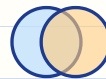


Number: Types, Sets and Fractions



Syllabus topics 1.1 Types of number · 1.2 Sets · 1.3 Powers and roots · 1.4 Fractions, decimals and percentages · 1.5 Ordering · 1.6 The four operations

For the Cambridge IGCSE Mathematics 0580 syllabus, exams in 2025, 2026 and 2027 (Core and Extended)

Syllabus statements covered in this chapter

Syllabus ref.	What you must be able to do	Level
C1.1 / E1.1	Natural numbers, integers, primes, squares, cubes, common factors and multiples (HCF, LCM), rational and irrational numbers, reciprocals; numbers in words	C E
C1.2 / E1.2	Set language, notation and Venn diagrams: two sets C ; two or three sets, $\in$, $\notin$, $\emptyset$, $\subseteq$, $\not\subseteq$ and set-builder notation E	C E
C1.3 / E1.3	Squares, square roots, cubes, cube roots and other powers and roots; recall squares to 15^2 and cubes of 1–5 and 10	C E
C1.4 / E1.4	Proper and improper fractions, mixed numbers, decimals and percentages; equivalence; recurring decimals to fractions E	C E
C1.5–1.6 / E1.5–1.6	Ordering with $=$, $\neq$, $>$, $<$, $\geq$, $\leq$; four operations with integers, fractions and decimals; order of operations	C E

What is inside

1. Concept notes, factor trees, Venn diagrams, 8 worked examples
2. Non-calculator skills; common mistakes from examiner reports
3. 20 quick-check MCQs, explained
4. Extended questions in Paper 2 (non-calculator) and Paper 4 (calculator) style, and Core questions in Paper 1 and Paper 3 style, all with full mark schemes
5. Quick-reference sheet, "I can" checklist

How to read these notes

C = Core · **E** = Extended only

red = key term green = definition

Marks: **M1** method · **A1** accurate answer (after M) · **B1** independent mark

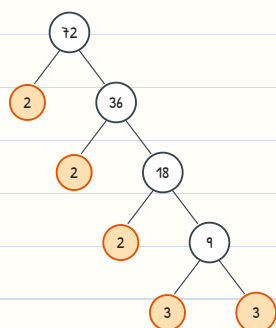
★ **Exam tip:** HCF is the **highest** number that divides both; LCM is the **lowest** number both divide into. The HCF is never bigger than the smaller number; the LCM is never smaller than the larger number.

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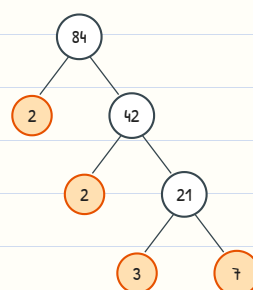
1.1 Types of number

type	meaning	examples
natural numbers	the counting numbers	1, 2, 3, 4, ...
integers	whole numbers: positive, zero and negative	..., -2, -1, 0, 1, 2, ...
prime numbers	have exactly two factors, 1 and itself (1 is not prime)	2, 3, 5, 7, 11, 13, 17, 19, 23, 29, ...
square numbers	n^2 for an integer n	1, 4, 9, 16, 25, ..., 225
cube numbers	n^3 for an integer n	1, 8, 27, 64, 125, ..., 1000
rational numbers	can be written as $\frac{a}{b}$ with a, b integers, $b \neq 0$; includes terminating and recurring decimals	$\frac{3}{4}$, -5, 0.2, $0.\dot{3}$, $\sqrt{16}$
irrational numbers	cannot be written as a fraction; decimal never ends or repeats	π , $\sqrt{2}$, $\sqrt{7}$, $\sqrt[3]{5}$
reciprocal	the reciprocal of x is $\frac{1}{x}$; a number $\times$ its reciprocal = 1	reciprocal of $\frac{2}{3}$ is $\frac{3}{2}$; of 5 is $\frac{1}{5} = 0.2$

- **Factors** of n divide n exactly; **multiples** of n are $n, 2n, 3n, \dots$. Write large numbers in words carefully: 6 000 000 000 is six **billion**; 10 007 is ten thousand and seven.
- **Product of prime factors**: split into primes with a factor tree or repeated division, then write with indices.



$$72 = 2^3 \times 3^2$$



$$84 = 2^2 \times 3 \times 7$$

Factor trees.

