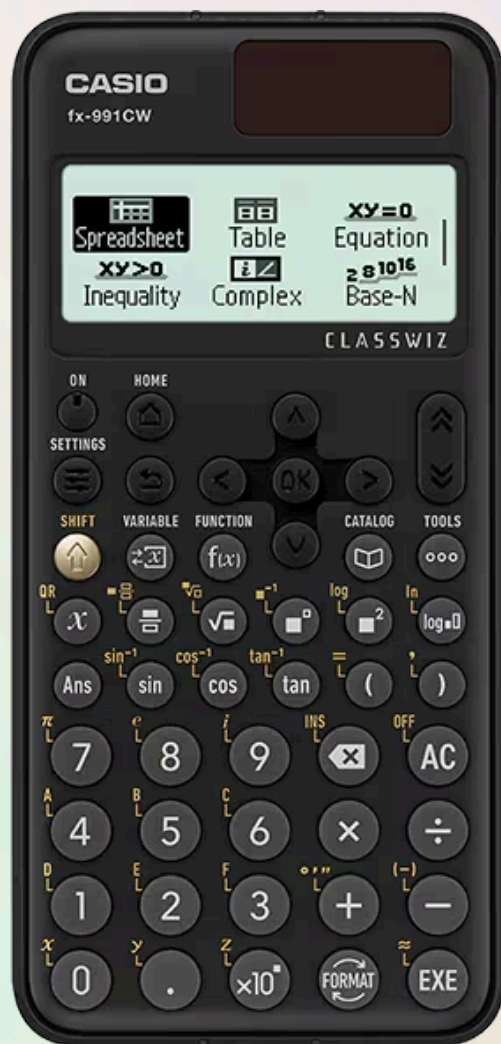# The Ultimate A Level Maths Calculator Guide.

Casio Classwiz fx991cw

*"Never waste a minute or mark in an exam again with this **ultimate calculator guide**"*

@amythemathsteacher

Table of Contents

Join the A Level Maths Study Hub

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How to use this guide

Compatible Calculators
This guide is written for the Casio ClassWiz fx-991CW. Most functions also work on the older model, though menu navigation may differ slightly.

⚠️ **CRITICAL EXAM WARNING**

Always read the question carefully! Some questions explicitly state:

 "Solutions relying on calculator technology are not acceptable" or "In this question you must show all stages of your working."

When you see this, you MUST show full working and cannot rely on calculator shortcuts. We'll cover how to identify these questions and what to do instead.

Two Ways to Use Your Calculator

For **CHECKING your work** (most common) - verify calculations and catch mistakes, or for **DIRECT CALCULATIONS when allowed** (especially in statistics and simultaneous equations). Always show your working either way.

Why Statistics Comes First

Statistics is where your calculator saves the most time and effort. Complex probability distributions, hypothesis testing, and regression calculations are all *expected* to be done on the calculator.

What's Included

Step-by-step button sequences to find calculator functions, some worked examples, and links to videos where I demonstrate the techniques.

How to Practice

Try each technique with your calculator, practice on past papers, and always check if calculator technology is allowed first.
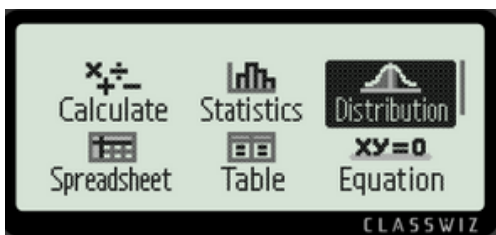
Ready? Let's dive in

Calculating Binomial Probabilities

Example: X ~ B(50, 0.2)

Calculate P(X=5)

🔢 **CALCULATOR STEPS**
1. Press: [**Home button**]
2. Choose **Distribution**
3. Choose **Binomial PD**
4. Choose **Variable**
5. **Enter 5,** 50, 0.2 (for this example)
6. Press [**EXE**]

Calculate P(X≤5)

Binomial CD only does ≤

🔢 **CALCULATOR STEPS**
1. Press: [**Home button**]
2. Choose **Distribution**
3. Choose **Binomial CD**
4. Choose **Variable**
5. **Enter 5,** 50, 0.2 (for this example)
6. Press [**EXE**]

Calculate P(X≥5)

So you must calculate:
1 − P (X≤4)
because you want to include the 5 and not subtract it

