Victorian Essential Learning Standards

CAS Technology Mathematics at Level 6

Part 5: Case Studies – CAS in Practice

Contents

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41 St Andrews Place East Melbourne Victoria 3002 Australia

TELEPHONE +61 3 9651 4300 FACSIMILE +61 3 9651 4324

EMAIL vcaa@edumail.vic.gov.au

WEB www.vcaa.vic.edu.au

Case studies – using CAS in three schools

Following is one of three sets of course outline materials and related activities developed and used by teachers who have worked with CAS as part of the Victorian Curriculum and Assessment Authority's (VCAA's) Mathematical Methods (CAS) pilot program, and who implemented Mathematical Methods (CAS) Units 1 to 4 in 2006. The course outlines illustrate a variety of approaches, with different emphases, and use of documentation.

Case study A

School

Ballarat Grammar School – independent, co-educational, regional, Preparatory–Year 12

Curriculum structure

Year 9

Ballarat Grammar has six Year 9 classes run in the purpose-built Year 9 'Heinz Centre', positioned on the far north of the Ballarat campus. As part of the students' Year 9 experience, they participate in a three-week city stay in Melbourne, based in the Swanston Street 'City-Cite'. Mathematics is one of five core subjects taught at the Year 9 level, the others being LOTE, Art, Beliefs and Values and PE. The other studies are absorbed into the integrated program.

Mathematics at Year 9 is timetabled for three 60-minute periods per week, except for the Term 4 three-week block in Melbourne. An independent assignment is set for completion during the Melbourne experience. The Year 9 Mathematics teachers go to the Year 9 centre and teach the students in their mixed ability home-room setting. In Semester 2, in addition to the core Maths studies, an Advanced Algebra group as well as an Extra Maths class are offered.

Year 10

Ballarat Grammar has eight Year 10 Mathematics classes, with classes grouped according to the aspirations of the students for their future VCE mathematical studies. One class of General Mathematics (Specialist) Units 1 and 2 is offered to one group of students. Foundation Maths Units 1 and 2 is also offered at Year 10. This leaves six classes that follow the Year 10 Mathematics program, studied at various levels.

Mathematics at Year 10 is timetabled for four 60-minute periods per week, except for the examination blocks at the end of both Semesters 1 and 2.

'Techno Maths' is also offered as an Extra Maths class elective.

The following Year 9 program is based on two 17-week semesters.

CAS technology used
CASIO *Classpad* 300 series

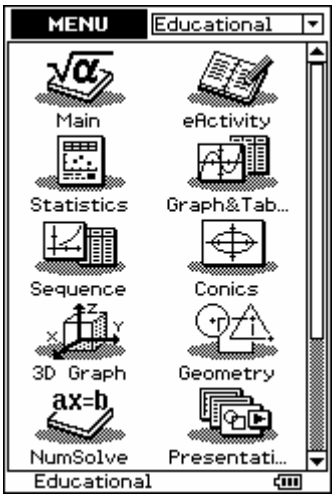
Broad topic block planner

Year 9			
Semester 1		Semester 2	
Weeks	Topic	Weeks	Topic
1–3	Number systems	1–3	Linear equations and formulas
4–5	Measurement	4–5	Linear graphs
6	Pythagoras' theorem	6–8	Algebra techniques
7–8	Trigonometry	9–12	Quadratic functions
9–12	Geometry	13–14	Probability
13–14	Indices	15–17	Statistics
15–17	Consumer maths		

The following Year 10 program is based on one 17-week and one 18-week semester.

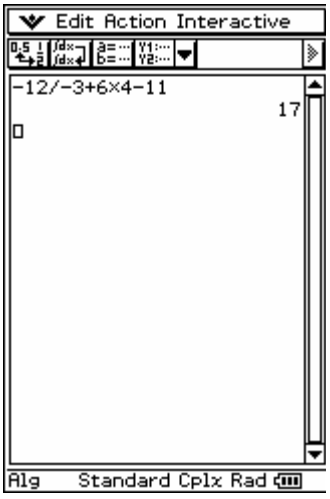
Year 10			
Semester 1		Semester 2	
Weeks	Topic	Weeks	Topic
1–3	Number systems	1–3	Linear equations and formulas
4–5	Measurement	4–6	Algebra techniques
6	Coordinate geometry	7–8	Quadratic equations
7–8	Trigonometry	9–12	Quadratic functions
9–12	Geometry	13–14	Exponential and logarithmic relations
13–14	Circle geometry and location	15	Variation
15–17	Business maths	16–17	Probability
		18	Statistics
		Extension	Absolute value graphs

Using CAS technology, teachers can draw on the program to develop relevant teaching and learning activities in the dimensions *Number*, *Space*, *Measurement*, *chance and data*, *Structure* and *Working mathematically* of the mathematics domain of the Victorian Essential Learning Standards (VELS). A CASIO *Classpad* 300 has been used to demonstrate related activities.