- **HCF** = product of the primes common to both, each to the **lower** power. **LCM** = product of all the primes, each to the **higher** power.

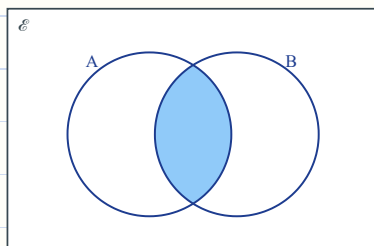
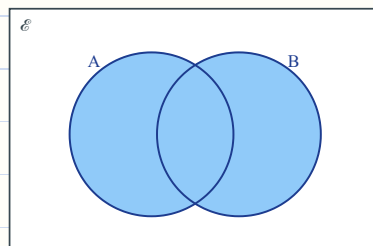
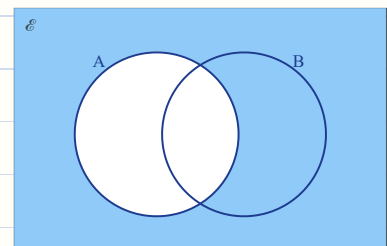
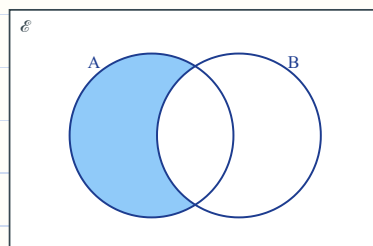
Worked example 1: HCF and LCM

Find the HCF and LCM of 72 and 84.

$72 = 2^3 \times 3^2$, $84 = 2^2 \times 3 \times 7$. HCF = $2^2 \times 3 = 12$. LCM = $2^3 \times 3^2 \times 7 = 504$. Check: HCF $\times$ LCM = $12 \times 504 = 6048 = 72 \times 84 \checkmark$.

Worked example 2: rational or irrational?Which of these are irrational? $\sqrt{9}$, $\sqrt{10}$, $0.\dot{4}$, $\pi + 1$, $\frac{22}{7}$ $\sqrt{10}$ and $\pi + 1$. ($\sqrt{9} = 3$, $0.\dot{4} = \frac{4}{9}$ and $\frac{22}{7}$ are fractions, so rational.)**1.2 Sets and Venn diagrams**

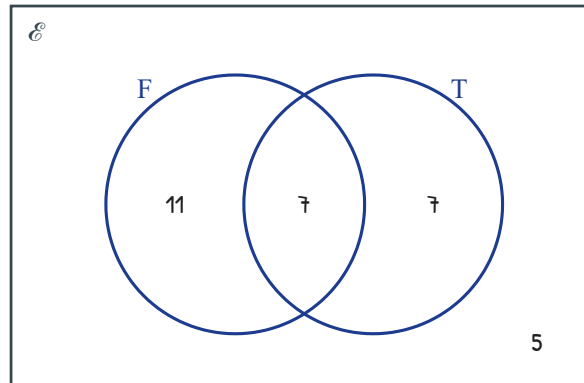
notation	meaning	level
$\mathcal{E}$	universal set (everything being considered)	C
$n(A)$	number of elements in set A	C
A'	complement of A : elements of $\mathcal{E}$ not in A	C
$A \cup B$	union: in A or B or both	C
$A \cap B$	intersection: in both A and B	C
$x \in A, x \notin A$	x is / is not an element of A	E
$\emptyset$	the empty set (no elements)	E
$A \subseteq B, A \not\subseteq B$	A is / is not a subset of B (every element of A is in B)	E
$\{x : 2 \leq x < 6\}$	set-builder notation: all x with $2 \leq x < 6$	C

 $A \cap B$  $A \cup B$  A'  $A \cap B'$ *Shaded regions for common set expressions.*

Worked example 3: completing a Venn diagram

In a class of 30 students, 18 play football (F), 14 play tennis (T) and 5 play neither. How many play both?

$n(F \cup T) = 30 - 5 = 25$. Both = $18 + 14 - 25 = 7$. So F only = 11, T only = 7.

**Extended only**

- For three sets, fill the diagram from the **centre outwards**: first $A \cap B \cap C$, then the other overlaps, then the "only" regions, then the outside.
- $A \subseteq B$ is drawn with circle A inside circle B . If $A \cap B = \emptyset$ the circles do not overlap.