🔢 **CALCULATOR STEPS**
1. Press: [**Home button**]
2. Choose **Distribution**
3. Choose **Binomial CD**
4. Choose **Variable**
5. **Enter 4**, 50, 0.2 (for this example)
6. Press [**EXE**]
7. **Subtract the answer from 1**

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Calculating Binomial Probabilities

Example: X ~ B(50, 0.2)

Calculate P(X<5)

Enter 4 because we don't want to include 5

🔢 **CALCULATOR STEPS**
1. Press: [**Home button**]
2. Choose **Distribution**
3. Choose **Binomial PD**
4. Choose **Variable**
5. **Enter 4**, 50, 0.2 (for this example)
6. Press **[EXE]**

Remember binomial CD only does ≤

Calculate P(X>5)

Calculate 1 – P(x ≤5) This time we don't want to include 5, so we subtract it.

🔢 **CALCULATOR STEPS**
1. Press: [**Home button**]
2. Choose **Distribution**
3. Choose **Binomial CD**
4. Choose **Variable**
5. **Enter 5**, 50, 0.2 (for this example)
6. Press **[EXE]**
7. **Subtract from 1**

Confused? Watch me go through this here.

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Finding the critical region for hypothesis testing (binomial)

X ~ B(50, 0.2)

5% significance level, two tailed test

Normally, you will be asked to do trial and error and calculate the BINOMIAL CD probabilities ONE AT A TIME 😰 until you find one less than 2.5% (in this case).

But did you know the *list function* produces as many probabilities as you need to so you can just pick out the one you need?

First, find the most likely outcome:

$$0.2 \times 50 = 10$$

Then find the lower tail :

The first value under 2.5%. so 4 is your critical value.

🔢 **CALCULATOR STEPS**
1. Press: [**Home button**]
2. Choose **Distribution**
3. Choose **Binomial CD**
4. Choose **LIST**
5. **List out the values under 10 in the x column**
6. Press [**EXE**]
7. Enter 50, 0.2
8. Press [**EXE**]
9. Pick the highest value under 2.5%

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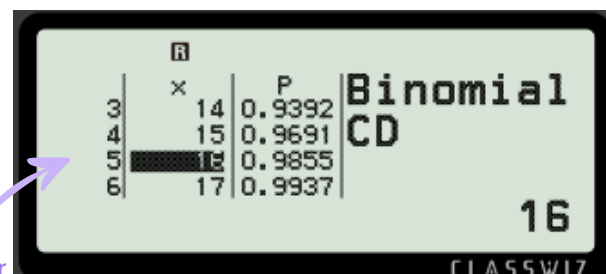# Finding the critical region for hypothesis testing (binomial)

X ~ B(50, 0.2)   **5% significance level, two tailed test**

🔢 CALCULATOR STEPS
1. Repeat the steps above just inputting values slightly over 10.

Then find the upper tail by choosing the first value OVER 97.5% (because the calculator only does ≤ and when we subtract from 1 we need it under 2.5%)


The first value over 97.5%. So 16 is a critical value.

The critical region is X≤4 and X≥16

Confused? Watch me go through this here.

Important note: Unless specifically asked for the critical region, when hypothesis testing, **you should just calculate the probability and compare it to the significance level.**
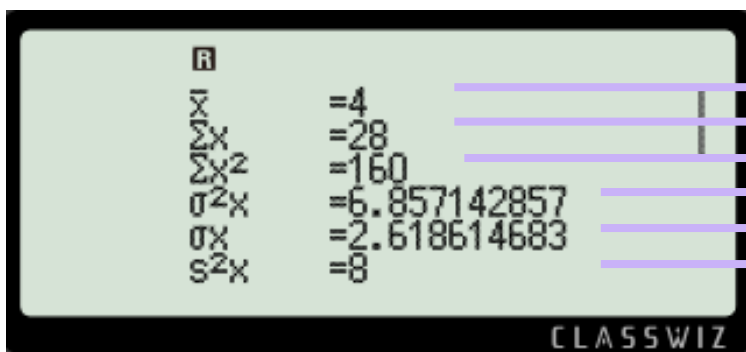
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Calculating mean, variance and standard deviation
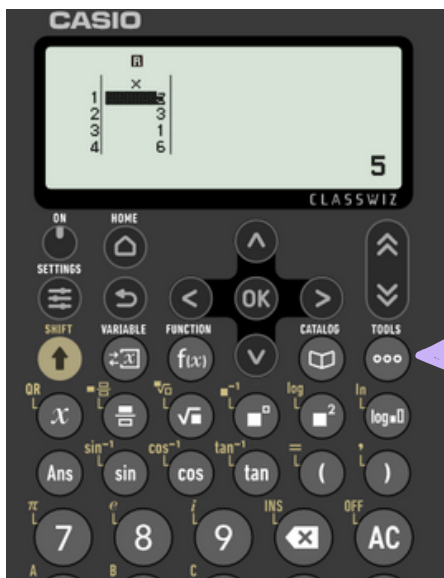
🔢 **CALCULATOR STEPS**