The Classpad 300 series of hand-held technology can be used as a CAS enabled device, and combines numerical, statistical, graphical, symbolic, geometric and text functionalities within a dynamic operating system. Consequently, this CAS calculator is much more than just a device principally used to carry out symbolic manipulation such as algebra. The interplay of various aspects of numeric, graphic and symbolic calculation is illustrated through the following examples.

Year 9 program

Timeline **Semester 1**	**Level 6** **Year 9 Topic**	**VELS Learning focus**	**CAS implementation**
Week 1–3	**Number systems** • the real number system • arithmetic with *N*, *Z*, *Q* (fractions and decimals), irrationals and squares • surds operations: +, -, ×, rationalise simple denominators **Ratio and rates** • arithmetic of simplifying ratios • quantities, units	*Number* • set of real numbers • irrationals • surds • exact and approx context • arithmetic computations (natural, integers, decimals, fractions, irrationals) *Structure* • properties of real number system (natural, integers, rationals, irrationals) • use surds in calculations	Order of operations Example 1 Divisibility rules Example 2 Substitution with whole numbers Example 3 Fractions Example 4 Example 5 Fractions to decimals Example 6 Squares and square roots Example 7 Example 8 Simplifying surds Example 9 Multiplying surds Example 10 Rationalising denominators Example 11
Week 1–3 **CAS**	**Order of operations** Example 1 Calculate $-12 \div -3 + 6 \times 4 - 11 = 17$ A CAS deals with the order of operations. In the Main Menu, type the number, then EXE.		

Week 1–3 CAS

Divisibility rules

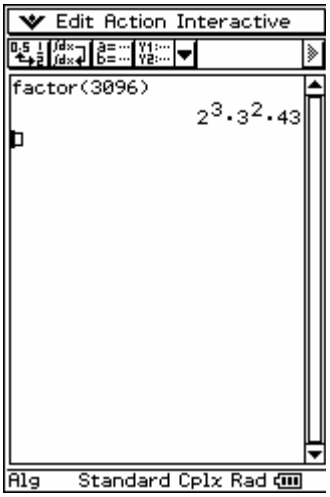
Example 2

Express 3096 as a product of its primes

$= 2^3 \times 3^2 \times 43$

A CAS can express numbers as the product of their prime factors.

In the Main Menu type the number, then go to Interactive, Transformation and Factor.



Week 1–3 CAS

Substitution with whole numbers

Example 3

If $a = 10, b = 2, c = 4$, evaluate

$a^2 + b^2 - c^2$

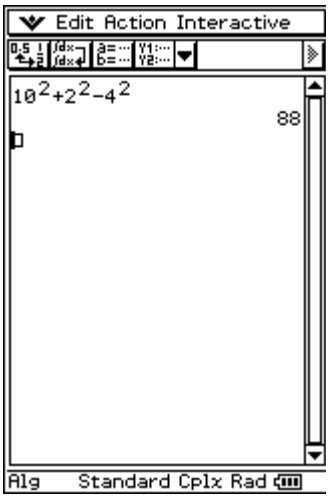
Answer: 88

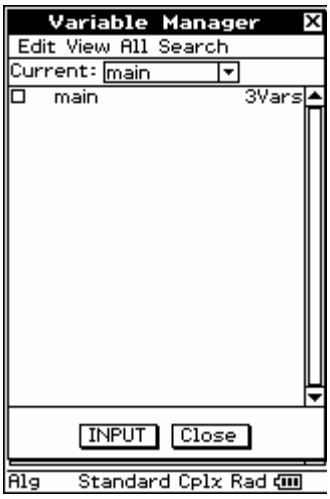
Either directly type in the number substitute or use the facility of defining variables.