Worked example 4: set notation

$\mathcal{E} = \{x : x \text{ is an integer, } 1 \leq x \leq 12\}$, $P = \{\text{prime numbers}\}$, $E = \{\text{even numbers}\}$. List $P \cap E$ and find $n(P' \cap E')$.

$P \cap E = \{2\}$. $P' \cap E' = \text{odd numbers that are not prime} = \{1, 9\}$, so $n(P' \cap E') = 2$.

1.3 Powers and roots

- Learn squares 1^2 to 15^2 (1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196, 225) and cubes of 1, 2, 3, 4, 5, 10 (1, 8, 27, 64, 125, 1000) and their roots, e.g. $\sqrt{169} = 13$, $\sqrt[3]{125} = 5$.
- Example: $5^2 \times \sqrt[3]{8} = 25 \times 2 = 50$.

1.4 Fractions, decimals and percentages

- A **proper fraction** has numerator < denominator ($\frac{3}{5}$); an **improper fraction** has numerator > denominator ($\frac{7}{4}$); a **mixed number** has a whole number part ($1\frac{3}{4}$). Always simplify fractions.
- Converting: $\frac{3}{8} = 3 \div 8 = 0.375 = 37.5\%$; $0.45 = \frac{45}{100} = \frac{9}{20}$; $12\% = \frac{12}{100} = \frac{3}{25}$.

Extended only

- Recurring decimals**: $0.1\dot{7} = 0.1777\dots$, $0.\dot{1}2\dot{3} = 0.123123\dots$, $0.1\dot{2}\dot{3} = 0.12323\dots$
- To convert to a fraction: let $x =$ the decimal; multiply by powers of 10 so the recurring parts line up; subtract; solve.

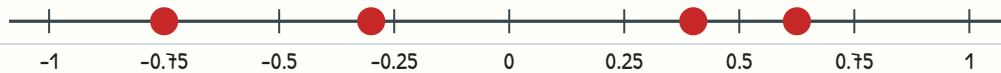
Worked example 5: recurring decimal E

Write $0.2\dot{6}$ as a fraction in its simplest form.

$$x = 0.2666\dots; 10x = 2.666\dots; 100x = 26.666\dots \text{ Subtract: } 90x = 24, \text{ so } x = \frac{24}{90} = \frac{4}{15}.$$

1.5 Ordering

- Symbols: = equal, $\neq$ not equal, $>$ greater than, $<$ less than, $\geq$ greater than or equal to, $\leq$ less than or equal to.
- To order fractions, decimals and percentages, convert all to decimals.



$$-\frac{3}{4} < -0.3 < 40\% < \frac{5}{8} \text{ shown on a number line.}$$

1.6 The four operations

- **Order of operations:** Brackets, Indices, Division and Multiplication (left to right), Addition and Subtraction (left to right).
- Fractions: change mixed numbers to improper fractions first. To divide, multiply by the reciprocal. Give answers in the form asked (e.g. a mixed number, simplest form).
- Negative numbers: $(-3) \times (-4) = 12$; $-3 - (-7) = 4$. A temperature rise from -8°C to 5°C is $5 - (-8) = 13^\circ\text{C}$.

Worked example 6: mixed numbers (non-calculator)

Work out $2\frac{1}{4} \div 1\frac{4}{5}$, giving your answer as a mixed number in its simplest form.

$$\frac{9}{4} \div \frac{9}{5} = \frac{9}{4} \times \frac{5}{9} = \frac{5}{4} = 1\frac{1}{4}.$$

Worked example 7: order of operations

Work out $18 - 3 \times (5 - 2)^2 \div 9$.

Brackets: 3; indices: 9; then $3 \times 9 \div 9 = 3$; $18 - 3 = 15$.

Worked example 8: reciprocal

Write down the reciprocal of $\frac{5}{8}$, and of 0.25.

$$\frac{8}{5} \text{ (or } 1\frac{3}{5}, 1.6\text{); reciprocal of } 0.25 = \frac{1}{0.25} = 4.$$

Non-calculator and calculator skills

Without a calculator (Papers 1 and 2)

- Show every step: the factor tree or division ladder, the common denominator, the improper fractions. Marks are given for method (M1) even if the final answer is wrong.
- Cancel before multiplying fractions: $\frac{25}{6} \times \frac{9}{10} = \frac{5 \times 3}{2 \times 2} = \frac{15}{4}$.