1. Press: [**Home button**]
2. Choose **Statistics**
3. Choose **1 variable**
4. Make sure frequency is off by pressing the **3 dots under "tools"**, choose **frequency**, choose **off**. Press the **back button** to go back to your table.
5. Enter your data
6. Press [**EXE**]
7. Select **1 var** results
8. Read your results

|	
$\bar{x}$ =4	**Mean**
Σx =28	Sum of all the values
Σx^2 =160	Sum of all the squared values
$\sigma^2 x$ =6.857142857	**Variance**
σx =2.618614683	**Standard Deviation**
$s^2 x$ =8	Sample Variance (ignore)

Calculating the PMCC and the equations of the regression line

🔢 CALCULATOR STEPS
1. Press: **[Home button]**
2. Choose **Statistics**
3. Choose **2 Variable**
   - Enter your data: Column 1 (x_1): First variable values
   - Column 2 (y_1): Second variable values
4. Press **[EXE]**
5. Select **Reg Results**
6. Choose **y=a+bx**
7. Look for **r** in the results

CASIO
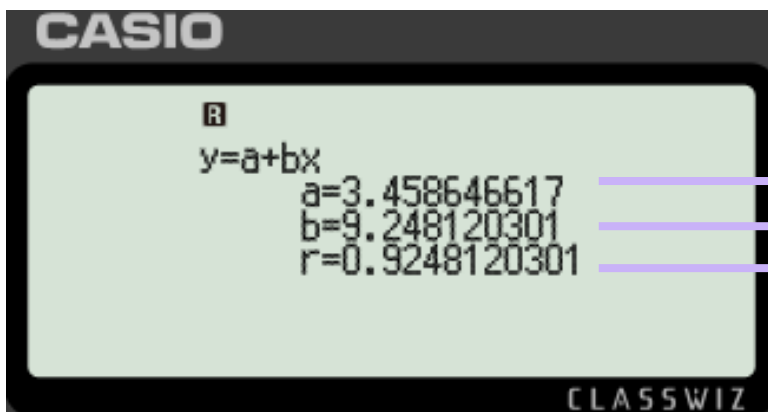
R
y=a+bx
a=3.458646617 → **Regression line y intercept**
b=9.248120301 → **Gradient of the regression line**
r=0.9248120301 → **PMCC**

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r = 0.925 indicates that it is a strong positive correlation

The regression line is a calculated version of a "line of best fit" that minimise the distance between all the points and the regression line.
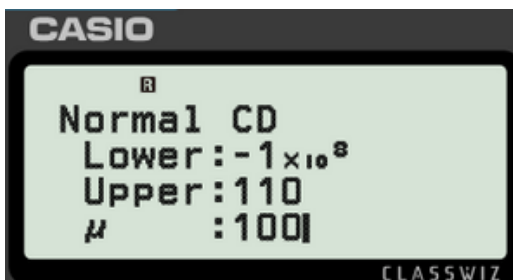
$$y = 9.25x + 3.46 \quad (3sf)$$

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Calculating Normal Probabilities

Example: $X \sim N(100, 15^2)$

Calculate P(X≤110)

Just write something very small like –10000000

CASIO

Normal CD
  Lower:-1×10⁸
  Upper:110
  μ   :100|

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🔢 **CALCULATOR STEPS**
1. Press: [**Home button**]
2. Choose **Distribution**
3. Choose **Binomial CD**
4. Choose **Lower as a very small value**
5. Choose **Upper as 110**
6. Choose mean(μ) 110
7. Standard deviation(σ) as 15
Press **[EXE]**

Calculate P(X≥95)

