Q1

1

For a repeated percentage increase of x% we can use a multiplier of m
After 5 years the £6000 has increased by x% each year to £8029.35, so we can write

$$6000 \times m^5 = 8029.35$$

[1]

Divide both sides by 6000

$$m^5 = 1.338225$$

Take the 5th root of both sides, you may have to press SHIFT + $\sqrt{\square}$ on your calculator

$$m = \sqrt[5]{1.338225} = 1.0599999...$$

[1]

This is equivalent to an increase of 5.999... %

x = 6% [1]

Q2

2

For a repeated percentage increase of x% we can use a multiplier of m
After 1 year the £12000 has increased by x% each year to £12336, so we can write

$$12000 \times m = 12336$$

[1]

Divide both sides by 12000

$$m = 1.028$$

This is equivalent to an increase of 2.8%

[1]

In the second year the rate is $\frac{x}{2}$%

The rate in the 2nd year is $2.8 \div 2 = 1.4\%$

Take the final amount at the end of year 1, and increase by 1.4% for year 2

$$12336 \times 1.014 = 12508.704$$

[1]

Round to nearest penny

£12 508.70 [1]

Q3

3a

We are looking for when the boat is less than 50% of its new value

$$0.5 \times 12500 = £6250$$

Substitute increasing values for n into the formula $12500 \times (0.85)^n$ until the value is below 6250

$$n=1: 12500 \times (0.85)^1 = 10625$$

$$n=2: 12500 \times (0.85)^2 = 9031.25$$

$$n=3: 12500 \times (0.85)^3 = 7676.5625$$

$$n=4: 12500 \times (0.85)^4 = 6525.078125$$

$$n=5: 12500 \times (0.85)^5 = 5546.316406$$

Method [1]

$$5546.32 < 6250$$

5 years [1]

3b

After paying 40% tax on the interest, Jack receives £79.20. This means that 60% of the interest is £79.20

$$60\% = £79.20$$

Divide both sides by 60

$$1\% = £1.32$$

Multiply both sides by 100

$$100\% = £132 \text{ interest}$$

[1]

We now know that he earned £132 interest on £5500 after 1 year
We can now work out what percentage of £5500, this interest represents

$$\frac{£132}{£5500} \times 100$$

[1]

$R = 2.4$ % [1]

Q4

4a

In the first year, 2.5% interest is earned on £2000

$$2000 \times 1.025 = £2050$$

[1]

x% is earned in year 2 and 3 (compound interest), and there is a total of £2124.46 at the end of the 3rd year
An increase of x% can be represented by a multiplier m

$$2050 \times m^2 = 2124.46$$

[1]

Divide both sides by 2050

$$m^2 = 1.036321951$$

Square root both sides

$$m = 1.017998...$$

[1]

$$\text{This is equivalent to an increase of } 1.7998... \%$$

Round to 3 significant figures

1.80 % [1]

4b

There has been an increase by 12.5% to £225
So £225 represents 112.5% of the original price

$$£225 = 112.5\%$$

[1]

Divide both sides by 112.5

$$£2 = 1\%$$

[1]

Multiply both sides by 100

[1]

$$£200 = 100\%$$

£200 [1]

Q5

5

For the first year, 1.8% interest is applied

$$200\,000 \times 1.018 = 203\,600$$

[1]

x% is then applied for the 2nd and 3rd year, we can use a multiplier of m, which is applied twice (squared) to reach a value of 209 754 yen

$$203\,600 \times m^2 = 209\,754$$

Divide both sides by 203 600

$$m^2 = 1.030225933...$$

Square root both sides

$$m = 1.01500046...$$

[1]

Remember that this is a multiplier, not the percentage. So the equivalent percentage increase is by 1.500046 %, or approximately 1.5 %

$x = 1.5$ [1]

Q6

6

Substitute the values into the formula for compound interest.

Formula for compound interest $A = P\left(1 + \frac{r}{100}\right)^n$.

A = final amount = 206.46
P = initial amount = 200
r = interest rate = r
n = number of years = 2.
Substitute the values into the formula to form an equation.

$$200\left(1 + \frac{r}{100}\right)^2 = 206.46$$

[1]

Divide both sides by 200.

$$\left(1 + \frac{r}{100}\right)^2 = \frac{206.46}{200}$$
$$\left(1 + \frac{r}{100}\right)^2 = 1.0323$$

Expand the brackets by multiplying every term in the first bracket by every term in the second bracket.

$$\left(1 + \frac{r}{100}\right)\left(1 + \frac{r}{100}\right) = 1.0323$$
$$1\left(1 + \frac{r}{100}\right) + \frac{r}{100}\left(1 + \frac{r}{100}\right) = 1.0323$$
$$1 + \frac{r}{100} + \frac{r}{100} + \left(\frac{r}{100}\right)^2 = 1.0323$$
$$1 + \frac{2r}{100} + \left(\frac{r}{100}\right)^2 = 1.0323$$

[1]

Set equal to zero and rearrange.

$$1 + \frac{2r}{100} + \left(\frac{r}{100}\right)^2 - 1.0323 = 0$$
$$\left(\frac{r}{100}\right)^2 + \frac{2r}{100} - 0.0323 = 0$$

Remove the fractions by multiplying every term by 100^2.

$$\left(\frac{r}{100}\right)^2 (100)^2 + \frac{2r}{100}(100)^2 - 0.0323(100)^2 = 0$$
$$\frac{10000r^2}{10000} + \frac{200000r}{100} - 323 = 0$$

$r^2 + 200r - 323 = 0$ [1]

Q7

Compound interest is where each year the interest is calculated by finding the percentage of the current amount.

Recall the formula for compound interest $A = P\left(1 + \frac{r}{100}\right)^n$.

A is the total final amount.
P is the initial amount.
r is the interest rate.
n is the number of years.

Substitute $A = 559.78$, $P = 500$, $n = 6$ to form an equation.

$$559.78 = 500\left(1 + \frac{r}{100}\right)^6$$

[1]

Divide both sides by 500.

$$\left(1 + \frac{r}{100}\right)^6 = \frac{559.78}{500} = 1.11956$$

Take the 6th root of both sides.

$$1 + \frac{r}{100} = \sqrt[6]{1.11956} = 1.019000...$$

[1]

Solve the equation by subtracting 1 from both sides and then multiplying both sides by 100. Use the answer button to avoid losing accuracy.

$$\frac{r}{100} = 0.019000...$$
$$r = 1.9000...$$

Round to 3 significant figures.

$\boldsymbol{r = 1.90}$ [1]

Q8

8

This is compound interest so the amount of interest paid each year increases.
Use the formula for compound interest, $P\left(1 + \frac{r}{100}\right)^n$, where P is the initial amount, r is the interest rate and n is the number of years.

$P = \$550$, $r = x\%$ so use the multiplier $\left(1 + \frac{x}{100}\right)$, $n = 10$.

$$550 \times \left(1 + \frac{x}{100}\right)^{10} = 638.30$$

[1]

Rearrange by taking the tenth root of both sides.

$$\left(1 + \frac{x}{100}\right)^{10} = \frac{638.3}{550}$$

$$1 + \frac{x}{100} = \sqrt[10]{\frac{638.3}{550}}$$

[1]

Solve the equation by subtracting 1 and multiplying by 100.

$$x = 100\left(\sqrt[10]{\frac{638.3}{550}} - 1\right)$$

$$= 1.50004...$$

Round the final answer appropriately.

$\boldsymbol{x = 1.5}$ [1]