- To check a prime: test division by primes up to $\sqrt{n}$ (for 91, test 2, 3, 5, 7: $91 = 7 \times 13$, not prime).
- Recurring decimals: always write the two equations (e.g. $100x$ and $10x$) and subtract; this is the expected method.

With a calculator (Papers 3 and 4)

- Use the fraction key and the $S \Leftrightarrow D$ key to convert between fractions and decimals; use brackets around numerators and denominators.
- Write down the full calculator display before rounding.

Common mistakes that lose marks

- **HCF and LCM swapped.** Candidates often find the right primes and then give the LCM when asked for the HCF (or the reverse).
- **Product of primes.** Listing all factors (1, 2, 3, 6, 7, ...) instead of primes; including 1 as a prime; leaving $2 \times 3 \times 3$ unsimplified when an index form is asked, or multiplying it back to the number.
- **Reciprocal.** Not knowing the word: the reciprocal of $\frac{1}{3}$ is 3, not 0.33.
- **Mixed numbers.** Working with the fraction parts separately and forgetting the whole numbers; not giving the answer as a mixed number when the question asks.
- **Recurring decimals (E).** Reading $0.2\dot{6}$ as $0.2626 \dots$; ignoring the dot.
- **Venn diagrams.** Putting the total of a set in its "only" region; forgetting the intersection when asked for $n(A)$; shading instead of writing numbers.
- **Large numbers in words.** 7 000 000 000 is seven billion (not seventy million or seven thousand million).

Quick-check multiple-choice questions

20 questions, 1 mark each. Choose one answer, A, B, C or D. Questions marked **E** are Extended only. Answers with explanations follow the questions.

1. Which number is prime?

A 29

B 39

C 49

D 51

2. What is 72 written as a product of its prime factors?

A 8×9

B $2^2 \times 3^3$

C $2^3 \times 3^2$

D 2×36

3. What is the HCF of 36 and 60?

A 6

B 12

C 180

D 4

4. What is the LCM of 8 and 12?

A 4

B 96

C 48

D 24

5. Which number is irrational?

A $\sqrt{25}$

B $\sqrt{12}$

C $0.\dot{3}$

D $\frac{1}{7}$

6. What is the reciprocal of $\frac{2}{7}$?

A $3\frac{1}{2}$

B $-\frac{2}{7}$

C 0.27

D $\frac{7}{9}$

7. What is $\sqrt{196} - \sqrt[3]{64}$?

A 6

B 8

C 12

D 10

8. Which is 0.375 as a fraction in its simplest form?

A $\frac{375}{100}$

B $\frac{3}{4}$

C $\frac{3}{8}$

D $\frac{15}{40}$

9. What is $2\frac{2}{3} \times 1\frac{1}{8}$?

A 3

B $2\frac{1}{12}$

C $3\frac{1}{4}$

D $2\frac{2}{24}$

10. What is $12 - 8 \div 4 + 2 \times 3$?

A 7

B 16

C 9

D 12

11. A temperature falls from 4°C to -9°C . By how much does it fall?

A 5°C

B -13°C

C 13°C

D 36°C

12. Which is in order, smallest first?

A $0.7, \frac{2}{3}, 68\%$

B $68\%, \frac{2}{3}, 0.7$

C $\frac{2}{3}, 0.7, 68\%$

D $\frac{2}{3}, 68\%, 0.7$

13. $A = \{1, 2, 3, 4, 6\}$, $B = \{2, 4, 6, 8\}$. What is $A \cap B$?

A $\{2, 4, 6\}$

B $\{1, 2, 3, 4, 6, 8\}$

C $\{1, 3\}$

D $\{8\}$

14. In a Venn diagram, $n(A) = 15$, $n(B) = 12$ and $n(A \cap B) = 4$. What is $n(A \cup B)$?

A 31

B 23

C 27

D 19

15. **E** What is $0.\dot{4}\dot{5}$ as a fraction in its simplest form?

A $\frac{45}{100}$

B $\frac{9}{20}$

C $\frac{45}{90}$

D $\frac{5}{11}$

16. **E** What does $A \subseteq B$ mean?

A A and B have no elements in common

B B is inside A

C every element of A is in B

D A is empty

17. **E** $\mathcal{E} = \{1, 2, \dots, 10\}$, $M = \{\text{multiples of } 3\}$. What is $n(M')$?