So you must calculate:
1 – P (X≤4)
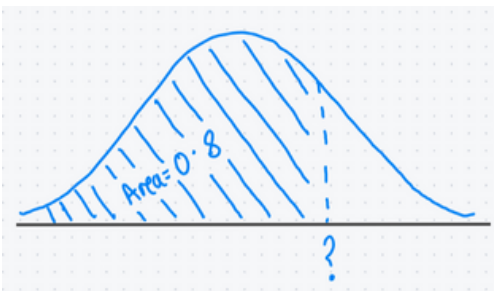because you want to include the 5 and not subtract it

🔢 **CALCULATOR STEPS**
1. Press: [**Home button**]
2. Choose **Distribution**
3. Choose **Normal CD**
4. Choose **Lower as 95**
5. Choose **upper as a very large value (like 100000)**
6. Choose **mean(μ) as 100**
7. Choose **Standard deviation(σ) as 15**
8. Press **[EXE]**

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Inverse Normal Probabilities

Example: $X \sim N(100, 15^2)$

Calculate x
$P(X \leq x) = 0.8$

🔢 **CALCULATOR STEPS**
1. Press: [**Home button**]
2. Choose **Distribution**
3. Scroll Down
4. Choose **Inverse Normal**
5. Enter:

$\qquad$ Area = 0.8
$\qquad\qquad$ μ = 100
$\qquad\qquad$ σ = 15
6. **Press [EXE]**

The answer is 112.62. This means that there is a 80% chance that X is less than 112.62.

Calculate x
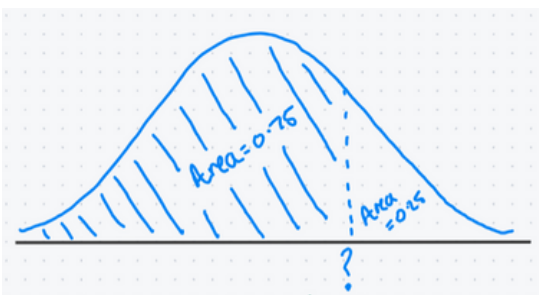## $P(X \geq x) = 0.25$

Inverse normal only calculates less than or equal to.

🔢 **CALCULATOR STEPS**
1. Press: [**Home button**]
2. Choose **Distribution**
3. Scroll Down
4. Choose **Inverse Normal**
5. Enter:

$\qquad$ Area = 0.75
$\qquad\qquad$ μ = 100
$\qquad\qquad$ σ = 15
6. **Press [EXE]**

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Hypothesis Testing with the Normal Distribution – full example

A machine fills bags with mean weight 500g. After maintenance, you test if the mean has changed. Sample of 25 bags gives x̄ = 495g. Population σ = 20g. Test at 5% significance.

Define your variables

X = weight of a bag $\bar{X}$ = sample mean weight of 25 bags

First, remember we are hypothesis testing using the SAMPLE MEAN distribution. So we need to adjust the standard deviation:

$$\sigma = 20g \qquad \sigma_{\bar{x}} = \sqrt{\frac{20^2}{25}} = 4$$

We set up the distribution for the sample mean:

$$\bar{X} = N(500, 4)$$

Set up your hypothesis tests:

$$H_0: \bar{X} = 500 \qquad H_1: \bar{X} \neq 500$$

Half the significance level for a two tailed test.

Calculate the probability of the sample mean:

$$P(\bar{X} \leq 495) = 0.1056 > 2.5\%$$

🔢 CALCULATOR STEPS
1. Press: **[Home button]**
2. Choose **Distribution**
3. Choose **Normal CD**
4. Choose **Lower as –999**
5. Choose **upper as 495**
6. Choose **mean as 500**
7. Choose **standard deviation as 4**
8. Press **[EXE]**

Conclusion:

Since $P(\bar{X} \leq 49.5) > 2.5\%$ we accept H_0.

There is not sufficient evidence to say the mean weight of the bags has changed.

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Solving Quadratics and Cubics

Solve $2x^2 + 5x + 2 = 0$

🔢 **CALCULATOR STEPS**
1. Press: [**Home button**]
2. Select: **Equation**
3. Choose: **Polynomial**
4. Choose the **quadratic or cubic function**
5. **Input** your coefficients.
5. Press [**EXE**] to see the results

Yes really

Factorising Quadratics and Cubics

WoW!

