Place value, ordering and order of operations

N1–N3 · Number · revision notes

The basic number skills behind every paper: place value, ordering numbers, the order of operations, negative numbers, written methods and reciprocals. Expect short questions, especially on the non-calculator paper, and you need these skills inside almost every other question.

Key facts

- BIDMAS: Brackets, Indices, Division and Multiplication (left to right), Addition and Subtraction (left to right)
- Subtracting a negative is adding: 5 − (−2) = 7
- To divide by a decimal, multiply both numbers by 10, 100, ... first
- $<$ less than, $\leq$ less than or equal to, $>$ greater than, $\geq$ greater than or equal to, $\neq$ not equal to
- × and ÷: same signs → positive, different signs → negative
- Decimal places in a product = total decimal places in the numbers being multiplied
- Reciprocal of x is $\frac{1}{x}$; reciprocal of $\frac{a}{b}$ is $\frac{b}{a}$

Notes

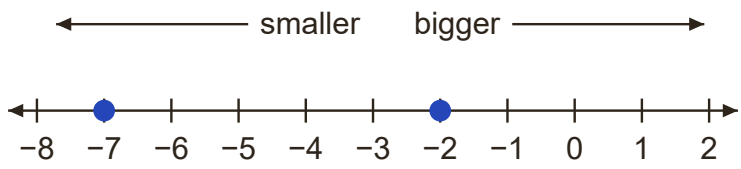
Place value and ordering

- Each column is worth 10 times the column to its right: thousands, hundreds, tens, ones, then tenths, hundredths, thousandths after the decimal point.
- To order decimals, line up the decimal points and compare digits from the left: 0.47 = 0.470, which is bigger than 0.407.

ones		tenths	hundredths	thousandths
0	.	4	**7**	0
0	.	4	**0**	7

Line up the decimal points. The tenths are the same, so compare the hundredths: 7 is more than 0, so 0.47 is bigger.

- On a number line, numbers get smaller as you go left, so −7 is less than −2.



−7 is further left than −2, so −7 is less than −2.

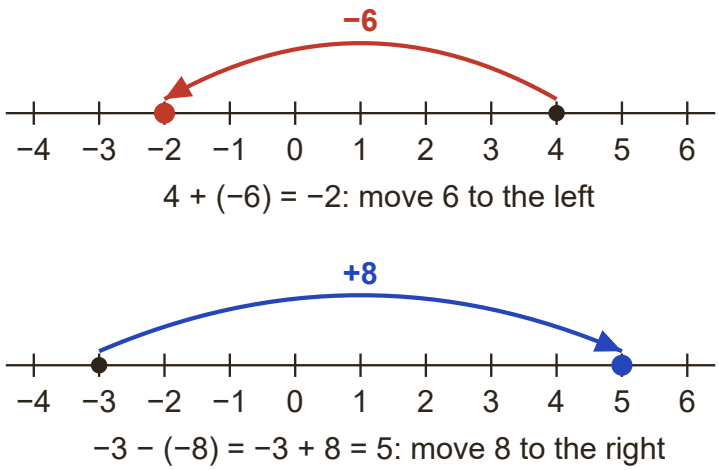
- Symbols: $<$ less than, $>$ greater than, $\leq$ less than or equal to, $\geq$ greater than or equal to, $\neq$ not equal to. The narrow end points at the smaller number.

Order of operations

- **BIDMAS**: Brackets, Indices (powers and roots), Division and Multiplication, Addition and Subtraction.
- Division and multiplication have equal priority, so work from left to right: 12 ÷ 3 × 2 = 4 × 2 = 8. The same goes for addition and subtraction.
- Example: $5 + 3 \times 2^2 = 5 + 3 \times 4 = 5 + 12 = 17$
- A fraction bar and a square root sign work like brackets: work out the whole top, the whole bottom, or everything under the root first. $\sqrt{9 + 16} = \sqrt{25} = 5$, not 3 + 4.
- Inverse operations undo each other (+ and −, × and ÷, squaring and square rooting). Use them to check answers.

Negative numbers

- Adding a negative is the same as subtracting: 4 + (−6) = −2.
- Subtracting a negative is the same as adding: −3 − (−8) = −3 + 8 = 5.



Adding a negative moves you left; subtracting a negative moves you right.

- Multiplying or dividing: same signs give a positive answer, different signs give a negative answer. −4 × −6 = 24 and 20 ÷ (−5) = −4.
- $(-3)^2 = 9$, but -3^2 means $-(3^2) = -9$. Use brackets on your calculator when you square a negative number.

Decimals and reciprocals

- Multiplying decimals: multiply as whole numbers, then give the answer as many decimal places as the numbers had in total. 0.3 × 0.04: 3 × 4 = 12, three decimal places, so 0.012.
- Dividing by a decimal: multiply both numbers by 10 (or 100) until you are dividing by a whole number. 7.2 ÷ 0.3 = 72 ÷ 3 = 24.
- Using a known fact: if 34 × 26 = 884, then 3.4 × 26 = 88.4 and 0.34 × 2.6 = 0.884.
- The **reciprocal** of a number is 1 divided by it: the reciprocal of 5 is $\frac{1}{5}$ and of $\frac{3}{4}$ is $\frac{4}{3}$. A number times its reciprocal is 1. Zero has no reciprocal.

How to answer each type of question

M = method mark, A = answer mark, B = a mark on its own.

Work out, using the order of operations

1 to 2 marks | Grade 2

1. Work out brackets first. Treat the top and the bottom of a fraction as if each were in brackets.
2. Then powers and roots.
3. Then × and ÷ from left to right, then + and − from left to right.
4. Write each stage down so a slip still leaves you with method marks.

