



SAT MATH GUIDE

A math guide by a perfect scorer.

WHAT IS INSIDE

1

Every formula

sorted by the four test domains

20 PAGES

2

Desmos

exactly what to type, on every topic

20 TIPS

3

Shortcuts

the ones nobody teaches you

15 OF THEM

4

Mistakes

where the marks actually go

14 TRAPS

Never think twice before investing in yourself.

Method, not more content.

By Shuja Haider

coachingwithshuja.com

Edition 2.0 · August 2026



Before you start

Three minutes of reading that will save you a lot of time later.

Know what is already given

The test prints a box of formulas at the top of every maths module. Cards marked ON THE SHEET are in that box. Do not spend time learning them. Just know where they are.

Desmos is open the whole time

Every card that can be done faster on Desmos has a blue line showing you exactly what to type. Learn those. They are worth more than any formula on this sheet.

Do the shortcuts last

Learn the normal method first. A shortcut you half remember will slow you down more than doing it the long way.

Read the mistakes page twice

Almost nothing is lost to hard maths. It is lost to reading the question wrong, and the same few mistakes come up again and again.

How the test is set up

	Questions	Time	Per question	Notes
Module 1	22	35 min	about 95 s	Everyone gets the same one
Module 2	22	35 min	about 95 s	Gets harder or easier based on Module 1
Total	44	70 min		Two modules, back to back

NOTE What 95 seconds really means

You do not spend 95 seconds on every question. Spend 40 to 60 on the easy ones so you have two and a half minutes for the three or four that are actually hard. That is the only reason speed matters.



What you get free, and what you do not

The test prints a formula box at the top of every maths module. Everything in it is on the left. Everything you actually have to carry in is on the right.

Circle ON THE SHEET $A = \pi r^2$ $C = 2\pi r$	Rectangle ON THE SHEET $A = \ell w$	Triangle ON THE SHEET $A = \frac{1}{2}bh$	Right triangle ON THE SHEET $c^2 = a^2 + b^2$
Box ON THE SHEET $V = \ell wh$	Cylinder ON THE SHEET $V = \pi r^2 h$	Sphere ON THE SHEET $V = \frac{4}{3}\pi r^3$	Cone ON THE SHEET $V = \frac{1}{3}\pi r^2 h$
Pyramid ON THE SHEET $V = \frac{1}{3}\ell wh$	Special trian ON THE SHEET $x, x\sqrt{3}, 2x$ $s, s, s\sqrt{2}$	Circle facts ON THE SHEET 360° round 2π radians	Triangle angl ON THE SHEET add to 180°

Nowhere in the test, so you have to know it

What you need	Where it comes up
Slope, and all three forms of a line	Algebra
How many solutions a system has	Algebra
Quadratic formula and how many real roots	Advanced Math
Sum and product of the solutions	Advanced Math
Vertex from $-b$ over $2a$	Advanced Math
All the exponent and radical rules	Advanced Math
Growth, decay and compound interest	Advanced Math
Percent change and the multiplier method	Problem Solving
How mean, median, range and SD behave	Problem Solving
Equation of a circle, and completing the square	Geometry
Arc length, sector area, radians	Geometry
Surface area of anything at all	Geometry
SOH CAH TOA and $\sin x = \cos(90 - x)$	Geometry

NOTE The point of this page

Do not spend a single minute learning the left hand side. Spend it all on the right hand side, and on knowing where the box is when you need it.



Algebra

Linear equations, linear functions, inequalities and systems. The biggest block of marks on the test.

Linear equations in one variable

Solving

$$ax + b = c$$

Undo whatever was done to x, in reverse order.
Brackets first, then collect the x terms on one side.

In Desmos: type the whole equation with x in it and read the value Desmos shows on the line below.