A 7

B 3

C 10

D 6

18. **E** Which describes $\emptyset$?

A universal set

B the complement

C a subset with 1 element

D the empty set

19. **E** $p = 2^3 \times 5$ and $q = 2^2 \times 5^2 \times 7$. What is the LCM of p and q ?

A $2^2 \times 5$

B $2^3 \times 5^2 \times 7$

C $2^5 \times 5^3 \times 7$

D $2^3 \times 5 \times 7$

20. **E** Which is $0.1\dot{6}$ as a fraction?

A $\frac{16}{99}$

B $\frac{16}{90}$

C $\frac{1}{6}$

D $\frac{4}{25}$

Answers and explanations

1 A · 2 C · 3 B · 4 D · 5 B · 6 A · 7 D · 8 C · 9 A · 10 B · 11 C · 12 D · 13 A · 14 B · 15 D · 16 C · 17 A · 18 D · 19 B · 20 C

1. **A.** $39 = 3 \times 13$, $49 = 7^2$, $51 = 3 \times 17$.

2. **C.** $72 = 2 \times 2 \times 2 \times 3 \times 3$.

3. **B.** $36 = 2^2 \times 3^2$, $60 = 2^2 \times 3 \times 5$; $\text{HCF} = 2^2 \times 3$.

4. **D.** $8 = 2^3$, $12 = 2^2 \times 3$; $\text{LCM} = 2^3 \times 3 = 24$.

5. **B.** 12 is not a square number.

6. **A.** $\frac{7}{2} = 3\frac{1}{2}$.

7. **D.** $14 - 4$.

8. **C.** $\frac{375}{1000}$ simplified.

9. **A.** $\frac{8}{3} \times \frac{9}{8} = 3$.

10. **B.** $12 - 2 + 6$.

11. **C.** $4 - (-9)$.

12. **D.** 0.667, 0.68, 0.7.

13. **A.** Elements in both.

14. **B.** $15 + 12 - 4$.

15. **D.** $100x - x = 45$, $x = \frac{45}{99} = \frac{5}{11}$.

16. **C.** Definition of subset.

17. **A.** $M = \{3, 6, 9\}$; $10 - 3$.

18. **D.** Empty set.

19. **B.** Highest power of each prime.

20. **C.** $100x - 10x = 15$, $x = \frac{15}{90} = \frac{1}{6}$.

Exam-style Extended questions: Paper 2 style (non-calculator)

Do not use a calculator. Show all your working. Total: 22 marks.

Question 1 [7 marks]

- (a) Write 1260 as a product of its prime factors. [2]
- (b) Find the highest common factor of 1260 and 168. [2]
- (c) $a = 2^4 \times 3 \times 5^2$ and $b = 2^2 \times 3^3 \times 5$. Find the lowest common multiple of a and b . Give your answer as a product of prime factors. [1]
- (d) Write down an irrational number between 5 and 6. [1]
- (e) Write down the reciprocal of $1\frac{3}{4}$. [1]

Mark scheme

- (a) $2^2 \times 3^2 \times 5 \times 7$ (B2) (B1 for 2, 2, 3, 3, 5, 7 seen or a correct tree / ladder)
- (b) $168 = 2^3 \times 3 \times 7$ (M1); HCF = $2^2 \times 3 \times 7 = 84$ (A1)
- (c) $2^4 \times 3^3 \times 5^2$ (B1)
- (d) e.g. $\sqrt{30}$, $\sqrt{27}$, $\pi + 2$ (any irrational strictly between 5 and 6) (B1)
- (e) $\frac{4}{7}$ (B1)

Question 2 [8 marks]

- (a) Work out $3\frac{1}{3} - 1\frac{4}{5}$. Give your answer as a mixed number in its simplest form. [3]
- (b) Show that $1\frac{5}{9} \div \frac{7}{12} = 2\frac{2}{3}$. [2]
- (c) Write the recurring decimal $0.3\dot{1}8$ as a fraction in its simplest form. Show all your working. [3]

