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Some of the content in this book will only be assessed if you're taking the Extended version of the Cambridge International GCSE. We've marked up all the content that's only for the Extended course with purple brackets, like the ones around this text, or the example below.

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Order of Operations

Welcome to the wonderful world of maths. We're going to start off with something easy — the **order of operations** like addition, subtraction and multiplication — also known as **BODMAS**.

BODMAS

BODMAS tells you the **ORDER** in which these operations should be done:



BODMAS: Brackets, Other, Division & Multiplication, Addition & Subtraction

Work out **Brackets** first, then **Other** things like squaring, then **Divide / Multiply** groups of numbers before **Adding / Subtracting**. To decide between dividing and multiplying, or between adding and subtracting, just work **from left to right**.

This set of rules works really well, so remember “BODMAS”.

EXAMPLES:

1. Work out $7 + 9 \div 3$

- 1) Follow BODMAS — do the **division** first... $7 + 9 \div 3$
- 2) ...then the **addition**: $= 7 + 3$

$$= 10$$

If you don't follow BODMAS, you get:
 $7 + 9 \div 3 = 16 \div 3$
 $= 5.333... \times$

2. Calculate $15 - 7^2$

- 1) The square is an ‘**other**’ so that's first: $15 - 7^2$
- 2) Then do the **subtraction**: $= 15 - 49$

$$= -34$$

3. Find $(5 + 3) \times (12 - 3)$

- 1) Start by working out the **brackets**: $(5 + 3) \times (12 - 3)$
- 2) And now the **multiplication**: $= 8 \times 9$

$$= 72$$

4. $e = (f - 7)^2 + \frac{4g}{h+1}$, where $f = 4$, $g = 3$, $h = -2$.

Work out the value of e .

- 1) Write down the formula: $e = (f - 7)^2 + \frac{4g}{h+1}$

- 2) Put the numbers in: $e = (4 - 7)^2 + \frac{4 \times 3}{-2 + 1}$

- 3) Then work it out **in stages**:

Putting brackets round the negative number makes it clear that -3 is squared, not just 3.

$$\begin{aligned} e &= (f - 7)^2 + \frac{4g}{h+1} \\ e &= (4 - 7)^2 + \frac{4 \times 3}{-2 + 1} \\ &= (-3)^2 + \frac{12}{-1} \\ &= 9 + \frac{12}{-1} \\ &= 9 + -12 \\ &= -3 \end{aligned}$$

Work **brackets** out first.

Around the top and bottom of a fraction there are ‘**invisible brackets**’. You just have to imagine they're there.

Then **other** stuff — in this case square the first bit.

Then **divide**.

Finally **add or subtract**.

Make sure you're confident with this before moving on

BODMAS comes up all the time, so it's really important that you can do it without getting confused.

Calculator Buttons

This page is really important — it's all about using **calculators**.

Know Your Buttons

Look for these buttons on your calculator — they might be a bit different on yours.



The **reciprocal** button. The reciprocal of a number is 1 divided by it. So the reciprocal of 2 is $\frac{1}{2}$.



The **cube root** button. You might have to press **shift** first.



This uses your **last answer** in your current calculation — very useful.



Swaps your answer from a **fraction** to a **decimal** and vice versa.

BODMAS on Your Calculator

BODMAS questions can be packed with **tricky decimals** and maybe a **square root** and **sin/cos/tan**. You **could** do it on your calculator in one go, but you could lose precious marks if you make a mistake.

EXAMPLE:

Work out $\left(\frac{64 \cos 80^\circ}{0.48 + \sqrt{0.79}}\right)^3$.
Write down all the figures on your calculator display.

You **MUST** write down the numbers as you go. That way, even if you mess up at the end, you may still get a mark.

$$\begin{aligned} &\left(\frac{64 \cos 80^\circ}{0.48 + \sqrt{0.79}}\right)^3 \\ &= \left(\frac{11.11348337}{1.368819442}\right)^3 \\ &= 8.119027997 \\ &= 535.1950858 \end{aligned}$$

There are lots of **slightly different ways** of working out this type of calculation. Here's one:

- 1) Work out the **bottom** of the fraction: $0.48 + \sqrt{0.79} =$
Write the answer down and store it in the **memory** by pressing: **STO M+**
- 2) Now work out the **top** of the fraction: $64 \cos 80 =$
- 3) Do the division: **Ans** \div **RCL M+** $=$
This gets the value of the bottom of the fraction out of the memory.
- 4) And cube the answer: **Ans** \times^3 $=$

NOTE:

- 1) On some calculators, a **bracket** opens when you use a **trig function** or the square/cube root function. So to enter something like $\tan 40^\circ + 1$, you have to **close the bracket**: **tan 40) + 1**
- 2) On some calculators, the cursor stays **under the square root bar** until you move it out by pressing the right arrow.

Check Your Answer Using Brackets (and)

Check your **answer** to a question like the one above by typing it into your calculator in **fewer steps**.

- 1) To work out $\frac{64 \cos 80^\circ}{0.48 + \sqrt{0.79}}$ you **CAN'T** just press **64 cos 80 \div 0.48 + $\sqrt{0.79} =$**
- 2) The calculator follows BODMAS, so it'll think you mean $\frac{64 \cos 80^\circ}{0.48} + \sqrt{0.79}$.
- 3) You need to use the **BRACKETS BUTTONS** — the calculator will do the bits in brackets first. So you can press:

$$\left(64 \cos 80 \right) \div \left(0.48 + \sqrt{0.79} \right) =$$

(Cube this to check the question above.)

Your calculator might need you to add an extra **)** here. See the note above.

You might also need an extra **)**, or to move right one space here.

Your calculator can save you time in the exam

Different calculators have different ways of doing things. Make sure you're familiar with how your calculator works before the exam — it might save you some marks as well as some time.