No solution or all values

$$3x + 2 = 3x + 5$$

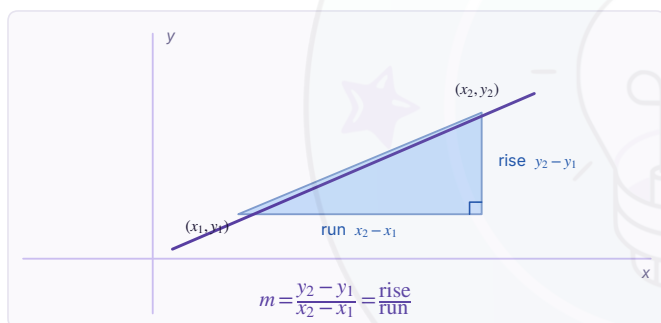
no solution

$$3x + 2 = 3x + 2$$

true for every x

Simplify both sides. If the x terms cancel and you are left with something false, there is no solution. If you are left with something true, every value of x works.

Linear equations in two variables and linear functions



One solution



lines cross once
 $a_1/a_2 \neq b_1/b_2$

No solution



parallel, different c
 $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

Infinitely many



same line twice
 $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

Slope

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

rise over run

In Desmos: type both points as (x, y) and Desmos will plot them. Type the line through them to check.

Slope-intercept form

$$y = mx + b$$

b is where the line crosses the y-axis. m is how much y changes every time x goes up by 1.

Point-slope form

$$y - y_1 = m(x - x_1)$$

Fastest when you are given one point and the slope.
No rearranging.

Standard form

SHORTCUT

$$Ax + By = C$$

Slope is $-A/B$ without rearranging anything. Useful when comparing two lines for parallel or perpendicular.



Parallel and perpendicular

$$m_1 = m_2$$

parallel

$$m_1 m_2 = -1$$

perpendicular

Perpendicular means flip the fraction and change the sign. Slope $2/3$ becomes $-3/2$.

Reading a word problem

$$y = mx + b$$

The rate, the 'per hour' or 'per item' number, is m . The starting amount, the fixed fee, the deposit, is b .

Distance between two points

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

This is just Pythagoras with the horizontal and vertical gaps.

Midpoint

$$M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

Average the x values, average the y values.

Linear inequalities

The one rule that matters

$$-2x > 6 \Rightarrow x < -3$$

Multiply or divide by a negative and the sign flips. Everything else works exactly like an equation.

Which side to shade

$$y > mx + b$$

above the line

$$y < mx + b$$

below the line

Solid line for less than or equal, dashed for strictly less than.

In Desmos: type the inequality exactly as written and Desmos shades the correct region for you. For a system, type both and look at the overlap.

Absolute value

$$|x| < a \Rightarrow -a < x < a$$

one range in the middle

$$|x| > a \Rightarrow x < -a \text{ or } x > a$$

two separate pieces

Less than gives you a sandwich. Greater than splits into two.

Words to signs

at most $\leq$ at least $\geq$

'No more than' is the same as at most. 'Fewer than' is strictly less than, with no equals.

Systems of linear equations

This is the question the test asks most often in this topic, and there is a clean way to do it that never fails.



NOTE How many solutions: the method that always works

Put both equations into $y = mx + b$. Then just look at them.

Different m , the lines cross once, so there is exactly one solution.

Same m but different b , the lines are parallel and never meet, so there is no solution.

Same m and same b , it is the same line written twice, so there are infinitely many solutions.

That is the whole thing. Slope decides whether they meet, intercept decides whether they are the same line.

SHORTCUT The faster version once you trust it

If both equations are in the form $ax + by = c$, you can compare the numbers directly without rearranging.

a_1/a_2 is not equal to b_1/b_2 , one solution.

$a_1/a_2 = b_1/b_2$ but not equal to c_1/c_2 , no solution.

$a_1/a_2 = b_1/b_2 = c_1/c_2$, infinitely many.

Same answers, about ten seconds faster. Use it once the slope method feels automatic, not before.

Solving a system by hand

substitution or elimination

If one equation already has x or y on its own, substitute. If the coefficients line up nicely, eliminate. Otherwise just use Desmos.

In Desmos: type both equations on separate lines and click the point where the lines cross. Desmos gives you the exact coordinates.

When they ask for $x + y$

TRAP

$$x + y \quad 2y \quad y - x$$

Read the last line of the question again. It very often wants a combination, not x on its own. The value of x will still be sitting there as an answer choice.