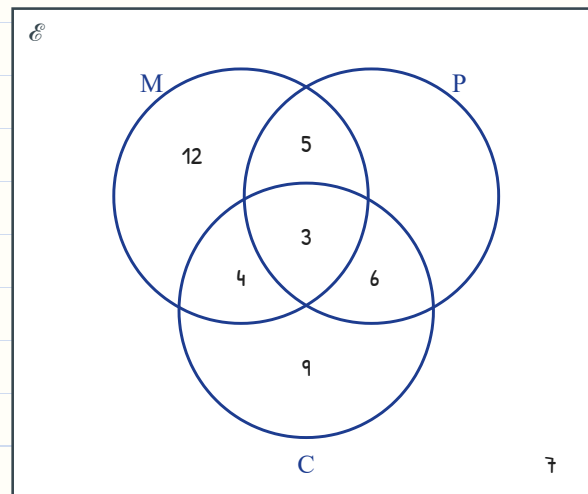
Mark scheme

- (a) $\frac{10}{3} - \frac{9}{5}$ (M1); $\frac{50}{15} - \frac{27}{15} = \frac{23}{15}$ (M1); $1\frac{8}{15}$ (A1)
- (b) $\frac{14}{9} \times \frac{12}{7}$ (M1); $= \frac{168}{63} = \frac{8}{3} = 2\frac{2}{3}$ with cancelling shown (A1)
- (c) $x = 0.31818\dots$; $1000x = 318.1818\dots$ and $10x = 3.1818\dots$ (M1); $990x = 315$ (M1); $x = \frac{315}{990} = \frac{7}{22}$ (A1)

Question 3 [7 marks]

- (a) $\mathcal{E} = \{x : x \text{ is an integer, } 1 \leq x \leq 15\}$, $F = \{\text{factors of } 12\}$, $S = \{\text{square numbers}\}$. (i) List the elements of $F \cap S$. (ii) Find $n(F \cup S)$. (iii) Use set notation to complete: $\{4\} \dots F$. [3]

(b) 60 students were asked if they study Music (M), Physics (P) or Chemistry (C). The Venn diagram shows some of the results. One region is blank.

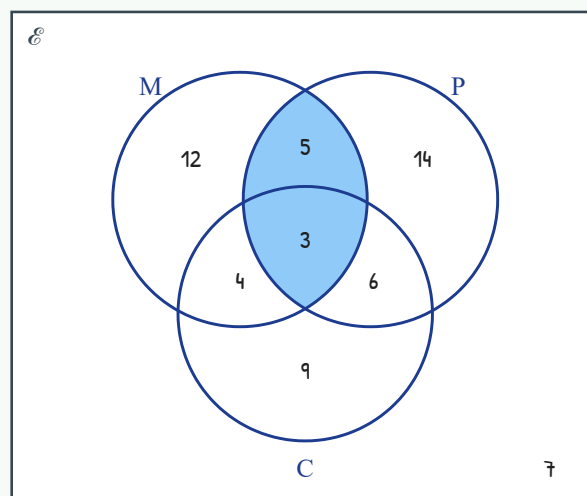


Venn diagram (Question 3).

(i) Find the number of students who study Physics only. (ii) Find $n(M \cap P)$. (iii) A student is chosen at random. Find the probability that the student studies exactly two of the three subjects. [4]

Mark scheme

- (a)(i) $\{1, 4\}$ (B1); (ii) $F = \{1, 2, 3, 4, 6, 12\}$, $S = \{1, 4, 9\}$, $n(F \cup S) = 7$ (B1); (iii) $\{4\} \subseteq F$ (accept $\subset$) (B1)
- (b)(i) $60 - 46 = 14$ (B1); (ii) $5 + 3 = 8$ (B1); (iii) $5 + 4 + 6 = 15$ (M1); $\frac{15}{60} = \frac{1}{4}$ (A1)



Mark-scheme figure: shaded region is $M \cap P$.

Exam-style Extended questions: Paper 4 style (calculator)

A calculator may be used. Total: 12 marks.

