI Dep for  $\frac{520}{"80"} \times 100$*

*Al cao*

[3]

03. 4 2

$$5469.78 \div 1.05 \div 1.05 \div 1.05 \dots$$

$$\text{or } 4500 \times 1.05 \times 1.05 \dots$$

*MI for  $5469.78 \div 1.05$  or  $4500 \times 1.05$  or 4725 seen.*

*Al cao*

[2]

04. (a) 182, 178, 180, 184 2  
*M1 mean of any three consecutive months, eg  $(147 + 161 + 238) \div 3$  oe*  
*A1 cao*
- (b) Sale price = 80% 2  
 Fun Friday price = 70% of 80% = 56% (oe)  
*B1 B1 for a fully correct explanation involving a worked example (oe)*  
*B1 a partially complete explanation*
- [4]**
05. (a) £5062.50 3  
 $\pounds 12000 \times 0.25 = \pounds 3000$ ;  $\pounds 12000 - \pounds 3000 = \pounds 9000$   
 $\pounds 9000 \times 0.25 = \pounds 2250$ ;  $\pounds 9000 - \pounds 2250 = \pounds 6750$   
 $\pounds 6750 \times 0.25 = \pounds 1687.50$ ;  $\pounds 6750 - \pounds 1687.50 =$   
*M1 for  $12000 \times 0.75 (= 9000)$  oe or  $\pounds 3000$  or  $\pounds 23437.50$  seen*  
*M1 (dep) for at least two further depreciation calculations*  
*(complete steps)*  
*A1 cao*  
**OR** *M2 for  $12000 \times (0.75)^3$  or 5062.50 seen*  
*(M1 for  $12000 \times (0.75)^n$ ,  $n = 2$  or 4)*
- (b) 0.4096 2  
 $0.8 \times 0.8 \times 0.8 \times 0.8$  (oe)  
*M1  $0.8^4$  (oe)*  
*A1 cao*
- [5]**
06. 275 3  
 $80\% = 220$   
 $220 \div 80 \times 100$   
*M1 for recognising that 80% is equivalent to 220*  
*M1 for  $220 \div 80 \times 100$  oe*  
*A1 cao*
- [3]**
07. (a) 4.5 1  
*B1 cao*

(b) 1205.86 2

$$500 \times 1.045^{20} = 1205.857\dots\dots$$

*MI for  $500 \times 1.045^{20}$*

*A1 for 1205.85 – 1206*

*(SC: B1 for 705.85 – 706 no working)*

[3]

08. (a) Reason 1

*B1 Reason eg fall is less than 100%*

(b)  $0.8^2 = 0.64$  2  
 $(100\% - 20\%)^2$

*B1 sight of 0.8*

*B1 cao*

[3]

09. (a) Increase =  $708 - 620 (=88)$  4  
 % increase =  $\frac{88}{620} \times 100$   
 = 14.1935...  
 14 or 14.2 or 14.19

*MI for  $708 - 620 (=88)$*

*MI for  $\frac{88}{620} \times 100$*

*OR*

*MI for  $\frac{708}{620} \times 100$*

*MI for '114.19(3...)' – 100*

*A2 for 14 or 14.2 or 14.19*

*(A1 for unrounded or truncated answer)*

*(SC if A0 award B1 for an answer rounded or given to*

*2dp,*

*1dp, 2sf or nearest whole number)*

(b)  $\frac{129.86}{100 - 14} \times 100 = \frac{12986}{86}$  3  
 151

*MI for recognizing that  $(100 - 14)\%$  is equivalent to 129.86*

*MI (dep.) for  $\frac{129.86}{100 - 14} \times 100$  oe*

*A1 cao*

(c)  $\frac{19 + 20 + 15}{3}$   
18

2

*MI for adding three consecutive numbers and dividing by 3*  
*AI cao*

**[9]**

10. (a) He has taken it from this year instead of last year 1  
*B1 Reason or appropriate calculation*

(b)  $\frac{240}{1.2}$   
200

2

*MI  $\frac{240}{1.2}$  oe*  
*AI cao*

**[3]**

11. 3% = 0.72  
1% = 0.24  
100% = 24  
103% = 24.72  
24.72
- 3
- MI for 3% = 0.72 or 0.03x = 0.72*  
*MI for 1% = 0.24 oe or 24 or 0.72  $\times$  33.3 or  $\frac{0.72}{3} \times 103$*   
*AI for 24.72*  
*SC B2 for 24 seen*