Advanced Math

Equivalent expressions, nonlinear equations and systems, and nonlinear functions.

Equivalent expressions

Exponents

$$x^a x^b = x^{a+b}$$

$$\frac{x^a}{x^b} = x^{a-b}$$

$$(x^a)^b = x^{ab}$$

Multiply, add the powers. Divide, subtract them.
Power of a power, multiply them.

The awkward ones

$$x^0 = 1$$

$$x^{-a} = \frac{1}{x^a}$$

$$x^{a/b} = \sqrt[b]{x^a}$$

A negative power means flip it. A fraction power means a root. The bottom of the fraction is the root.

Factoring you should spot instantly

$$a^2 - b^2 = (a+b)(a-b)$$

$$a^2 \pm 2ab + b^2 = (a \pm b)^2$$

Difference of squares also works on numbers. 51 squared minus 49 squared is 100 times 2, so 200.

Radicals

$$\sqrt{ab} = \sqrt{a} \sqrt{b}$$

$$\frac{1}{\sqrt{a}} = \frac{\sqrt{a}}{a}$$

Split a root over a product. To clear a root from the bottom, multiply top and bottom by it.

Rational expressions

undefined when the bottom is 0

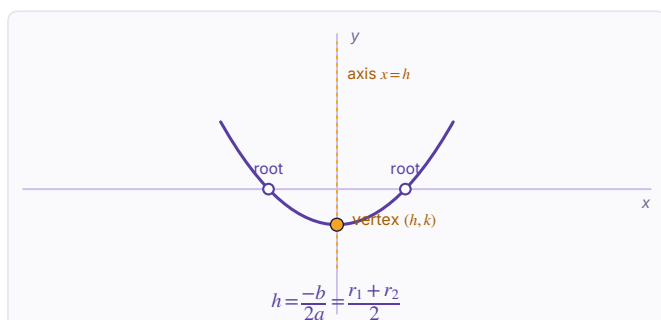
'For what value of x is this undefined' is a one step question. Set the denominator to zero and solve.

Checking two expressions match

$$f(x) = g(x)?$$

In Desmos: type both expressions as y1 and y2. If the graphs sit exactly on top of each other, they are equivalent. Faster than expanding by hand.

Nonlinear equations and systems





The three forms of a quadratic

$$y = ax^2 + bx + c$$

c is the y-intercept

$$y = a(x - h)^2 + k$$

vertex is (h, k)

$$y = a(x - r_1)(x - r_2)$$

roots are r1 and r2

Each form hands you something for free. Pick the form that already contains what the question wants.

Quadratic formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

In Desmos: type the equation with = 0 and Desmos marks both roots on the x-axis. Click them to read the values.

How many real solutions

$$b^2 - 4ac$$

Positive means two, zero means one, negative means none. This is the same idea as before: does the curve cross the x-axis, touch it, or miss it entirely.

Vertex without any work

SHORTCUT

$$x = \frac{-b}{2a}$$

Put that x back into the equation to get the y value. The vertex also sits exactly halfway between the two roots.

Sum and product of the solutions

SHORTCUT

$$r_1 + r_2 = -\frac{b}{a}$$

$$r_1 r_2 = \frac{c}{a}$$

When the question says 'the solutions are p and q, find p + q', you do not need to solve anything. Read it off the coefficients. Divide by a, not just by 1.

Completing the square

$$x^2 + bx = \left(x + \frac{b}{2}\right)^2 - \left(\frac{b}{2}\right)^2$$

Halve the number in front of x, square it, add and subtract it. You need this for vertex form and for circle equations.

A curve and a line together

set them equal

In Desmos: type both and click the crossing points. This also instantly tells you how many solutions there are, which is usually what is asked.

Solutions that do not actually work

TRAP

check both answers

If you squared both sides or multiplied out a denominator with x in it, you can create an answer that fails in the original equation. Put both back in and check.

