NUMBERS-SET-2-QP-MS

1 **(a)** Karl invests $200 at a rate of 1.5% per year simple interest.

Calculate the value of Karl's investment at the end of 8 years.

$ ..... [3]

(b) Lena invests $200 at a rate of 1.4% per year compound interest.

Calculate the value of Lena's investment at the end of 8 years.

$ ..... [3]

(c) The rates of interest remain the same as in **part (a)** and **part (b)**.

Find how many **more** complete years it will take for the value of Lena's investment to be greater than the value of Karl's investment.

..... [2]

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MARKSCHEME:

(a)	224	**3**	**M2** for $200+\frac{200\times1.5\times8}{100}$ oe or **M1** for $\frac{200\times1.5\times8}{100}$ oe implied by 24
(b)	223.53	**3**	**M2** for $200\times\left(1+\frac{1.4}{100}\right)^{8}$ oe **M1** for $200\times\left(1+\frac{1.4}{100}\right)^{k}$ oe k integer >1 If 0 scored, **SC1** for 23.5 or 23.52 to 23.53
(c)	3 nfww cao	**2**	**M1** for trials with 1.5% **and** 1.4% beyond *their* 224 **and** *their* 223.53 respectively, implied by 11, or appropriate equation or graph sketch implied by 10.79..., 2.79...

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2 **(a)** Sergio invests \$2000 at a rate of 3% per year compound interest.

(i) Find the value of his investment at the end of 5 years.

\$ ..... [3]

(ii) After how many complete years is the value of his investment greater than \$4000?

..... [3]

(b) Anna invests \$2000 at a rate of 0.24% per **month** compound interest.

Find the value of her investment at the end of 5 years.

\$ ..... [3]

(c) Calculate the **monthly** compound interest rate that is equal to a compound interest rate of 3% per year.

.....% [3]

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MARKSCHEME:

(a)(i)	2318.55	**3**	**M2** for $2000\times\left(1+\frac{3}{100}\right)^{5}$ or **M1** for $2000\times\left(1+\frac{3}{100}\right)^{k}$, $k>1$ If 0 scored, **SC1** for 318.5... or 319 or 320
(a)(ii)	24	**3**	**B2** for 23.4 or 23.44 to 23.45 or **M2** for $n=\frac{\log\left(\frac{4000}{2000}\right)}{\log 1.03}$ oe or **M1** for $2000\times 1.03^{n}=4000$ oe
(b)	2309.37	**3**	**M2** for $2000\times\left(1+\frac{0.24}{100}\right)^{60}$ or **M1** for $2000\times\left(1+\frac{0.24}{100}\right)^{k}$, $k>1$
(c)	0.247 or 0.2466…	**3**	**M2** for $\sqrt[12]{1+\frac{3}{100}}$ implied by 1.00246[6..] or **M1** for $x^{12}=1+\frac{3}{100}$ oe

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3 **(a)** Louis invests $500 at a rate of 2.5% per year simple interest.

Calculate the total amount of interest at the end of 8 years.

$ ..... [2]

(b) Martha invests $500 at a rate of 2.4% per year compound interest.

Calculate the total amount of interest at the end of 8 years.

$ ..... [4]

(c) Naomi invests an amount of money at a rate of 2.1% per year compound interest.

Find the number of complete years it takes for the value of Naomi's investment to double.

..... [4]

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(d) Oscar invests an amount of money at a rate of r% per year compound interest.
At the end of 31 years the value of Oscar's investment is 2.5 times greater than the original amount of money.

Find the value of r.

