1 The length of the Jinghu high speed railway from Beijing to Shanghai is 1318 km.

(a) A train travels at an average speed of 252 km/h.
This train leaves Beijing at 12 49.
The local time in Beijing is the same as the local time in Shanghai.

Find the time, correct to the nearest minute, that this train arrives in Shanghai.

.... [4]

(b) On the journey this train passes over a bridge of length 6772 m at 252 km/h.
The train is 401 m long.

(i) Change 252 kilometres per hour to metres per second.

.... m/s [2]

(ii) Calculate the time, in seconds, for the train to completely cross the bridge.

.... s [2]

MARKSCHEME:

(a)	18 03	**4**	**M1** for 1318 ÷ 252 **A1** for 5.23 or 5.230... **M1** for converting *their* time in hours to hours and minutes
(b)(i)	70	**2**	**M1** for $252 \times \dfrac{1000}{60 \times 60}$ oe
(b)(ii)	102 s or 102.4 to 102.5	**2**	**FT** 7173 ÷ *their* 70 **M1** for (6772 + 401) ÷ *their* 70

2 **(a)** In a school there are 225 girls and 190 boys.

(i) Work out the number of boys as a fraction of the total number of students.
Give your answer in its lowest terms.

.... [2]

(ii) Write the ratio   number of girls : number of boys in its simplest form.

.... [2]

(b) In a mathematics class there are 15 boys.
The ratio   number of girls : number of boys = 6 : 5.

Find the number of girls in this class.

.... [2]

(c) In a science class of 33 students there are 15 boys.

(i) Find the number of boys as a percentage of the number of students in the class.

.... % [1]

(ii) 20% of these boys did not complete an experiment.

Work out the number of boys who did not complete the experiment.

.... [2]

(d) This year the number of students studying mathematics is 390.
This is an increase of 4% on the number of students who studied mathematics last year.

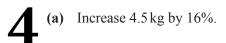Work out the number of students who studied mathematics last year.

.... [3]

MARKSCHEME:

(a)(i)	$\frac{38}{83}$ cao	**2**	**M1** for $\frac{190}{225+190}$ implied by correct unsimplified fraction	
(a)(ii)	45 : 38 final answer	**2**	**M1** for 225 : 190 oe If 0 scored **SC1** for 38 : 45 final answer	
(b)	18	**2**	**M1** for 15 ÷ 5 soi by [1 part =] 3	
(c)(i)	45.5 or 45.45…	**1**		
(c)(ii)	3	**2**	**M1** for $\frac{20}{100} \times 15$ oe	
(d)	375 nfww	**3**	**M2** for $390 \div \left(1+\frac{4}{100}\right)$ oe or **M1** for recognising 390 as 104%	

3 **(a)** The population of a small town is decreasing at a rate of 5% every 10 years.
The population is now 26 010.

Calculate the population in 20 years time.
Give your answer correct to the nearest 100.

.... [3]

(b) The population was previously **increasing** at a rate of 2% each year.
The population is now 26 010.

(i) Calculate the population 2 years ago.

.... [2]

(ii) Find the number of complete years since the population was last less than 20 000.

.... [4]

MARKSCHEME:

(a)	23 500	3	**B2** for 23 470 or 23 474. … or **M1** for $26\,010 \times \left(1 - \dfrac{5}{100}\right)^2$ oe If 0 scored, **SC1** for 9300 or 9320 or 9324 or for *their* seen answer rounded to the nearest 100
(b)(i)	25 000 cao nfww	2	**M1** for $26\,010 \div \left(1 + \dfrac{2}{100}\right)^2$
(b)(ii)	14 nfww	4	**M3** for $n\log(1.02) = \log\left(\dfrac{26010}{20000}\right)$ soi by 13 or 13.3 or 13.26 to 13.27 or for trial and improvement reaching $n = 13$ and 14 or **M2** for $(1.02)^n = \dfrac{26010}{20000}$ oe or for trial and improvement at least 3 times or **M1** for $26010 = 20000(1.02)^n$ oe

4 **(a)** Increase 4.5 kg by 16%.

.... kg [2]

(b) Find the percentage profit when the cost price of a book is $8.50 and the selling price is $11.05 .

....% [3]

(c) The price of a loaf of bread increases by $0.06 .
This is a 5% increase.

Find the original price of this loaf of bread.

$.. [2]

MARKSCHEME:

(a)	5.22		2	**M1** for $4.5 \times \dfrac{16}{100}$ or better If 0 scored **SC1** for figs 522
(b)	30		3	**M2** for $\dfrac{11.05 - 8.5}{8.5}[\times 100]$ or $\dfrac{11.05}{8.5} \times 100$ or **M1** for $\dfrac{11.05}{8.5}[\times 100]$
(c)	1.2[0]		2	**M1** for $\dfrac{0.06}{5} \times 100$

5

Each year the value of a motor bike **decreases** by 10% of its value at the start of the year.
At the start of 2019, the value of the motor bike was $2025.