Nonlinear functions

Function notation

$$f(3)$$

put 3 in wherever you see x

$f(x) = 0$ means the same as roots, x-intercepts, zeros and solutions. The test swaps between those words deliberately.

Moving a graph up and down

$$f(x) + k$$

up by k

$$f(x) - k$$

down by k

Outside the bracket, it does exactly what it looks like.



Moving a graph left and right

TRAP

$$f(x+h)$$

LEFT by h

$$f(x-h)$$

RIGHT by h

Inside the bracket, it does the opposite of what it looks like. This catches almost everyone once.

Flipping a graph

$$-f(x)$$

flips top to bottom

$$f(-x)$$

flips left to right

In Desmos: type $f(x)$ and the transformed version together and watch what moves. Ten seconds and you will never mix them up again.

Growth and decay

$$y = a(1+r)^t$$

growth

$$y = a(1-r)^t$$

decay

a is where it starts, r is the rate as a decimal, t is how many times it has happened.

Doubling and half life

$$y = a \cdot 2^{t/d}$$

doubles every d

$$y = a\left(\frac{1}{2}\right)^{t/h}$$

halves every h

Divide the time by the length of one doubling or halving.

Compound interest

TRAP

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

n is how many times a year it compounds. 12 for monthly, 4 for quarterly. The power is n times t, not t.

Is it linear or is it growth

+5 a year vs +5% a year

Same amount added each time is linear. Same percentage each time is exponential. The test writes both sentences almost identically.

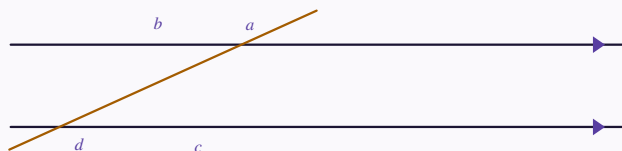


Geometry and Trigonometry

Lines and angles, triangles, right triangle trig, circles, area and volume.

Lines, angles and triangles

Parallel lines + transversal



corresponding & alternate angles are EQUAL
co-interior angles SUM TO 180°

Similar figures



$$\frac{a}{a'} = \frac{b}{b'} = k$$

area $\times k^2$ volume $\times k^3$

Angles on a line and round a point

$$180^\circ \quad 360^\circ$$

Angles opposite each other where two lines cross are equal.

Parallel lines cut by a third line

matching angles are equal

Angles in the same position are equal. Angles on the same side between the lines add to 180.

Angles in shapes

$$\text{triangle} = 180^\circ$$

$$(n - 2) \times 180^\circ$$

any polygon

The outside angles of any polygon always add to 360, whatever the number of sides.

Exterior angle of a triangle

SHORTCUT

ext = the two far angles added

Saves you doing 180 minus something twice.

Similar shapes

all sides scale by the same k

If the sides are in the ratio 2 to 3, the areas are 4 to 9 and the volumes are 8 to 27. Square it for area, cube it for volume.

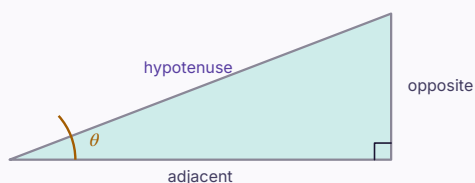
Equilateral triangle area

$$A = \frac{s^2 \sqrt{3}}{4}$$

Not on the reference sheet, and it comes up.

Right triangles and trigonometry

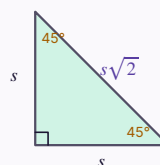
SOH · CAH · TOA



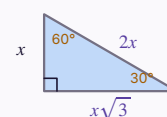
$$\sin \theta = \frac{o}{h} \quad \cos \theta = \frac{a}{h} \quad \tan \theta = \frac{o}{a}$$

$$a^2 + b^2 = c^2$$

45-45-90



30-60-90





SOH CAH TOA

$$\sin = \frac{\text{opp}}{\text{hyp}} \quad \cos = \frac{\text{adj}}{\text{hyp}} \quad \tan = \frac{\text{opp}}{\text{adj}}$$

Opposite is across from the angle. Adjacent is next to it. Hypotenuse is always the longest side.