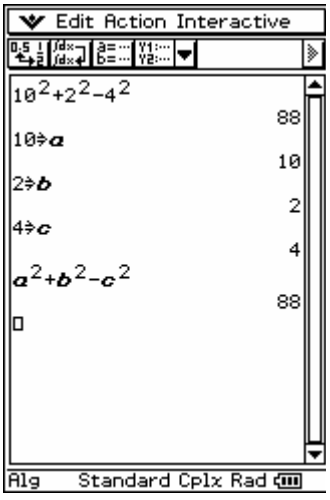
In the Main Menu type $10 \Rightarrow a,$ using VAR in the mth keyboard.

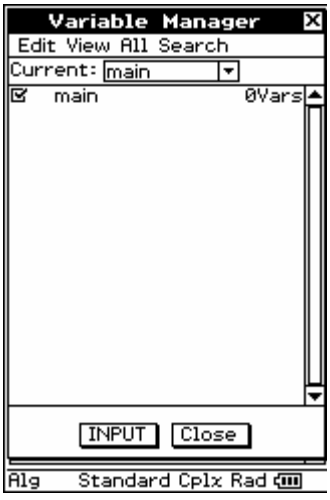
Define each of the letters as so, and then type $a^2 + b^2 - c^2$, EXE.

To clear these variables go to a =, b =, showing three variables are defined. Clear these by ticking main and edit, deleting. Even though it will say it is locked, the variables will be cleared, until they are defined the next time.









Week 1–3 CAS

Fractions

Example 4

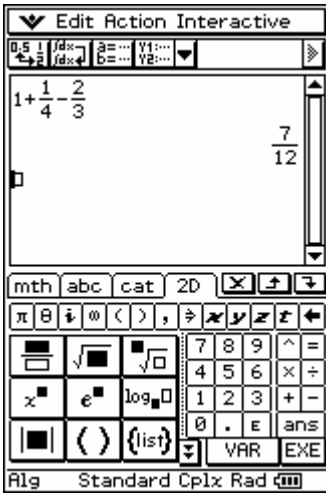
Evaluate $1\frac{1}{4}-\frac{2}{3}=\frac{7}{12}$

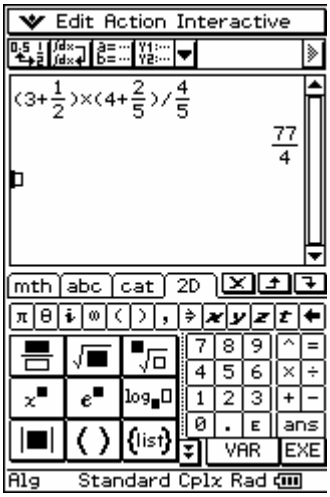
Mixed numbers are typed as $1+\frac{1}{4}$.

Use keyboard 2D to type in a fraction.

Example 5

Evaluate $3\frac{1}{2}\times 4\frac{2}{5}\div\frac{4}{5}=\frac{77}{4}$





Week 1–3 CAS

Fractions to decimals

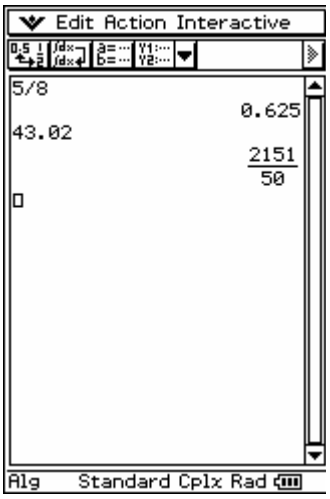
Example 6

Write $\frac{5}{8}$ as a decimal and 43.02 as a fraction.

Answer: 0.625 and $\frac{2151}{50}$

Type in 5/8 and EXE and black the answer. Then tap the top left 0.5 to ½ icon.

Type in 43.02 and EXE. A fraction will result.



