

Exercise walk-through

# 1.4

## Ratio, rate, proportion and exponentials

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# 1. Unit 3.1 at a glance

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Core N1-N20: ordering, four operations, factors and indices, standard form, sets, calculator use, rounding, FDP operators, percentage change, ratio and proportion.

Extension additions: index-form factors, fractional powers, exact surds, bounds calculations, recurring decimals, reverse percentage, the compound interest formula, exponential growth and decay.

NO formulae sheet in 9260 - the recall list is the specification itself. Spec lines with no specimen marks are taught as specification originals and labelled.

## 2. Ordering and the four operations

### Ordering and the four operations

Order on the number line with  $=$ , not-equal,  $<$ ,  $>$  - convert to one form first ( $3/5 = 0.6$ ). Formal methods for integers, decimals, fractions and mixed numbers:  $2 \frac{1}{3} + 1 \frac{1}{4} = 43/12 = 3 \frac{7}{12}$ .

Inverse operations cancel early:  $(15/28) \times (7/9) = 5/12$  after cancelling the 7 and the 3.

# Check yourself

## Check yourself

Ordering and formal methods; inverse cancellation; index-form factors with HCF and LCM; fractional powers; exact surds and rationalising; standard form; sets with counts; rounding.

Bounds choosing the right extremes; FDP operators; recurring decimals; reverse percentage; compound interest; ratio sharing and rates; direct and inverse proportion; exponential models fitted and solved.

## Exercises 2.1·2.3

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**2.1** Simplify  $45 : 60$  [1]

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**2.2** Share £350 in the ratio  $2 : 5$  [3]

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**2.3** A job pays £9.20 per hour. Find the pay for 7.5 hours. [2]

## Exercises 2.1·2.3

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**2.1** Simplify  $45 : 60$  [1]

**2.1**  $3 : 4$ .

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**2.2** Share £350 in the ratio  $2 : 5$  [3]

**2.2** £100 and £250.

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**2.3** A job pays £9.20 per hour. Find the pay for 7.5 hours. [2]

**2.3**  $9.2 \times 7.5 = £69$ .

## Exercises 2.4·3.1

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**2.4**  $y \propto x$  with  $y = 21$  when  $x = 7$ : find the equation and  $y$  when  $x = 12$  [3]

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**2.5** A sequence of values reads 240, 192, 153.6. Find the ratio and state the model  $y = ab^t$ . [3]

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**3.1** (*Original.*) A recipe for 6 people uses 450 g of rice. (a) How much for 10 people? (b) With 525 g available, how many whole people can be fed? [4]

## Exercises 2.4·3.1

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**2.4**  $y \propto x$  with  $y = 21$  when  $x = 7$ : find the equation and  $y$  when  $x = 12$  [3]

**2.4**  $k = 3$ , so  $y = 3x$ ;  $y = 36$ .

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**2.5** A sequence of values reads 240, 192, 153.6. Find the ratio and state the model  $y = ab^t$ . [3]

**2.5** Ratio  $\frac{192}{240} = 0.8$  (and  $\frac{153.6}{192} = 0.8$ ):  $y = 240 \times 0.8^t$ .

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**3.1** (*Original.*) A recipe for 6 people uses 450 g of rice. (a) How much for 10 people? (b) With 525 g available, how many whole people can be fed? [4]

**3.1** (a)  $450 \times \frac{10}{6} = 750$  g. (b) Per person 75 g;  $525 \div 75 = 7$  people.

## Exercises 3.2·3.3

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**3.2** (*Original, 2E specimen family.*) A monitor reading decays by 20% each year from 240 units; the model is  $y = 240 \times 0.8^t$ . (a) Find the half-life (when  $y$  first falls below 120). (b) A second reading GROWS by 35% per year from 240: write its model and find the value when  $t = 5$ . [5]

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**3.3** (*Original.*)  $y$  is inversely proportional to  $x$ ;  $y = 4$  when  $x = 6$ . Find  $y$  when  $x = 8$ . [3]

## Exercises 3.2·3.3

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**3.2** (*Original, 2E specimen family.*) A monitor reading decays by 20% each year from 240 units; the model is  $y = 240 \times 0.8^t$ . (a) Find the half-life (when  $y$  first falls below 120). (b) A second reading GROWS by 35% per year from 240: write its model and find the value when  $t = 5$ . [5]

**3.2** (a)  $240 \times 0.8^t < 120$  needs  $0.8^t < 0.5$ , so  $t > \ln 0.5 / \ln 0.8 \approx 3.1$ : first below 120 during year 4 (at  $t = 4$ ,  $y = 98.3$ ). (b)  $y = 240 \times 1.35^t$ ; at  $t = 5$ :  $240 \times 1.35^5 = 240 \times 4.484 = 1076.2$ .

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**3.3** (*Original.*)  $y$  is inversely proportional to  $x$ ;  $y = 4$  when  $x = 6$ . Find  $y$  when  $x = 8$ . [3]

**3.3**  $y = \frac{k}{x}$ :  $k = 24$ , so  $y = 3$ .

Local review guidance: the constant or ratio found from one data pair first; exact amounts; exponential answers name the model used. This is authored classroom guidance.