The one trig fact worth memorising

SHORTCUT

$$\sin x = \cos(90^\circ - x)$$

If a question says $\sin(3x) = \cos(2x)$, then $3x + 2x = 90$. One line, no calculator. This turns a whole question type into arithmetic.

Triples worth recognising

3, 4, 5 5, 12, 13 8, 15, 17

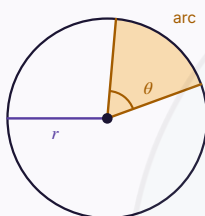
Also their multiples, so 6-8-10 and 9-12-15.
Spotting one saves you the whole Pythagoras step.

Sine squared plus cosine squared

$$\sin^2 \theta + \cos^2 \theta = 1$$

If you are given one of them, this gives you the other.

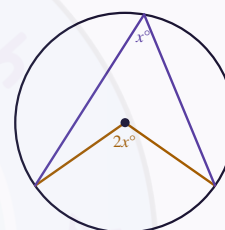
Circles



$$\text{arc} = 2\pi r \cdot \frac{\theta}{360} \quad \text{sector} = \pi r^2 \cdot \frac{\theta}{360}$$

$$(x-h)^2 + (y-k)^2 = r^2$$

Central vs inscribed



inscribed = $\frac{1}{2}$ × central

Equation of a circle

$$(x-h)^2 + (y-k)^2 = r^2$$

centre (h, k), radius r

Watch the signs. (x - 3) means the centre is at +3, not -3.

In Desmos: type the equation and Desmos draws the circle. You can see the centre and radius straight away.

Turning a messy circle equation into that form

$$x^2 + y^2 + Dx + Ey + F = 0$$

Complete the square on the x terms, then on the y terms. Halve, square, add to both sides. This is the standard hard circle question.

Arc and sector, one idea

SHORTCUT

$$\frac{\theta}{360} = \frac{\text{arc}}{\text{circumference}} = \frac{\text{sector}}{\text{area}}$$

One proportion replaces four formulas. Whatever fraction of 360 the angle is, that is the same fraction of the circumference and of the area.

Radians

$$180^\circ = \pi$$

$$\text{degrees} \times \frac{\pi}{180}$$

Half a circle is pi. A quarter is pi over 2. Most radian questions are just that.



Angles inside a circle

$$\text{inscribed} = \frac{1}{2} \times \text{central}$$

An angle drawn on the circle is half the angle at the centre standing on the same arc. An angle in a semicircle is always 90.

Diameter or radius

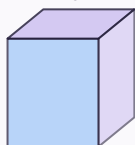
TRAP

$$d = 2r$$

Circle questions nearly always give you one and want the other. Write down $r =$ something before you touch a formula.

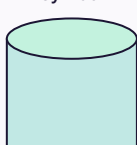
Area and volume

Prism



$$V = \ell wh$$

Cylinder



$$V = \pi r^2 h$$

Cone



$$V = \frac{1}{3} \pi r^2 h$$

Sphere



$$V = \frac{4}{3} \pi r^3$$

Volumes you are given

ON THE SHEET

$$V = \ell wh \quad V = \pi r^2 h$$

$$V = \frac{4}{3} \pi r^3 \quad V = \frac{1}{3} \pi r^2 h$$

All of these are printed in the test. Do not learn them.

Surface areas you are not given

$$\text{cylinder} = 2\pi r^2 + 2\pi rh$$

$$\text{sphere} = 4\pi r^2$$

$$\text{box} = 2(\ell w + \ell h + wh)$$

No surface area is printed anywhere. These you do have to know.

Any prism at all

SHORTCUT

$$V = \text{base area} \times \text{height}$$

Triangular, hexagonal, any shape, as long as the cross-section is the same all the way through. One formula covers all of them.

Cone and sphere against a cylinder

$$\text{cone} = \frac{1}{3} \text{cylinder}$$

$$\text{sphere} = \frac{2}{3} \text{cylinder}$$

Same radius and height. When a question puts two solids side by side, the answer is usually this ratio, no calculation needed.