Week 1–3 CAS

Squares and square roots

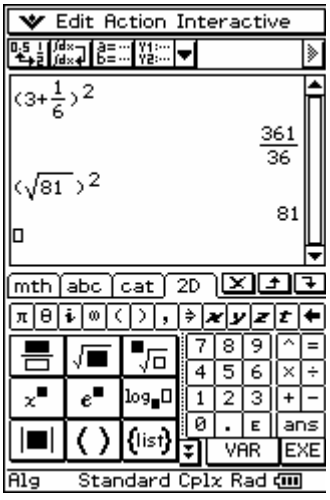
Example 7

Evaluate $\left(3\frac{1}{6}\right)^2=\frac{361}{36}$

Using Keyboard 2D, fraction $\frac{1}{6}$ and power x^2 buttons

Example 8

Evaluate $\left(\sqrt{81}\right)^2=81$



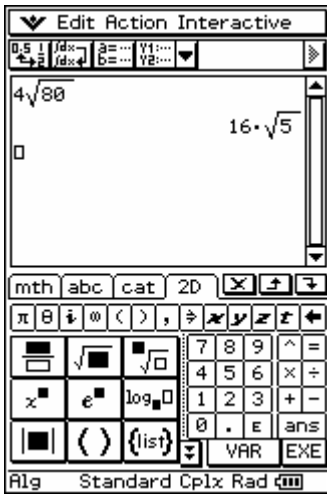
Week 1–3 CAS

Simplifying surds

Example 9

Simplify $4\sqrt{80} = 16\sqrt{5}$

using soft Keyboard 2D $\sqrt{\ }$.



Week 1–3 CAS

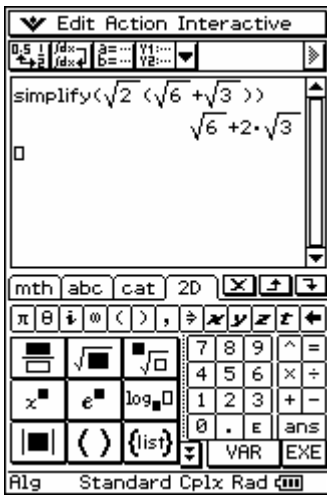
Multiplying surds

Example 10

Expand and express in simplest form $\sqrt{2}(\sqrt{6}+\sqrt{3})$

Answer: $\sqrt{6}+2\sqrt{3}$

Use soft Keyboard 2D, then Interactive, Transformation and Simplify.



Week 1–3 CAS

Rationalising denominators

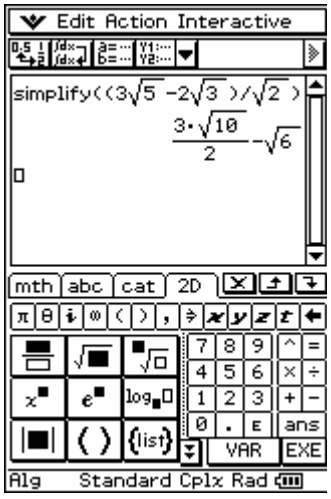
Example 11

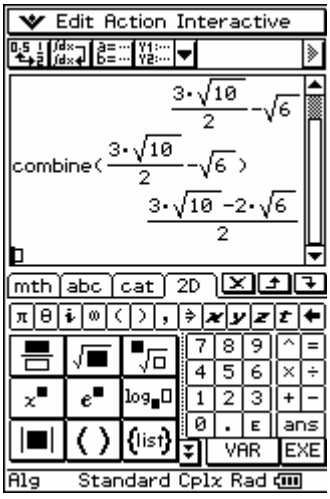
Express the following with a rational denominator $\dfrac{3\sqrt{5}-2\sqrt{3}}{\sqrt{2}}$

Answer: $\dfrac{3\sqrt{10}}{2}-\sqrt{6}$ or $\dfrac{3\sqrt{10}-2\sqrt{6}}{2}$

Use Keyboard 2D, then Interactive, Transformation and Simplify.

Using Interactive, Transformation and Combine puts the answer with a common denominator.





Timeline Semester 1	Level 6 Year 9 Topic	VELS Learning focus	CAS implementation
Week 4–5	**Measurement** • conversion of units • perimeters of polygons, circles • area of polygons, circles	*Measurement, chance and data* • measure, estimate • perimeter, area, surface area, angles	Circumferences Example 1 Areas of shapes Example 2 Areas of circles Example 3 Areas of circles using geometry Example 4

Week 4–5
CAS

Circumferences

Example 1

Find the circumference of the circle with radius of 40m =

$2 \times 40 \times \pi$ cm ≈ 251.327 cm

Circumference of circle is $C = 2\pi r$.

Either directly type in the number substitute, or use the facility of defining variables.