**[3]**

12. (a)  $121.6(0) \times \frac{100}{4}$   
= 3040

2

*MI for  $121.6(0) \times \frac{100}{4}$*   
*AI cao*

(b) 1.04 oe seen 3  
 $2828.8 \div 1.04$   
 $= 2720$

*B1 for 1.04 oe seen*  
*M1 for  $2828.8 \div 1.04$  oe*  
*A1 for 2720*

[5]

13. eg  $0.91^8 = 0.4702\dots$  3  
 $= 8$

*B1 for 0.91 seen oe*  
*M1 for  $0.91^2$  (0.8281) or higher power evaluated*  
*A1 for 8 – 8.01*

[3]

14.  $(100\% - 25\%) \times \text{Normal}$  3  
 Price = £ 12.75  
 Normal Price = £  $12.75 \div 0.75$   
 $= £17$

*M1  $(100\% - 25\%) \times \text{Normal Price} = £12.75$  or 0.75 or 75% seen*

*4 M1  $£12.75 \div 0.75$  or  $£12.75 \times \frac{4}{3}$  oe*

*A1 cao*

*Alternative:*

*M1 25% is £4.25 or  $£12.75 \div 3$  (= £4.25)*

*M1 (dep)  $£12.75 + "£4.25"$  oe*

*A1 cao*

[3]

15. 65% of orig value = £5460

$$1\% \text{ of orig value} = \frac{£5460}{65}$$

$$\text{Orig value} = \frac{£5460}{65} \times 100$$

£8400

3

*M1 65% (of orig value) = £5460 or (100% – 35%) × orig price  
= 5460 or 0.65 or 65% seen*

$$M1 \frac{£5460}{65} \times 100 \text{ or } \frac{5460}{0.65}$$

*A1 £8400*

[3]

16. (a)  $4500 \times 1.04^2$   
4867.20

3

*M1 for 4500 × 1.04 or for 4500 + 0.04 × 4500 or for 4680 or 180 or 360 or 4860*

*M1 (dep) '4680' × 1.04 or for '4680' + 0.04 × '4680'*

*A1 for 4867.2(0) cao*

*(If correct answer seen then ignore any extra years)*

**Alternative method**

*M2 for 2 4500 × 1.04<sup>2</sup> or 4500 × 1.04<sup>3</sup>*

*A1 for 4867.2(0) cao*

*[SC: 367.2(0) seen B2]*

(b)  $2400 \times 1.075^n$   
2580  
2773.5  
2981.5125  
3205.12...  
3445.51...  
5

2

*M1 for an attempt to evaluate  $2400 \times 1.075^n$  for at least one value of  $n$  (not equal to 1) or  $3445.51 \div 1.075^n$  ( $n \geq 2$ )*

*or  $\frac{3445.51}{2400}$  (= 1.4356...) and  $1.075^n$  evaluated,  $n \geq 2$*

*A1 for 5 cao*

[5]

17. 275

3

$$\frac{242}{0.88}$$

$$M2 \text{ for } \frac{242}{(100 - 12)} \times 100 \text{ oe}$$

$$[M1 \text{ for } \frac{242}{(100 - 12)} \text{ oe}]$$

*Al cao*

[3]

18. 6500

3

$$80\% = 5200$$

$$5200 \div 80 \times 100$$

$$M1 \text{ for } 100 - 20\% = 5200$$

$$M1 \text{ for } 5200 \div "80" \times 100$$

*Al cao*

[3]

19.  $102 \div 0.85$   
120

3

$$M1 \text{ for } 85\% = 102 \text{ oe}$$

$$M1 \text{ for } \frac{102}{0.85} \text{ or } \frac{102}{85} \times 100 \text{ oe}$$

*Al cao*

[3]

20. 2315.25

3

$$M1 \text{ } 2000 \times \frac{5}{100} \text{ or } 2000 \times 1.05 \text{ or } 2100 \text{ seen or } 100 \text{ (clearly}$$

*the interest) seen*

*M1 for a complete compound interest method shown*

*Al cao*

*[SC: B1 for 2300 or 300 seen with or without working]*

[3]



21.  $4500 \times 1.04^2$   
4867.20

3

*M1 for  $4500 \times 1.04$  or for  $4500 + 0.04 \times 4500$  or for 4680 or 180 or 360 or 4860*

*M1 (dep) '4680'  $\times 1.04$  or for '4680'  $+ 0.04 \times$  '4680'*

*A1 for 4867.2(0) cao*

*(If correct answer seen then ignore any extra years)*

**Alternative method**

*M2 for  $4500 \times 1.04^2$  or  $4500 \times 1.04^3$*

*A1 for 4867.2(0) cao*

*[SC: 367.2(0) seen B2]*

**[3]****01. Paper 4**

The correct class interval was often given in part (a), but some candidates chose the interval containing the number 20 (or 20.5), i. e.  $0 < C \leq 50$ . Various incorrect methods were used. Some candidates wrote down  $40 \div 5 = 8$  and gave the interval  $0 < C \leq 50$  and a few attempted to calculate an estimate of the mean and used this to write down the class interval. Part (b) was completed poorly. Most of those who gained a mark did so for explaining that £1000 was too large to be included in the table rather than for identifying the position of the median as being near the bottom of the class interval. Candidates usually gained either three marks or no marks in part (c). A pleasing number gave the correct answer of £6500 but many obtained an answer of £6240 by finding 120% of £5200.