(a) Find the value at the end of 4 years.
Give your answer correct to the nearest dollar.

$.. [4]

(b) Find the value at the start of 2017.

$.. [2]

(c) Find the number of complete years it takes for the value of $2025 to decrease to a value less than $500.

.... [4]

(d) (i) A car travels $50\,\text{km}$ at $x\,\text{km/h}$ and then $80\,\text{km}$ at $(x+10)\,\text{km/h}$.

Find an expression, in terms of x, for the total time taken, T hours.
Give your answer as a single fraction, in its simplest form.

$T =$ .... h [3]

(ii) When $T = 2$, show that $x^2 - 55x - 250 = 0$.

[2]

(iii) When $T = 2$, find the value of x.

$x =$ .... [3]

MARKSCHEME:

(a)	1329	4	**B3** for 1328.6 ... or 1330 or **M2** for 2025×0.9^4 oe or **M1** for 2025×0.9^k, $k > 1$ oe
(b)	2500	2	**M1** for $2025 \div 0.9^2$ oe
(c)	14	4	**B3** for 13.3 or 13.27 to 13.28 seen or **M3** for $n \log 0.9 = \log \dfrac{500}{2025}$ oe implied by or for correct trials reaching 13 and 14 or good sketch indicating value between 13 and 14 or **M2** for $0.9^n = \dfrac{500}{2025}$ oe or at least three correct trials with $n > 4$ or sketch that could lead to the solution or **M1** for $2025 \times 0.9^n = 500$ oe or at least two correct trials with $n > 4$ If 0 scored, **SC1** for answer 16 or for 15.3 or 15.27 to 15.28 seen

6 Alana and Bill share some money in the ratio 5 : 4.
Alana's share is $160.

(a) Show that Bill's share is $128.

[1]

(b) Alana spends \$$x$.
The ratio of Alana's money : Bill's money is now 4 : 5.

Find the value of x.

$x =$ .... [3]

(c) A shop has a sale.
Bill buys a jacket in the sale for $32.

   (i) Write $32 as a percentage of $128.

....% [1]

   (ii) The original price of the jacket was reduced by 20% to $32.

   Work out the original price.

$ .... [3]

MARKSCHEME:

(a)	$160 \times \dfrac{4}{5}$ oe	1	
(b)	57.60	3	**M2** for $128 \times \dfrac{4}{5}$ or $\dfrac{160-x}{128} = \dfrac{4}{5}$ or **M1** for $\dfrac{128}{5}$ or $\dfrac{160-x}{4}$ or $160-x : 128 = 4:5$
(c)(i)	25	1	
(c)(ii)	40	3	**M2** for $32 \times \dfrac{100}{80}$ oe or **M1** equating 32 to 80%

7 **(a)** Aisha invests $12 000 at a compound interest rate of 3.5% per year.

Calculate the value of her investment at the end of 4 years.

$... [3]

(b) 2 years ago, Byron invested $P at a compound interest rate of 3% per year.
The value of his investment is now $10 078.55 .

Calculate the value of P.

P = ... [3]

(c) 5 years ago Cheng invested $Q at a **simple** interest rate of 4% per year.
The value of his investment is now $20 400.

Calculate the value of Q.

Q = ... [3]

MARKSCHEME:

(a)	13 770.28	**3**	**M2** for $12\,000 \times \left(1 + \dfrac{3.5}{100}\right)^4$ oe or **M1** for $12\,000 \times \left(1 + \dfrac{3.5}{100}\right)^k$, $k > 1$ oe
(b)	9500	**3**	**M2** for $10\,078.55 \div \left(1 + \dfrac{3}{100}\right)^2$ oe or **M1** for $10\,078.55 \div \left(1 + \dfrac{3}{100}\right)^n$ oe
(c)	17 000	**3**	**M2** for $Q + \dfrac{Q \times 4 \times 5}{100} = 20\,400$ oe or **M1** for $\dfrac{Q \times 4 \times 5}{100}$ oe soi by e.g. $0.2Q$ If 0 scored, **SC1** for 16 800 or 16 760 to 16 770

7 **(a)** Simplify.

    (i) $\dfrac{a^5 \times a^4}{a^3}$

                                                 .... [2]

    (ii) $\log_5(5^x)$

                                                 .... [1]

    (iii) $\log_9(3^x)$

                                                 .... [1]

(b) Solve.

$$3 \log 10 - 2 \log 5 = \log x$$

                                  $x = $ .... [2]

MARKSCHEME:

(a)(i)	a^6 final answer	**2**	**B1** for a^9 or $a^2 \times a^4$ or $a^5 \times a$[1]	
(a)(ii)	x	**1**		
(a)(iii)	$\dfrac{1}{2}x$ oe	**1**		
(b)	40	**2**	**M1** for one correct use of $a\log b = \log b^a$ or for correct use of $\log a - \log b = \log(a \div b)$	