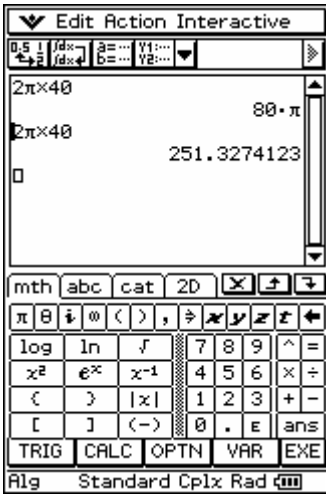
In the Main Menu, type $40 \Rightarrow r$, using VAR in the mth keyboard.

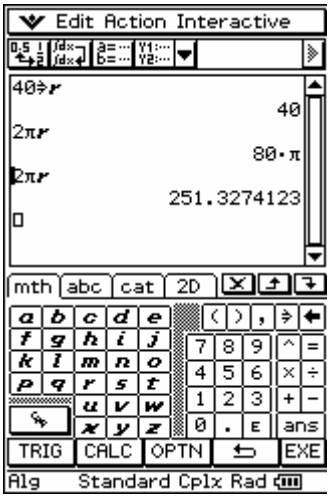
Then type $2\pi r$, EXE. This gives answer exactly.

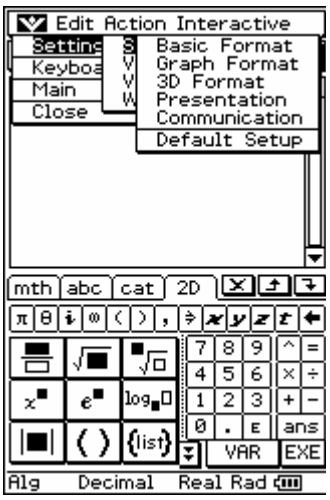
Or black exact answer and tap top left decimal icon for decimals.

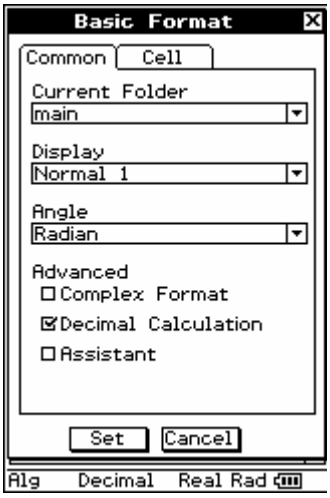
Alternatively, have the set up as decimals in the first place.

Go to settings (pointy icon top left), set up, basic format, tick decimal calculation.









Week 4–5
CAS

Areas of shapes

Example 2

Find the length of the hypotenuse and the area of a right-angled triangle with shorter sides 6 m and 8 m.

Answer: 10 m and 24 m^2

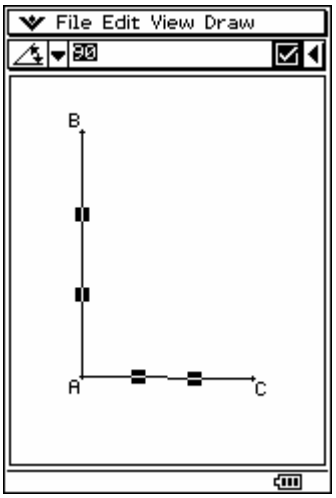
Use fraction, $\sqrt{\ }$ and x^{power} in 2D on the soft keyboard.

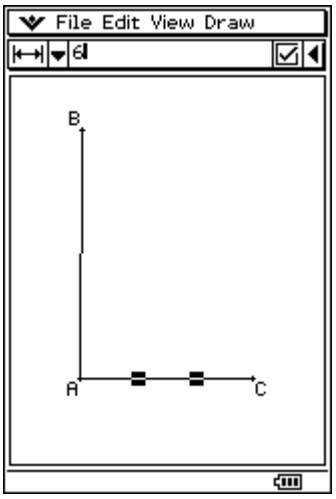
Alternatively, tap the Geometry icon on the Menu.

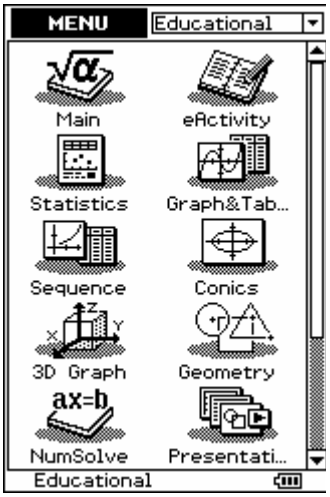
Tap the line segment icon and draw line segment AB. Add the line segment AC.