Factorise $2x^2 + 11x + 12$

🔢 **CALCULATOR STEPS**
1.Solve the equation = 0 as above
2. Rearrange the solutions to =0
3. Create the brackets and check to see if an adjustment is needed

$$x = \frac{-3}{2} \qquad x = -4$$

$$2x = -3 \qquad x + 4 = 0$$

$$2x + 3 = 0$$

Factorised form:

$$(2x+3)(x+4)$$

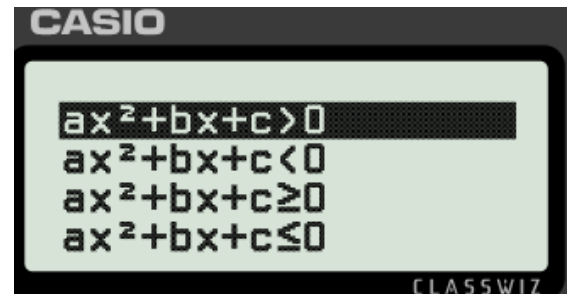**Confused? Watch me go through this here.**

Solving inequalities

🔢 **CALCULATOR STEPS**
1. Press: [**Home button**]
2. Scroll down to **inequality**
3. Choose quadratic (most common)
4. Choose the appropriate inequality
4. Enter coefficients
5. Press **[EXE]**

CASIO

📋 Spreadsheet	🔲 Table	XY=0 Equation
XY>0 Inequality	🄸 Complex	$_2 8^{10^{16}}$ Base-N

CLASSWIZ

CASIO

$ax^2+bx+c>0$
$ax^2+bx+c<0$
$ax^2+bx+c\geq0$
$ax^2+bx+c\leq0$

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Solve simultaneous equations

CASIO

×÷− Calculate	📊 Statistics	📈 Distribution
📋 Spreadsheet	🔲 Table	**XY=0 Equation**

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CASIO

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$\begin{cases} 3x + 2y = 16 \\ 1x - 1y = 1 \end{cases}$

1

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🔢 **CALCULATOR STEPS**
1. Press: [**Home button**]
2. Scroll down to **Equation**
3. Choose **Simul Equation**
4. Choose the number of unknowns (usually 2)
5. Enter the coefficients (remember they might be different letters, and you need the unknowns on one side)
6. Press **[EXE]** to go through the solutions
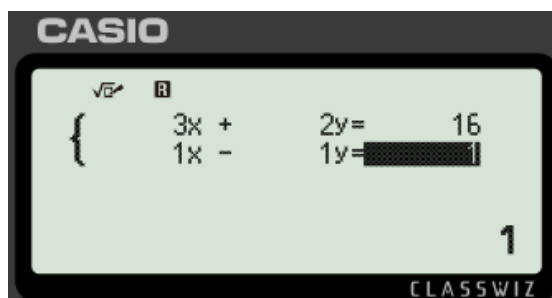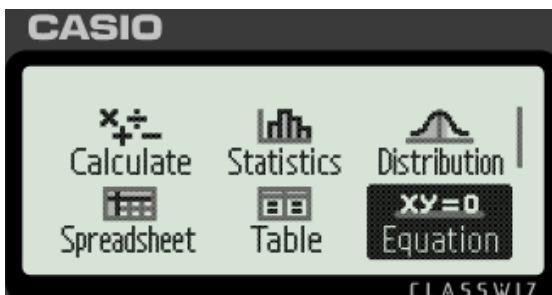
You must first rearrange both your equations into this form first!

Very useful for **Pure, Mechanics** and **Statistics** (save yourself time and errors!)

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Finding the equation of a straight line given two points

Wow!

**Find the equation of the line passing through the points (2, 5) and (8, 17).**
Give your answer in the form y = mx + c

Remember - in the exam, you often need to show working for this.

Calculator Method:
🔢 CALCULATOR STEPS
1. Press: **[Home button]**
2. Choose **Statistics**
3. Choose **2 Variable**
   - Enter your coordinates:
   - x_1 column: 2, 8
   - y_1 column: 5, 17
4. Press **[EXE]**
5. Select **Reg Results**
6. Select **y = a+bx**
   - Read the values:
   - b = gradient (m)
   - a = y-intercept (c)

