4S ACADEMY • DIGITAL SAT MATH • ADVANCED

Desmos Calculator Hacks for Module 2

Seven techniques that turn the hardest Module 2 questions into a few taps

The Digital SAT gives you the built in Desmos graphing calculator on the entire Math section. Used well, it converts algebra-heavy Module 2 questions into fast, visual ones. Each technique below gives you the move, a worked problem, and the trap that quietly costs points. Practise them until they are automatic.

1. Solve any equation by graphing

Strategy. To solve $f(x) = g(x)$, type `y=f(x)` and `y=g(x)` as two lines and read the x of the intersection. To solve $f(x) = 0$, type `y=f(x)` and read the x intercepts. Click any point to reveal exact coordinates.

Problem. Solve $3x^2 - 5x - 2 = 0$.

Solution. Type $y = 3x^2 - 5x - 2$. The curve crosses the x axis at $x = 2$ and $x = -\frac{1}{3}$. No factoring or quadratic formula needed.

Trap. Desmos gives decimals ($-0.333\ldots$). Convert to the exact form the question wants, here $-\frac{1}{3}$, before you enter the answer.

2. Systems of equations, linear and nonlinear

Strategy. Type both equations. The intersection point or points are the solutions. This works for two lines, a line and a parabola, a circle and a line, and more. For a "how many solutions" question, just count the intersections.

Problem. How many real solutions does the system $y = x^2 - 2$ and $y = 2x + 1$ have?

Solution. Graph both. They meet at two points, so there are 2 solutions. Clicking each intersection gives $(-1, -1)$ and $(3, 7)$.

Trap. A "no solution" answer is a real option: if the graphs never touch, the count is 0. Do not assume there must be an intersection.

3. Quadratics: vertex, roots, and max or min

Strategy. Type the quadratic and click the curve. Desmos marks the vertex (the maximum or minimum) and the zeros. The x of the vertex is the axis of symmetry; the y of the vertex is the maximum or minimum value.

Problem. What is the minimum value of $f(x) = x^2 - 6x + 5$, and where does it occur?

Solution. Graph it and click the lowest point: the vertex is $(3, -4)$. The minimum value is -4, occurring at $x = 3$.

Trap. Read what the question asks. "Where" wants the x value (3); "what is the minimum value" wants the y value (-4). They are different numbers.

4. Regression: line and curve of best fit

Strategy. For data and modelling questions, enter the data as a **table**, then type a regression: linear $y_1 \sim mx_1 + b$, quadratic $y_1 \sim ax_1^2 + bx_1 + c$, or exponential $y_1 \sim a\,b^{x_1}$. Desmos returns the parameters and R^2.

Problem. A table shows a population doubling each year. Which model fits, and what does it predict at $x = 6$?

Solution. Enter the table, type $y_1 \sim a\,b^{x_1}$. Desmos returns $b \approx 2$ with $R^2 \approx 1$ (a near-perfect exponential fit). Read the curve at $x = 6$ for the prediction.

Trap. "Best models the data" means highest R^2. A line can look close on a short range but lose badly to the right curve; always check R^2, do not eyeball it.

5. Inequalities and regions

Strategy. Type an inequality such as $y < 2x + 1$ and Desmos shades the solution region. To test "which point satisfies the system", graph every inequality and see which point lands inside the overlap.

Problem. Which of $(0, 0)$, $(2, 1)$, $(1, 3)$ satisfies both $y \geq x - 1$ and $y < 1$?

Solution. Shade both regions and see which point lands in the overlap. $(0, 0)$: $0 \geq -1$ and $0 < 1$, inside. $(2, 1)$: fails $1 < 1$. $(1, 3)$: fails $3 < 1$. So only $(0, 0)$ works.

Trap. Watch strict vs inclusive: $<$ shades to a *dashed* boundary (not included), $\leq$ to a solid one (included). A point exactly on a dashed line does not count.

6. Circles and coordinate geometry

Strategy. A circle is $x^2 + y^2 = r^2$ at the origin, or $(x - h)^2 + (y - k)^2 = r^2$ in general. Type it to visualise or verify, and to find where a line meets a circle.

Problem. Where does $y = x + 1$ meet the circle $x^2 + y^2 = 25$?

Solution. Type both. Desmos draws the line cutting the circle at $(-4, -3)$ and $(3, 4)$; click each crossing to read them.

Trap. Given a general equation like $x^2 + y^2 - 10x + 6y + 18 = 0$, type it as it stands, Desmos still draws the circle, so you never have to complete the square by hand to see the centre and radius.

7. Tables and plug-in verification

Strategy. Even when you solve by hand, confirm before moving on. Add a **table** of x values to check a function's output, or graph an answer choice to see if it fits. A five second check on a timed section prevents careless misses.

Problem. You solved an equation and got $x = 4$. Confirm it.

Solution. Type the original expression as y, add a table with $x = 4$, and read the output; or plug $x = 4$ back into both sides and confirm they match. If they do not, you have caught an error for free.

Trap. If you rearranged or squared an equation, you may have created an *extraneous* solution. Always verify each answer in the *original* equation, not the rearranged one.

On test day. Reach for Desmos whenever a question involves solving, a system, a max or min, data, or a graph. It is faster and less error prone than hand algebra, and it doubles as your checker for answers you found by hand.

4S Academy drills these until they are second nature in live Digital SAT sessions, then pairs them with timing and error logs so your score actually moves. Book a free 15 minute consultation at **4sacademy.com**