**Paper 6**

Competent candidates did part (a) well, by finding the location of the 20<sup>th</sup> or interpolating between the 20<sup>th</sup> and 21<sup>st</sup> values. Part (b) proved to be more difficult as candidates had to give a clear explanation for their answer. The most successful ones were those who referred to the 20.5<sup>th</sup> or 21<sup>st</sup> values, but other candidates gained the mark by commenting that the old median was at the start of the interval so the class interval would not change.

Part (c) was a standard reverse percentage, which many candidates recognised. However, many did not and gave the answer as £6240.

02. Many candidates did not know how to tackle the reverse percentage problem and '£624', obtained by finding 20% of £520 and adding it to £520, was a common answer.
03. Most candidates attempted simple interest methods, rather than compound interest. Many preferred to work out the four consecutive years rather than in one step. Many gave the correct answer of 4 years.

**04. Mathematics A****Paper 4**

Very few candidates gave the impression of ever having studied this topic; many failed to attempt it. Some worked out the mean of all 6 months, whilst a common error failed to use their calculators correctly and pressed  $\div$  before totalling. In part (b) many candidates failed to give an answer that was little more than a re-statement of the question. There were, however, some good attempts at explaining the situation. The most successful candidates were those who included a numerical example of the difference.

**Paper 6**

Success was very much centre specific for part (a) with many candidates opting to find the mean of all six values or the means of the first 3 and the last 3.

Most candidates could give a partial answer for part (b) by essentially repeating the stem of the question. The more successful candidates used a combination of multipliers ( $0.8 \times 0.7 = 0.56$ ) or gave a specific example (usually based on a multiple of £10)

**Mathematics B Paper 17**

Understanding of moving averages was centre dependant; many candidates finding the mean of all 6 months in an effort to salvage something from the lack of coverage of this topic.  $147 + 161 + 238/3 = 387$  etc was a common error, showing knowledge of the topic but misuse of the calculator.

In part (b) many candidates clearly understood the problem but found difficulty in verbalising their explanation; those who chose to illustrate their reasoning with an example usually succeeded.

A number of candidates merely tried to re-write the question and those misunderstanding the problem usually based their argument on Fun Friday having an extra 10% reduction only.

**05. Mathematics A****Paper 4**

There was a great variation across centres. A significant number treated this as a simple interest question, as evidenced by many answers of £3000 or £9000. As with previous numerical questions, there were many instances this year of candidates attempting this question using non-calculator methods. It is also disappointing that many candidates wrote their answers without consideration to money notation: missing off the trailing zero. This even applied to many of the brightest candidates. Part (b) was rarely attempted. Frequently 0.8 or 0.2 were seen on the answer line, earning no marks.

**Paper 6**

Part (a) was successfully answered – either by taking of successive 25% or (less commonly) by using the formula. Very few candidates thought that £3000 had to be taken off each year. Part (b) was less successfully done with many answers of 0.2 or  $0.2^4$ .

**Mathematics B Paper 17**

The majority of candidates were able to accurately calculate 25% of £12000 and use this value appropriately to find the value after one year. Many continued to subtract £3000 for each subsequent year, although many candidates did proceed to compute a correct final value.

Part (b) was poorly done with only a small minority quoting  $0.8^4$  and even less evaluating this.

**06. Specification A****Higher Tier**

Candidates almost always fell into one of two groups. Those who recognised the question as a reverse percentage using 80% and those who did not, generally using 120%. Thus the answers £275 (full marks) and £264 (no marks) dominated. One or two candidates completely misinterpreted the question and subtracted £44 to get 176.

**Intermediate Tier**

Almost one quarter of the candidates successfully calculated the normal price of the saddle but the majority failed to recognise that £220 represented 80% of the original price. The most common approach was to work out 20% of £220 and add it on, leading to an answer of £264. Even some of those who wrote  $£220 = 80\%$  then proceeded to work out 120% of £220.