$r =$ ..... [3]

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MARKSCHEME:

(a)	100	**2**	**M1** for $\frac{500\times2.5\times8}{100}$ oe
(b)	104 or 104.4 to 104.5	**4**	**B3** for 604 or 604.4 to 604.5 or **M2** for $500\times\left(1+\frac{2.4}{100}\right)^{8}$ oe or **M1** for $500\times\left(1+\frac{2.4}{100}\right)^{n}$ with $n>1$ oe
(c)	34	**4**	**M3** for $[n=]\frac{\log 2}{\log(1.021)}$ oe or at least two trials with $n>30$ or graph leading to solution oe (implied by 33.4 or 33.35...) or **M2** for $1.021^{n}=2$ oe or suitable graph e.g. $y=1.021^{x}$ or 3 correct trials or **B1** for 1.021^{n} oe seen
(d)	3[.00] or 2.999...	**3**	**M2** for $\sqrt[31]{2.5}$ oe or sketch of graph leading to answer or **M1** for $(...)^{31}=2.5$ oe or sketch of a relevant graph

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4 Herman bought a motorbike on 1 January 2014.
By 1 January 2015 the value of the motorbike had reduced by 16%.
By 1 January 2016 the value of the motorbike had reduced by 12% of the value on 1 January 2015.
The value of the motorbike on 1 January 2016 was $7392.

(a) Find how much Herman paid for the motorbike.

$ ..... [3]

(b) From 2016, the value of the motorbike reduced by 8% each year.

Calculate the number of complete years it will take for the value of the motorbike to decrease from $7392 to $5000.

..... [4]

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MARKSCHEME:

(a)	10 000	**3**	**M2** for $\frac{7392}{(1-0.16)(1-0.12)}$ oe or **M1** for $\div(1-0.16)$ or $\div(1-0.12)$ oe or **M1** for 88% is 'equivalent' to 7392
(b)	5	**4**	**M3** for $[k=]\frac{\log\frac{5000}{7392}}{\log 0.92}$ oe or correct trials as far as 4 and 5 or **M2** for $0.92^k=\frac{5000}{7392}$ oe or at least 3 correct trials or **M1** for $7392\times0.92^k=5000$ oe

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5 **(a)** Riaz invests $5000 at a rate of 2.5% per year simple interest.

(i) Calculate the value of the investment at the end of 4 years.

$ ..... [3]

(ii) Calculate the number of complete years it will take for the value of the investment to be $6500.

..... [2]

(b) Yasmin invests $5000 at a rate of 2% per year compound interest.

(i) Calculate the value of Yasmin's investment at the end of 4 years.

$ ..... [3]

(ii) Calculate the number of complete years it will take for the value of Yasmin's investment to first be worth more than $6500.

..... [4]

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MARKSCHEME:

(a)(i)	5500	**3**	**M2** for $5000+\frac{5000\times2.5\times4}{100}$ oe or **M1** for $\frac{5000\times2.5\times4}{100}$ oe
(a)(i)	12	**2**	**M1** for $\frac{5000\times2.5\times n}{100}=6500-5000$ oe
(b)(i)	5412.16	**3**	**M2** for $5000\times\left(1+\frac{2}{100}\right)^4$ or **M1** for $5000\times\left(1+\frac{2}{100}\right)^n$, $n>1$
(b)(ii)	14	**4**	**M3** for $[n=]\ \frac{\log\left(\frac{6500}{5000}\right)}{\log 2}$ soi by 13.2 or 13.24 to 13.25 or answer 13 or correct trials as far as 13 and 14 or **M2** for $1.02^n=\left(\frac{6500}{5000}\right)$ or at least 3 correct trials or suitable graph or **M1** for $5000\times1.02^n=6500$ soi.

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6 The number of fish in a lake decreases by 4% each year.

In January 2018 there are 30 000 fish in the lake.

(a) Calculate the number of fish in the lake in

(i) January 2019,

..... [2]

(ii) January 2029,

..... [3]

(iii) January 2017.

..... [3]

(b) Find the last year in which there were at least 50 000 fish in the lake.

..... [4]

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(c) Philip runs a fishing business and he works 50 weeks every year.
In 2018, he catches 800 kg of fish in each of these weeks.
He sells all the fish he catches at a price of $3.50 for each kilogram.

(i) Calculate the total amount he receives in 2018.

$ ..... [3]

(ii) For each of the 50 weeks, Philip's business costs $2240 to run.