CASIO

	x		y	
1		2		5
2		8		17
3				
4				

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CASIO

y=a+bx
a=1
b=2
r=1

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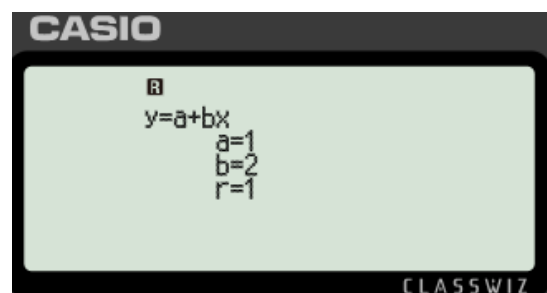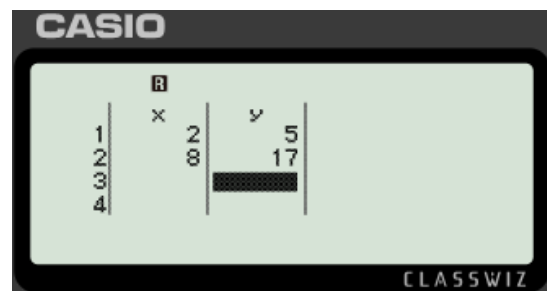
Solution y = 2x + 1

Calculating the coefficients for binomial expansion

Find the first 3 terms of the expansion $(2+3x)^5$

$$^5C_0 \times 2^5 \times (3x)^0 \quad + \quad ^5C_1 \times 2^4 \times (3x)^1 \quad + \quad ^5C_2 \times 2^3 \times (3x)^2$$

$$1 \times 32 \times 1 \quad + \quad 5 \times 16 \times 3x \quad + \quad 10 \times 8 \times 9x^2$$

$$32 \quad + \quad 240x \quad + \quad 720x^2$$

Calculator Method:

🔢 CALCULATOR STEPS
1. Press: **[Home button]**
2. Choose **Calculate**
3. Press **[Catalog]**
4. Choose **probability**
5. Select **Combination**
6. Press the **[left button]** to put a number in front and then the **[right button]** to put a number after.
7. Press **[EXE]**
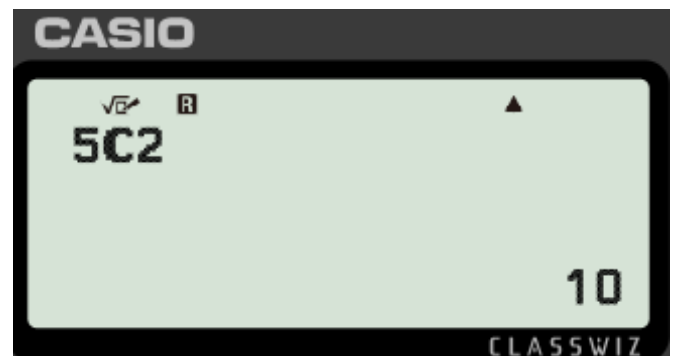
Need help improving your grades?
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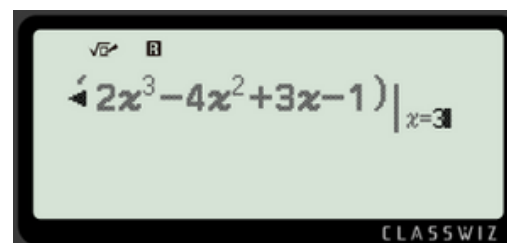
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Checking differentiation / Calculating the derivative at a certain point

Given $f(x) = 2x^3 - 4x^2 + 3x - 1$, find $f'(3)$

Calculator Method:
🔢 CALCULATOR STEPS
1. Press: **[Home button]**
2. Choose **Calculate**
3. Choose **Catalog**
4. Choose **Func Analysis**
5. Choose **Derivative**
6. Enter your **f(x) function** using the **[x]** button as your variable.
7. Choose use the **right arrow** and enter the value of x that you want to calculate the derviative for (3 in this case).
8. Presse **[EXE]**

$$2x^3 - 4x^2 + 3x - 1)\Big|_{x=3}$$

Checking differentiation: You can use this method to check your differentiation even when not evaluating at a point.
>Just pick a couple of values to put into the calculator and compare it to when you substitute into your answer. It's not 100% fool proof but it's a pretty good checking method
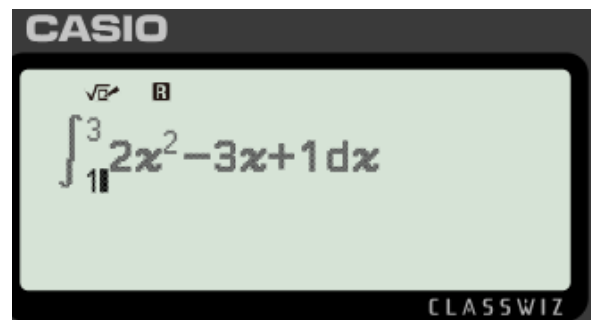
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Checking Definite Integration

