

Multipliers

Ex1 Population = 120,000 at beginning of 2018
Increases at 8.7% per annum. What is population
at beginning of 2022?

$$\text{Multiplier} = 1.087$$

$$\begin{aligned} \text{Time } 4 \text{ years} \quad & 120000 \times 1.087^4 \\ & = 167,533 \\ & = 168,000 \text{ to 3 sig fig.} \end{aligned}$$

Ex2 £5000 is invested in bank at
6.2% per annum.
How many years before it passes £10,000

After n years we have

$$5000 \times 1.062^n$$

$$\text{Try } n=10 \quad 5000 \times 1.062^{10} = £9124.63$$

$$n=11 \quad 5000 \times 1.062^{11} = £9690$$

$$n=12 \quad = £10291$$

Takes 12 years to double to over £10k

Ex 3 I invest £4000 for 2 years
and it amounts to £4665.50

What was the annual rate of interest

$$4000 \times M^2 = 4665.60$$

$$M^2 = \frac{4665.60}{4000}$$

$$M = \sqrt{\frac{4665.60}{4000}}$$

$$M = 1.08$$

Annual interest rate = 8%

Exercise

1) Find how many years it takes to treble
£20,000 at 9% per annum increase.

$$20000 \times 1.09^{12} = 56253$$

$$20000 \times 1.09^{13} = 61316 \checkmark$$

13 years

2) I invest £10000 for 3 years
and it amounts to £11576.25

Find the annual rate of interest.

$$10000 \times M^3 = 11576.25$$

$$M^3 = \frac{11576.25}{10000}$$

$$M = \sqrt[3]{\frac{11576.25}{10000}} = 1.05$$

so annual interest rate = 5%

Example A car cost £10000 new. After 3 years it is worth £8305.84 what is the annual rate of depreciation

$$10000 \times M^3 = 8305.84$$

$$M^3 = \frac{8305.84}{10000}$$

$$M = \sqrt[3]{\frac{8305.84}{10000}} = 0.94$$

Depreciation rate = 6%

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.
- What was its weight after
 - 1 day?
 - 2 days?
 - 4 days?
 - 1 week?
 - 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.
- Gareth started work at the business on a salary of £12 200. What salary will he be on after 4 years?
 - 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?

$$1 a) i) \quad 10 \times 1.05 = 10.5 \text{ kg}$$

$$ii) \quad 10 \times 1.05^2 = 11.025 \text{ kg}$$

$$iii) \quad 10 \times 1.05^4 = 12.155 \text{ kg}$$

$$iv) \quad 10 \times 1.05^7 = 14.071 \text{ kg}$$

$$b) \quad 10 \times 1.05^8 = 14.775 \text{ kg}$$

$$10 \times 1.05^9 = 15.51 \text{ kg} \quad \checkmark \quad \text{Takes 9 days}$$

$$2) \quad 50 \times 1.17^{10} = 240$$

$$50 \times 1.17^{11} = 281$$

$$50 \times 1.17^{12} = 329 \quad \checkmark$$

Takes 12 years to pass 3m

$$3) a) \quad \pounds 12,200 \times 1.04^4 = \pounds 14272$$

$$b) \quad 9350 \times 1.04^{10} = \pounds 13841$$

$$9350 \times 1.04^{15} = \pounds 16838$$

$$9350 \times 1.04^{20} = \pounds 20487 \quad \checkmark$$

$$9350 \times 1.04^{19} = \pounds 19699$$

20 years to pass $\pounds 20k$