Problem Solving and Data Analysis

Ratios and rates, percentages, one and two variable data, probability, and reading statistical claims.

Ratios, rates and proportions

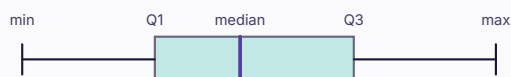
Percent change



$$\% \text{ change} = \frac{\text{new} - \text{old}}{\text{old}} \times 100$$

increase 15% = $\times 1.15$ decrease 15% = $\times 0.85$

Box plot anatomy



$$IQR = Q_3 - Q_1$$

Proportion

$$\frac{a}{b} = \frac{c}{d} \Rightarrow ad = bc$$

Set up the fraction so the same units are on the top of both sides. Then cross multiply.

Speed, distance, time

$$d = rt$$

Check the units before you calculate. Minutes and hours mixed together is the most common error here.

Unit conversion

$$\frac{60 \text{ km}}{1 \text{ h}} \times \frac{1000 \text{ m}}{1 \text{ km}} \times \frac{1 \text{ h}}{3600 \text{ s}}$$

Stack fractions so the unit you want gone cancels diagonally. If the units left over are the ones asked for, your working is right.

Two people working together

SHORTCUT

$$\frac{1}{t} = \frac{1}{a} + \frac{1}{b}$$

Two taps, two workers, two printers. Same structure every time.

Percentages

Percent change

$$\frac{\text{new} - \text{old}}{\text{old}} \times 100$$

Always divide by the old value, never the new one.

Use a multiplier instead

SHORTCUT

$$+15\% \Rightarrow \times 1.15$$

$$-15\% \Rightarrow \times 0.85$$

Turns every percent question into one multiplication.

Two changes in a row

SHORTCUT

$$\times 1.2 \times 0.8 = 0.96$$

Up 20 percent then down 20 percent leaves you 4 percent down, not back where you started. Multiply the multipliers.

Working backwards

$$\text{old} = \frac{\text{new}}{1.15}$$

'After a 15 percent rise it costs 460.' Divide, do not subtract 15 percent.



Three sentences that look the same

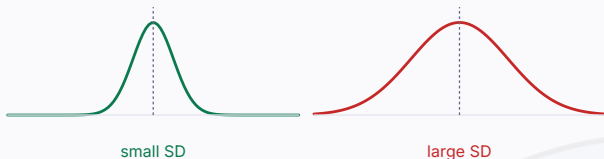
TRAP

$$0.3B \quad 1.3B \quad 0.7B$$

'30 percent of B' is $0.3B$. '30 percent more than B' is $1.3B$. '30 percent less than B' is $0.7B$.

One-variable data

Same mean, different spread
SD measures spread, never centre



Mean

SHORTCUT

$$\text{mean} = \frac{\text{total}}{\text{how many}}$$

Rearranged, total = mean times how many. Work in totals when a value is added or removed, it is far quicker.

Median

middle value once sorted

Sort the list first. The test gives it to you out of order on purpose. With an even count, average the middle two.

In Desmos: put the numbers in a table and type median(L1).

Range and IQR

$$\text{range} = \text{max} - \text{min}$$

$$\text{IQR} = Q_3 - Q_1$$

IQR is the width of the box in a box plot, the middle half of the data.

Standard deviation

how spread out the data is

You never calculate it. You only compare two sets. Bunched near the middle means small, spread out means large.

What changes	Mean	Median	Range	SD
Add the same number to everything	goes up	goes up	no change	no change
Multiply everything by k	times k	times k	times k	times k
Add one very large value	moves a lot	barely moves	grows	grows
Data gets more bunched up	same	same	shrinks	shrinks

NOTE Which way the mean moves

The mean gets dragged towards the extreme values, the median does not. So if there are a few very large values, the mean ends up bigger than the median. A few very small values and it ends up smaller.



Two-variable data and statistical claims

Line of best fit

$$\hat{y} = mx + b$$

'Predicted' always means read off the line, never off a plotted point.

In Desmos: put the data in a table, then type $y1 \sim mx1 + b$. Desmos gives you m and b straight away.