**Specification B**

The answer of £264 (120% of £220) was the most common answer from the majority of candidates. Some found 20% of £220 and then subtracted to give £176. Those that recognised that  $£220 = 80\%$  usually went on to gain full marks.

**07. Specification A**

Many candidates did not appear to be aware of the compound interest formula and so were unable to give the correct answer for part (a). Very common answers were 1.045 and 0.045. Part (b) was generally correctly answered as most candidates were able to use the  $y^x$  button on the calculator.

**Specification B**

The most common answer to part (a) was 1.045 with few candidates realising that this represented an increase of 4.5%. 45 and 0.45 were other commonly occurring incorrect answers. About 75% of candidates were able to score full marks in part (b). The common errors came from either an incorrect order of evaluation or incorrect use of a calculator.

**08. Intermediate Tier**

It was encouraging that so many candidates were able to give a sensible detailed reason as to why Bill was wrong. By comparison part (b) was rarely answered correctly, with many making reference to 0.2 rather than 0.8

**Higher Tier**

There were many lucid answers to part (a). Most pointed out that Bill was wrong because the amount being reduced by 20% reduced after each year. Some candidates gave an example to show what could happen, usually starting with a value of £100 or £1000. Part (b) was less successfully answered. There was some confusion over what is meant by a single number as many candidates interpreted this as what single digit is required. Many good candidates did write down 0 and most of them went on to find 0.64 rather than 0.16.

**09. Intermediate Tier**

It was surprising that part (a) caused as many problems as it did. Most candidates worked out the increase as 88 but the majority could not then calculate the percentage increase. Some calculated 88 as a percentage of 708 or 1328 while others calculated 620 as a percentage of 708. Many simply wrote 88% as the answer.

Candidates always tend to struggle with reverse percentage questions and this one, in part (b), was no exception. Only candidates who realised that £129.86 was 86% of the normal price were successful. Most worked out 14% of £129.86 and added it on.

In part (c) more than 60% of candidates calculated an average of three consecutive numbers but only one quarter of these worked out the second three-month moving average. The most common answer was 27, from using the last three months

**Higher Tier**

In (a), about equal numbers of candidates chose to calculate either  $\frac{88}{620} \times 100$  or

$\frac{708}{620} \times 100 - 100$  and virtually all of these were able to give their answer to an appropriate

degree of accuracy. Some of the weaker candidates knew that they needed to calculate 88, but were then unsure as to how proceed, 88% or 0.88% were common answers. There were a worrying number of candidates who attempted to do this question by trial and improvement.

In part (b), candidates either knew how to do the calculation or they didn't. Calculating a 14% reduction (or increase) in the cost was a common misunderstanding. Again there were many attempts to do this by trial and improvement.

Part (c) was done quite well by the majority of the candidates, but there were many, including some of the most able, who thought the second 3-point moving average was derived from the values 15, 27 and 39, thus demonstrating a lack of understanding in the way these averages overlap.

**10. Intermediate Tier**

In part (a) responses rarely gave an appropriate explanation. The most successful answers were ones which made a reference to last year's pay, or those that disproved the £192. Generally if candidates earned the mark in part (a) they understood the process, and were able to apply it to part (b) to calculate the correct amount. There are very few candidates who can successfully recognise or calculate reverse percentages.

**Higher Tier**

In part (a), many candidates had difficulty trying to explain why Bill was wrong. A popular approach was to show what Bill had done rather than explain why he was wrong. Attempts based on calculations had to be complete and not the calculation required in part (b). Explanations had to describe the mistake and say what should have been done. Mistakes in explanation were often based on confusion in the words “of” and “off”. The distinction between “20% of 240” and “20% off 240” was not always apparent in written explanations. Part (b) was done well by many candidates. Mistakes were often due to incorrect division by 1.2 rather than the choice of method. A small number of candidates thought this was a trick question and said that Bill was right.

**11. Intermediate Tier**

Many candidates had difficulty with this question and it was answered poorly. There was a general lack of appreciation that 0.72 represented 3% and common errors were to find 3% of 0.72 or to multiply 0.72 by 3. Most of those who realised  $0.72 = 3\%$  went on to work out 100% as 24. Many, though, forgot to add on 0.72 and it was more common for candidates to give 24, rather than 24.72, as the final answer.

**Higher Tier**

A slightly unusual percentage question! The main successful approach was to equate 3% with 0.72 litres and then go to 100% by dividing by 3 and then multiplying by 100. Since the question asked for the new production, the candidate had to remember to add on the 0.72 to get the final mark. Of course, this meant that many candidates gained 2 out of the three marks, because they forgot to add on the last 0.72. Better candidates went straight to converting  $3\% =$  to 103% equals.