Example. Work out $\dfrac{2+6\times 3^2}{5\times 3-7}$

Model answer.

Top: $3^2=9$, $6\times 9=54$, $2+54=56$

Bottom: $15-7=8$ (M1 for 56 or 8)

$56\div 8=7$ (A1)

Use a given calculation to write down others

1 mark each | Grade 4

1. Compare each number in the new calculation with the given fact: how many times bigger or smaller is it?
2. For ×, apply both changes to the answer. For ÷, a smaller number to divide by gives a bigger answer.
3. Check with a rough estimate that the size is sensible.

Example. Using the information that $47\times 23=1081$, write down the value of

(a) 4.7×2.3

(b) 0.47×230

(c) $1081\div 230$

Model answer.

(a) Both numbers are 10 times smaller, so the answer is 100 times smaller: 10.81 (B1)

(b) ÷ 100 and × 10, so the answer is 10 times smaller: 108.1 (B1)

(c) $1081\div 23=47$, and dividing by a number 10 times bigger gives 4.7 (B1)

Calculate with decimals without a calculator

2 marks each | Grade 3

1. Multiplying: remove the decimal points, multiply the whole numbers with a written method, then put back the total number of decimal places.
2. Dividing: multiply both numbers by the same power of 10 so you divide by a whole number, then use short division.
3. Estimate to check the position of the decimal point.

Example. (a) Work out 2.4 × 0.35
(b) Work out 9.36 ÷ 0.4

Model answer.

(a) 24 × 35 = 840 (M1 for a complete written method)
3 decimal places in total, so 0.840 = 0.84 (A1)
(b) 9.36 ÷ 0.4 = 93.6 ÷ 4 (M1)
= 23.4 (A1)

Use your calculator: write down all the figures, then round

2 to 3 marks | Grade 3

1. Work out the top and the bottom separately (write them down), or put brackets round the whole top and whole bottom.
2. Write down every figure on the display.
3. Round only in the part that asks you to, e.g. to 3 significant figures.

Example. (a) Use your calculator to work out $\dfrac{\sqrt{19.6 + 3.2^2}}{4.1 - 0.75}$
Write down all the figures on your calculator display.
(b) Write your answer to part (a) correct to 3 significant figures.

Model answer.

(a) Top: $19.6 + 10.24 = 29.84$, $\sqrt{29.84} = 5.4626...$ Bottom: 3.35 (B1 for 29.84 or 5.4626... or 3.35 seen)
1.630626899... (B1; your display may show it rounded, e.g. 1.6306269)
(b) 1.63 (B1)

Don't lose marks

- Working from left to right whatever the operation: 3 + 4 × 2 is 11, not 14.
- Doing every multiplication before any division: 12 ÷ 3 × 2 is 8, not 2.
- Typing −3² into a calculator (which gives −9) when you mean $(-3)^2 = 9$
- Putting the decimal point in the wrong place: 0.3 × 0.04 = 0.012, not 0.12.
- Thinking a decimal with more digits is bigger: 0.47 is bigger than 0.407.

- Rounding in part (a) when it asks for all the figures on the calculator display.

More tips

Memory tricks

- BIDMAS: D and M are equal partners, and so are A and S. When two are equal, go left to right.
- For × and ÷ with negatives: same signs, positive; different signs, negative.
- Two minus signs side by side, as in 5 − (−2), become a plus.
- Estimate first: 4.7 × 2.3 is about 5 × 2 = 10, so 10.81 is sensible and 108.1 is not.
- On a calculator, put brackets round the whole top and whole bottom of a fraction, or use the fraction key.

Exam technique

- On the non-calculator paper, show your written method (column, grid or bus stop). A correct method earns marks even if you slip.
- When a question gives you a fact such as 47 × 23 = 1081, use it. 'Write down' means little or no working is needed.
- When asked for all the figures on the display, copy every digit; round only when a later part tells you to.
- Check answers with inverse operations or a quick estimate.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 1 — **Order integers and decimals**
Line up the decimal points and compare digits from the left, so 0.407 is smaller than 0.47.

Grade 1 — **Use the order of operations (BIDMAS)**
Brackets, then indices, then × and ÷, then + and −, so 3 + 4 × 2 = 11.

Grade 2 — **Calculate with negative numbers**
Add, subtract, multiply and divide with negatives, e.g. −3 − (−8) = 5 and −4 × −6 = 24.

Grade 2 — **Use the inequality symbols correctly**
Use $=$, $\neq$, $<$, $>$, $\leq$ and $\geq$ to compare numbers, e.g. $-7 < -2$

Grade 3 — **Use written methods for all four operations**
Use column or grid multiplication and short or long division without a calculator.

Grade 3 — **Multiply and divide with decimals**
Work with whole numbers, then place the decimal point, e.g. 0.3 × 0.04 = 0.012 and 7.2 ÷ 0.3 = 24.

Grade 4 — **Use one calculation to find another**
Given 34 × 26 = 884, adjust the place value to get 3.4 × 2.6 = 8.84 or 884 ÷ 2.6 = 340.

Grade 4 — **Find and use reciprocals**
The reciprocal of a number is 1 divided by it, so the reciprocal of 4 is $\frac{1}{4}$ and of $\frac{2}{3}$ is $\frac{3}{2}$

Free notes, Full packs, practice papers and mock exams at chhetriacademy.com. Written for this site; not taken from past papers. Stuck? 1-to-1 tutoring with a free 30-minute trial lesson.