Margin of error

estimate $\pm$ margin

A bigger sample gives a smaller margin of error.
That one sentence answers most of these questions.

Who the result applies to

only the group sampled

If they surveyed one school at random, the conclusion is about that school. Not the city, not the country.

Does it prove cause

TRAP

only a randomised experiment does

If they just observed and recorded, you can say the two things are linked. You cannot say one caused the other.

Probability

$$P = \frac{\text{the ones you want}}{\text{the total}}$$

$$P(\text{at least one}) = 1 - P(\text{none})$$

In a two-way table, 'given that' or 'among those who' means your denominator is a row or column total, not the grand total.



Desmos

It is open for the whole maths section. Used properly it turns several questions a paper into a two second read.

Solve any equation at all

$$y_1 = \text{left side} \quad y_2 = \text{right side}$$

Type each side on its own line, then click where the two graphs cross. Works for roots, fractions, absolute values, powers, anything.

Solve a system

type both, click the crossing point

No substitution, no elimination. It also shows you immediately whether there are zero, one or infinitely many solutions.

Find roots, vertex, intercepts

click the grey dots

Desmos marks them automatically. Click one and it shows the exact coordinates.

When the question has a letter in it

type k and press add slider

For 'find the value of k so the system has no solution', drag the slider and watch. Far faster than algebra when you are short on time.

Statistics from a table

$$\text{mean}(L_1) \quad \text{median}(L_1)$$

$$\text{stdev}(L_1) \quad \text{quartile}(L_1, 1)$$

Add a table, paste the numbers in, then type these on a new line.

Line of best fit

$$y_1 \sim mx_1 + b$$

The squiggle is the regression symbol. Desmos returns m and b under the expression.

Limit the graph to the real situation

$$y = 2x + 1 \quad \{0 < x < 5\}$$

Curly braces after the equation cut the graph down to the range the word problem actually describes.

Inequalities and shading

$$y > 2x + 1$$

Type it exactly as written and Desmos shades the region. For a system of inequalities, type both and look at the overlap.

When not to open it

- Arithmetic you can do in your head. Typing 12×5 takes longer than knowing it.
- Questions asking what something means, like what a slope represents or whether a conclusion is fair. There is nothing to graph.
- Questions with only letters and no numbers. Pick your own number instead.
- Anything you have already answered. Checking it again is where people lose the time they just saved.



NOTE Two habits worth building before test day

Learn the keys. ^ for powers, / for fractions, sqrt for roots, and the right arrow key to get back out of a fraction or an exponent.

Zoom out before you conclude anything. The default window hides crossing points that sit outside it, and deciding there is no solution when the window is just too small is the most common Desmos mistake there is.





Shortcuts

Every one of these gives the same answer as the normal method, faster. Learn them in this order.

Sum and product of the solutions

$$r_1 + r_2 = -\frac{b}{a} \quad r_1 r_2 = \frac{c}{a}$$

When a question gives you a quadratic and asks for the sum or product of its solutions, read it off the coefficients. No factoring, no formula, and it still works when the roots are ugly.

Vertex without completing the square

$$x = \frac{-b}{2a}$$

Then substitute back for the y value. It is also the midpoint of the two roots, so if you already know those, you already know the vertex.

Sine and cosine of complementary angles

$$\sin x = \cos(90^\circ - x)$$

Turns 'if $\sin(3x) = \cos(x + 10)$, find x' into $3x + x + 10 = 90$.

Percent as a multiplier

$$\pm p\% \Rightarrow \times(1 \pm p)$$

Chains of percent changes become one multiplication, and working backwards becomes one division.

Scale factor for area and volume

$$\text{side} \times k \Rightarrow k^2, k^3$$

Never recalculate an area from scratch when the two shapes are similar.

Exterior angle of a triangle

ext = the two far angles

Skips the 180 minus step completely.

Outside angles of any polygon

always 360°

Each one in a regular polygon is 360 divided by the number of sides.

Arc and sector as one ratio

$$\frac{\theta}{360} = \frac{\text{arc}}{C} = \frac{\text{sector}}{A}$$

One proportion instead of four separate formulas.