Calculate his profit as a percentage of $2240.

..... % [3]

(d) In 2019, Philip's business costs 8% more to run than in 2018.
The selling price of fish decreases by 10%.

Find the amount of fish, in kilograms, Philip will need to catch each week to keep the percentage profit found in **part (c)(ii)** the same.

..... kg [4]

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MARKSCHEME:

(a)(i)	28 800	**2**	**M1** for $30000 \times \frac{100-4}{100}$ oe

5(a)(ii)	19 147 or 19 100 nfww	**3**	**FT** *their* 0.96, must be <1 and not 0.04 **M2** for $30000 \times (\textit{their}\ 0.96)^{11}$ or $28800 \times (\textit{their}\ 0.96)^{10}$ or **M1** for $30000 \times (\textit{their} 0.96)^{k}$, $k > 1$ oe
5(a)(iii)	31 250	**3**	**M2** for $30000 \div \textit{their}(0.96)$ or **M1** for $30000 = \textit{their} 0.96[x]$
5(b)	2005 nfww	**4**	**M3** for $n\log(\textit{their} 0.96) = \log\frac{30000}{50000}$ oe or **M2** for $(\textit{their} 0.96)^{n} = 0.6$ oe or **M1** for $50000 \times (0.96)^{n} = 30000$ oe OR **M3** for T and I with '12 and13' seen or **M2** for at least 3 correct trials or **M1** for $50000 \times (0.96)^{n} = 30000$ oe
5(c)(i)	140 000	**3**	**M2** for $800 \times 50 \times 3.5$ or **M1** for multiplying any two
5(c)(ii)	25	**3**	**M2** for $\frac{\textit{their}(\mathbf{i}) - 2240 \times 50}{2240 \times 50}[\times 100]$ oe or $\frac{\textit{their}(\mathbf{i})}{2240 \times 50} \times 100$ oe or $\frac{800 \times 3.5 - 2240}{2240}[\times 100]$ oe or $\frac{800 \times 3.5}{2240} \times 100$ or **M1** for $\textit{their}(\mathbf{i}) - 2240 \times 50$ or $\frac{\textit{their}(\mathbf{i})}{2240 \times 50}$ or $800 \times 3.5 - 2240$ or $\frac{800 \times 3.5}{2240}$
5(d)	960	**4**	**M3** for $\frac{2240 \times 1.08 \times 1.25}{3.5 \times 0.9}$ oe or for $\frac{x \times 3.5 \times 0.9 - 2240 \times 1.08}{2240 \times 1.08} = \frac{\textit{their}(\mathbf{c})(\mathbf{ii})}{100}$ oe or **B1** for 3.15 or 157.50 and **B1** for 2419.2 or 120 960 or 3024

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Adila has $10 000.

7 **(a)** She uses some of the money to buy a car.
The salesman reduces the price from $3800 to $3610.

Calculate the percentage reduction.

.....% [3]

(b) Adila invests the remaining $6390 at a rate of 3% per year compound interest.

(i) Find the value of the investment at the end of 5 years.

$ ..... [3]

(ii) Find the least number of complete years after which the value of the investment is more than $9000.

..... [4]

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MARKSCHEME:

(a)	5%	**3**	**M2** for $\frac{3800-3610}{3800}$ [$\times$ 100] oe or $\frac{3610}{3800}\times 100$ or **M1** for $\frac{3610}{3800}$ oe
(b)(i)	7410 or 7407 to 7408	**3**	**M2** for $6390 \times (1+\frac{3}{100})^5$ oe or **M1** for $6390 \times (1+\frac{3}{100})^k$ oe, $k > 1$
(ii)	12 nfww	**4**	**M3** for $n\log 1.03 = \log\left(\frac{9000}{6390}\right)$ soi by 11.6 or 11.58... oe or correct trials as far as 11 and 12 oe or **M2** for $1.03^n = \frac{9000}{6390}$ or at least 3 correct trials with $n \geqslant 5$ or **M1** for $6390 \times 1.03^n = 9000$ soi.

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