12. Part (a) proved to be as demanding as part (b) for many candidates, despite being apparently at a lower national curriculum level. There was a deal of confusion on whether to use 4% (the correct response), 104% (treating it as a reverse percentage problem) or 96% (again treating it as a reverse percentage problem but with a decrease in fare. Many candidates recognised that part (b) was the reverse percentage problem and were able to carry out the calculations efficiently.
13. This is a depreciation question where candidates really ought to understand the appropriate formula of  $\left(1 - \frac{r}{100}\right)^n$  or at least be able to successively multiply by  $\left(1 - \frac{r}{100}\right)$ . Those that did usually got the correct answer of 8 (9 was also accepted on the grounds of the wording of the question). A few did painstakingly subtract off 9% of the previous year’s value until they got to 47% of their initial value. Far too many just took off lots of 9%

**14. Higher Tier**

Candidates who understood the problem generally found £17 from equating £12.75 to 75%, finding 1% and then 100%. Some candidates spotted that they could find 25% as the intermediate stage and then multiply by 4, or the equivalent.

However, there were still far too many candidates who worked out 25% of £12.75 and added it on.

**Intermediate Tier**

Reverse percentage problems is a major weakness and this question was no exception. Some identified 75% as an aspect to be considered, but many found 25% of £12.75 and added it on.

15. This was generally poorly done with the correct answer given by only 13% of candidates. Most methods involved adding or subtracting 35% of £5460. Some candidates showed 65% or 0.65 but then went on to use it incorrectly.

16. In part (a) there was the expected mix of results between those calculating compound and simple interest. Most people were able to pick up at least one mark for 180, 4860 or 4680. Many opted for correct methods other than the efficient multiplying by 1.04 or  $1.04^2$ , eg by finding 4% and then adding to find the principal amount for the calculation for the next year. There was a significant number of students who seemed to rely on non-calculator techniques, breaking the problem down to 5% and 1% and then 4%. Many of these attempts ended in numerical errors.

In part (b) the best answers used a “trial & improvement” approach using  $(1.075)^n$  showing repeated multiplications of 2400 by 1.075 to find the answer and slightly fewer repeatedly divided 3445.51 by 1.075. There were a surprising number of lengthy methods involving multiplication and addition each year - often correct but for premature rounding. Candidates using this method sometimes miscounted the number of repetitions they had done and gave 4 or 6 as the answer. The two main errors were dividing  $(3445.51 - 2400)$  by £180 or subtracting 7.5% of 3445.51 and working backwards. This question was surprisingly well done even to the extent that a few candidates were able to use logs to solve  $1.075^n = 1.4356$ .

17. Very poorly answered. The most common incorrect answer came from  $1.12 \times 242$ .

**18. Paper 17**

This question was poorly done, the majority of candidates electing to find 120% of £5200, giving an answer of £6240. Candidates usually gained no or full marks in this question.

**Paper 19**

Candidates generally gained either full marks or no marks for this question. Those candidates who correctly recognised that £5200 represented 80% of the original amount generally proceeded to reach the correct answer. The answer of £6240, which arises from increasing £5200 by 20%, was very frequently seen as an incorrect answer.

- 19.** The most common answer given was £117.30. This came from candidates who used an incorrect method and increased £102 by 15%. The correct solution was seen from approximately 45% of candidates. A number of candidates worked through the question using 75% rather than 85%. Candidates should be reminded to show all their working including the initial subtraction in questions of this nature. Some candidates wrote  $85\% = £102$  but then still went on to increase £102 by 15%.
- 20.** Although a significant number of candidates gained full marks in this question, the vast majority scored one mark only for treating this as a simple interest problem. Of those candidates who showed understanding of the concept of compound interest it was pleasing to see direct methods ( $2000 \times 1.05^3$ ) being employed. A number of candidates just gave £315.25, the compound interest accrued, as their answer. This gained full marks if the value of the investment at the end of 3 years had previously been shown in their working. A few candidates employed depreciation methods instead of interest. Some of these used a correct depreciation method, whilst others took away  $3 \times £100$ , indicating a misunderstanding of the term ‘interest’.
- 21.** There were 2 successful approaches evident in this question. One was the year by year method where the candidate finds 4% of the principal and adds it on to £4500 for the value of the investment (£4680) at the end of the first year. For the second year, 4% of this value is added on to £4680 to get the value of the investment at the end of the second year. This was the approach of many candidates. Also seen was the more direct use of the multiplier  $1.04^2$  to get the answer in one line.
- Candidates who doubled the first year’s interest and added it on to get £4860 got 1 mark. Many candidates wrote the final answer as £4867.2 instead of the correct £4867.20.