Evaluate $\int_1^3 (2x^2 - 3x + 1)\, dx$

$$= \left[\frac{2x^3}{3} - \frac{3x^2}{2} + x \right]_1^3$$

$$= \left(\frac{2(3)^3}{3} - \frac{3(3)^2}{2} + 3 \right) - \left(\frac{2(1)^3}{3} - \frac{3(1)^2}{2} + 1 \right)$$

$$= \frac{22}{3}$$

🔢 CALCULATOR STEPS
1. Press: **[Home button]**
2. Press **calculate**
3. Choose **Func Analysis**
4. Choose **integration**
5. Enter the function: **2x² – 3x + 1**
6. Use the **[right arrow]** to scroll.
   Enter lower limit: **1**
7. Enter upper limit: **3**
8. Press **[EXE]**

CASIO

√▱ ℝ

$$\int_1^3 2x^2 - 3x + 1\, dx$$

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Checking Indefinite Integration

(only use if you have time at the end!)

WOW!

Find $\int x\sqrt{(x+4)}\, dx$

$\int (u^2-4) \times u \times 2u \, du$

$\int 2u^4 - 8u^2 \, du$

$= \dfrac{2u^5}{5} - \dfrac{8u^3}{3} + c$

$= \dfrac{2(\sqrt{x+4})^5}{5} - \dfrac{8(\sqrt{x+4})^3}{3} + c$

Let $u = \sqrt{x+4}$

$u^2 - 4 = x$

$\dfrac{dx}{du} = 2u$

$dx = 2u\, du$

Now for the magic – check your answer by making up your own limits (use 0 and 1 for convenience)

$\left[\dfrac{2(\sqrt{x+4})^5}{5} - \dfrac{8(\sqrt{x+4})^3}{3} \right]_0^1$

$= \left(\dfrac{2\sqrt{5}^5}{5} - \dfrac{8\sqrt{5}^3}{3} \right) - \left(\dfrac{2\sqrt{4}^5}{5} - \dfrac{8\sqrt{4}^3}{3} \right)$

$= 1.079773408$

WARNING – this is a checking step. You do not need to write this – don't confuse the examiner. Just type this straight into your calc.

🔢 CALCULATOR STEPS
1. Press: **[Home button]**
2. Press **calculate**
3. Choose **Func Analysis**
4. Choose **integration**
5. Enter the function: **x√(x + 4)**
6. Use the **[right arrow]** to scroll. Enter lower limit: **0**
7. Enter upper limit: **1**
8. Press **[EXE]**
9. **Check if the answers are the same.**

CASIO

$\int_0^1 x\sqrt{x+4}\, dx$

1.079773408

CLASSWIZ
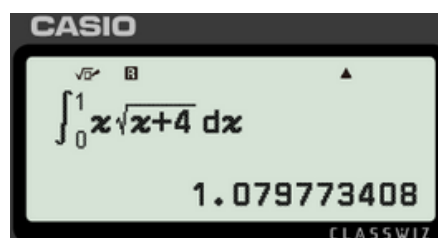
This matches our answer so we are most likely correct!

My opinion about the summation calculator for sequences and series
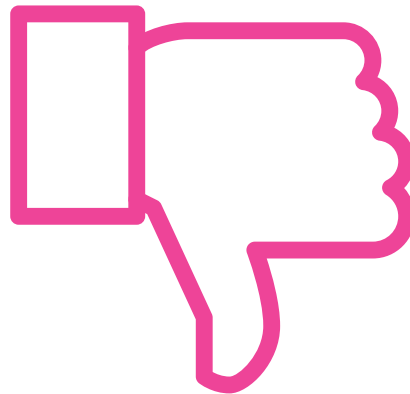
The **two formula to sum a series are pretty straightforward** and simple if you understand them. The calculator **needs to have the nth term in a specific format for you to even use this function** and it takes a while to calculate it. My advice is, **don't bother using this function** on the calculator.