Question 4 [6 marks]

- (a) Work out $\frac{\sqrt{7.2^2 + 3.5^3}}{4.1 - 0.85}$. Write down all the figures on your calculator display. [2]
- (b) Write these in order, starting with the smallest: $\frac{7}{11}$, $0.6\dot{3}$, 63.5% , $\sqrt{0.4}$ [2]
- (c) The population of a country is six billion, four hundred and three million. Write this number in figures. [1]

(d) Find the smallest integer n for which $\sqrt{n}$ is greater than 7.5. [1]

Mark scheme

- (a) $\sqrt{51.84 + 42.875} = \sqrt{94.715} = 9.7322 \dots$ (M1); $\div 3.25 = 2.99451 \dots$ (A1)
- (b) decimals: 0.63636..., 0.63333..., 0.635, 0.63245... (M1); $\sqrt{0.4}$, $0.6\dot{3}$, 63.5% , $\frac{7}{11}$ (A1)
- (c) 6 403 000 000 (B1)
- (d) 57 ($7.5^2 = 56.25$) (B1)

Question 5 [6 marks]

(a) Two buses leave a station together. One bus returns every 18 minutes, the other every 30 minutes.

After how many minutes will they next be at the station together? [2]

(b) A rectangular floor measures 4.2 m by 3.36 m. It is covered with identical square tiles with no gaps and no cutting. Find the largest possible side length of a tile, in centimetres, and the number of tiles needed. [4]

Mark scheme

- (a) LCM of 18 and 30 (M1); 90 minutes (A1)
- (b) 420 cm and 336 cm (B1); HCF: $420 = 2^2 \times 3 \times 5 \times 7$, $336 = 2^4 \times 3 \times 7$ (M1); 84 cm (A1); $5 \times 4 = 20$ tiles (B1)

Exam-style Core questions: Paper 1 and Paper 3 style

Question 6 is non-calculator; Question 7 allows a calculator. Total: 16 marks.

Question 6 [8 marks]

(a) From the list 15, 16, 17, 18, 19, 20, 21 write down (i) a prime number, (ii) a square number, (iii) a multiple of 7, (iv) a factor of 60. [4]

(b) Work out $\frac{3}{4} + \frac{2}{5}$. [2]

(c) Work out $(-6) \times 3 - (-4)$. [1]

(d) Write 0.08 as a percentage. [1]

Mark scheme

- (a)(i) 17 or 19 (B1); (ii) 16 (B1); (iii) 21 (B1); (iv) 15 or 20 (B1)
- (b) $\frac{15}{20} + \frac{8}{20}$ (M1); $\frac{23}{20}$ or $1\frac{3}{20}$ (A1)
- (c) -14 (B1)
- (d) 8% (B1)

Question 7 [8 marks]

(a) Work out $\frac{12.4 + 3.8^2}{\sqrt{2.89}}$. [2]

(b) In a group of 40 people, 23 own a car, 15 own a bicycle and 9 own both. Draw a Venn diagram and find how many own neither. [3]

(c) Write 90 as a product of its prime factors. [2]

(d) Write down the value of $\sqrt[3]{1000}$. [1]

Mark scheme

- (a) $\frac{12.4+14.44}{1.7}$ (M1); 15.788... (15.8) (A1)
- (b) regions 14 (car only), 9 (both), 6 (bicycle only) (M1); $40 - 29$ (M1); 11 (A1)
- (c) $2 \times 3^2 \times 5$ (B2) (B1 for 2, 3, 3, 5 seen)
- (d) 10 (B1)

Quick-reference sheet

Item	Statement	Level
primes	exactly two factors; 1 is not prime; 2 is the only even prime	C
HCF / LCM	HCF: common primes, lower powers; LCM: all primes, higher powers; $\text{HCF} \times \text{LCM} = \text{product of the two numbers}$	C
rational	$\frac{a}{b}$; terminating or recurring decimals; irrational: π , non-square roots	C
sets	$\cup$ union, $\cap$ intersection, A' complement, $n(A)$, $\mathcal{E}$; (E) $\in, \notin, \emptyset, \subseteq$, three-set Venn	C E
fractions	improper first; divide = $\times$ reciprocal; simplest form; mixed number if asked	C
recurring	$x, 10x, 100x \dots$ subtract to remove the recurring part	E
order	brackets, indices, $\div \times, + -$; compare by converting to decimals	C

"I can" checklist

- ☐ identify primes, squares, cubes, rational and irrational numbers and reciprocals; write numbers in words and figures
- ☐ write a number as a product of primes and find the HCF and LCM
- ☐ use set notation and Venn diagrams; (E) three sets, $\in, \emptyset, \subseteq$
- ☐ convert and order fractions, decimals and percentages; calculate with fractions, negatives and the order of operations
- ☐ (E) convert recurring decimals to fractions