Two things working together

$$\frac{1}{T} = \frac{1}{a} + \frac{1}{b}$$

Taps, workers, printers, machines. Always the same setup.



Work in totals, not averages

total = mean $\times$ how many

'The mean of 8 numbers is 12, one is removed and the mean becomes 11.' Totals make this two lines instead of six.

At least one

$1 - P(\text{none})$

Always faster than adding up all the ways it could happen.

Slope straight from standard form

$$Ax + By = C \Rightarrow m = -\frac{A}{B}$$

No rearranging needed when you just want to compare two lines.

Difference of squares on numbers

$$51^2 - 49^2 = (100)(2) = 200$$

Works on any pair, not just algebra.

Test the answer choices

start in the middle

On multiple choice with numbers, plugging one in is often faster than solving. Start with the middle option so one test rules out half of them.

Pick your own number

$x = 100$ for percent, $x = 2$ otherwise

When the question and every answer choice are all in letters, substitute a convenient number and see which choice matches.



Where the marks actually go

Almost none of this is hard maths. It is reading the question wrong, and the same few come up over and over.

TRAP You solved for x , they wanted $x + y$

The question asks for a combination, or for an expression. The value of x is always sitting there as one of the choices.

TRAP Percent of, more than, less than

'30 percent of B' is $0.3B$. '30 percent more than B' is $1.3B$. '30 percent less than B' is $0.7B$.

TRAP Given the diameter, needed the radius

Or the other way round. Write $r =$ something before you touch a formula.

TRAP Forgot to flip the inequality

Multiplying or dividing by a negative reverses the sign. Dividing by something whose sign you do not know is not allowed at all.

TRAP Answers that do not actually work

Squaring both sides, or clearing a denominator with x in it, can invent a solution. Put both answers back into the original equation.

TRAP Divided by 1 instead of a

Sum of the solutions is $-b/a$, not $-b$. When a is 1 they look the same, which is exactly why the harder questions never make it 1.

TRAP Units left as they were

Minutes against hours, cm against m, mm cubed against cm cubed. 1 cm cubed is 1000 mm cubed, not 10.

TRAP Took the median off an unsorted list

The list is printed out of order deliberately. Sort it first, every time.

TRAP Used the grand total as the denominator

'Given that', 'among', and 'of those who' all mean a row or a column total.

TRAP Read a link as a cause

Only a randomised experiment lets you say one thing caused the other.

TRAP Shifted the graph the wrong way

$f(x + 3)$ moves it LEFT three. Anything inside the bracket does the opposite of what it looks like.



TRAP Used t instead of n times t

Compound interest for 3 years compounded monthly has a power of 36.

TRAP Answer in the wrong form

Grid-in answers have a limited number of boxes. Improper fractions and decimals are both fine. Mixed numbers are not.

TRAP Assumed a negative answer was wrong

Grid-ins accept negatives. If yours is negative, type the minus sign.

Run this before every paper

Until you stop needing it. Then run it in the exam anyway.

Before you answer anything

- Read the last sentence first. What are they actually asking for?
- Underline every unit, in the question and in the answer choices.
- Write down what your variables mean before you write an equation.
- Check whether the formula you need is already printed at the top of the module.

Before you move on

- Did I answer what they asked, or did I stop at x?
- Are the units the ones they wanted?
- If I squared anything or cleared a denominator, did I check both answers?
- Does the size of the answer make sense? A probability over 1 or a negative length means something went wrong.
- For grid-ins, is it in a form they accept and does it fit the boxes?

The week before

- Drill the shortcuts until they are automatic. Half remembering one is worse than not knowing it.
- Sit two full 70 minute modules back to back. The second module adapts, and most people have never practised that.
- Practise typing into Desmos. Fractions, powers, sliders, tables, regressions.
- Read the mistakes page again. That is where the difference between a 700 and a 780 lives.

NOTE Last thing

None of this replaces doing the questions. A formula is what you reach for once you already know what kind of question you are looking at, and that only comes from real papers.
Method, not more content.