The formulae are in the formula booklet

Arithmetic series

$$S_n = \tfrac{1}{2}n(a + l) = \tfrac{1}{2}n[2a + (n - 1)d]$$

Geometric series

$$S_n = \frac{a(1 - r^n)}{1 - r}$$

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Numerical methods- iteration

Example: Solve $x^3 - x - 1 = 0$ to 3sf using iteration

Rearrange to: $x = \sqrt[3]{(x + 1)}$

Starting value: $x_0 = 1$

Calculator Method:
🔢 CALCULATOR STEPS
1. Press: **[Home button]**
2. Choose **Calculate**
3. Enter the **starting value** (1 in this case) and press **[EXE]** – this stores 1 as "ans"
4. Press **[AC]**
5. Enter the rearranged formula replacing the x with **ans**
6. Press **[EXE]**
7. Record your answer as x1
8. Continue pressing **[EXE]** and recording your solutions until you see no change (to 3sf) at least 3 times.
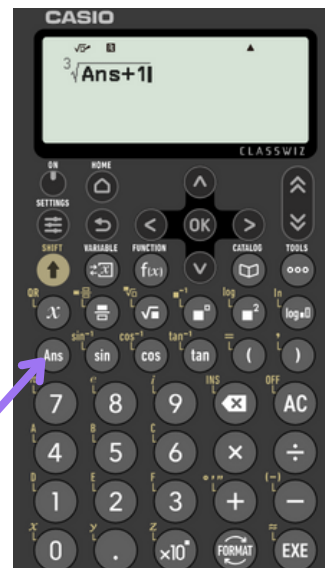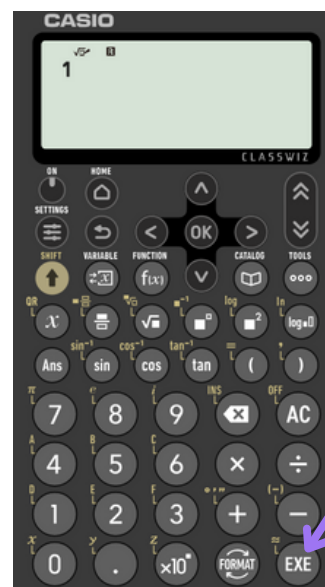
$x_0 = 1$

$x_1 = 1.25992105$

$x_2 = 1.312293837$

$x_3 = 1.322353819$ ⎫
$x_4 = 1.324268145$ ⎬ No change
$x_5 = 1.324632625$ ⎭

$\therefore$ $x = 1.32$ (3sf)

Using the calculator for mechanics

There are not a great deal of uses for the calculator's advanced functions in mechnics but a few that might e useful are as follows:

Unit Conversions
In Mechanics we generally convert everything to SI Units so we use kg, metres and seconds. The most useful conversion your calculator can do is Velocity conversions

Calculator Method:
🔢 CALCULATOR STEPS
1. Press: **[Home button]**
2. Choose **Calculate**
3. Press **[Catalog]**
4. Scroll down to **unit conversions.**
5. Choose velocity
6. Choose which way you want to convert.
7. Put your number at the start.
8. Press **[EXE]**
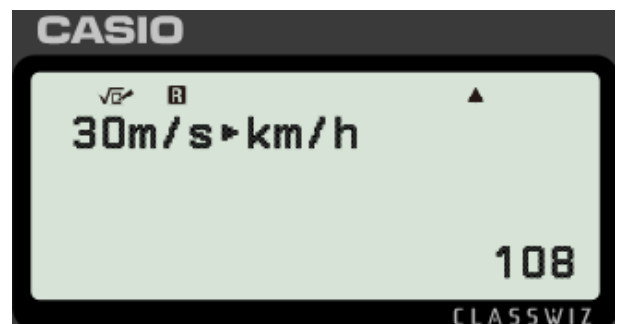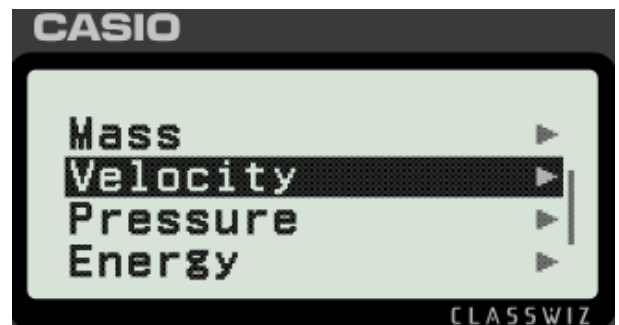
Simultaneous equations
Simultaneous equations come up a lot in Mechanics and so using the method from page 13 will help speed up the process and avoid error. For example, in pulleys questions when you have two equations of motion and need to calculate the Tension.

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These shortcuts will save you time in exams, but if you're **serious about hitting the grade you want**, you need more than quick fixes.

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Interactive Q&A throughout

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