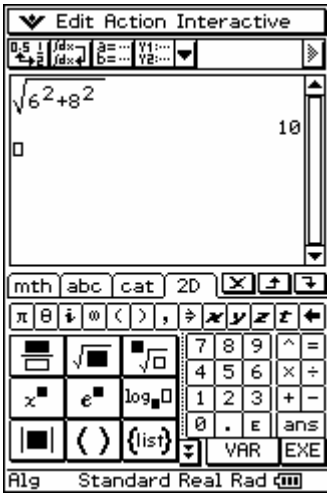
The side arrow gets to the Measurement bar, allowing you to enter measurements.

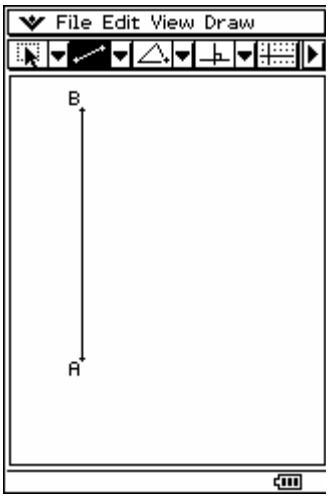
Fix a right angle at A and define the lengths as 6 and 8. Add hypotenuse.

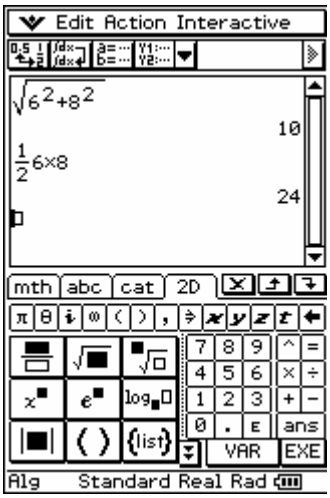


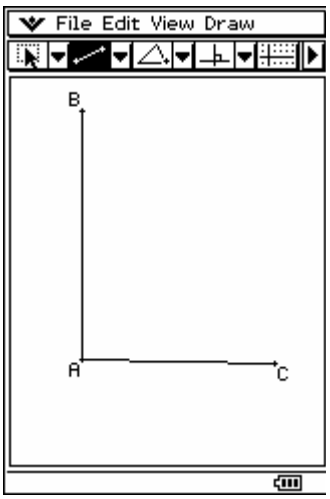




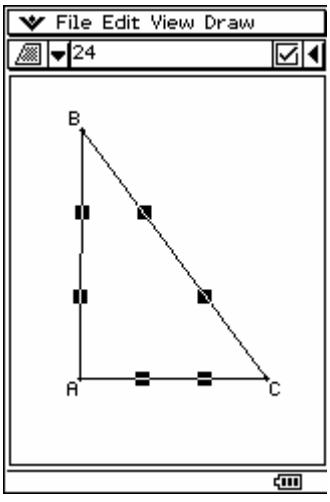


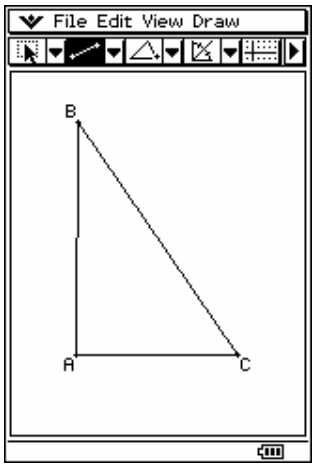






and using the measurement bar, the area = 24 m^2





Week 4–5 CAS

Areas of circles

Example 3

Find the area of the circle with radius of 40 m = 1600π cm^2 $\approx$ 5026.548

Area of circle is $A = \pi r^2$.

Either directly type in the number substitute, or use the facility of defining variables.

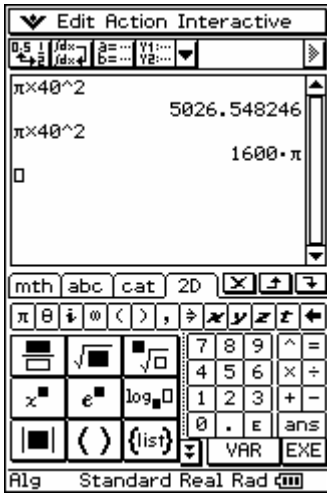
In the Main Menu, type $40 \Rightarrow r$, using VAR in the mth keyboard.

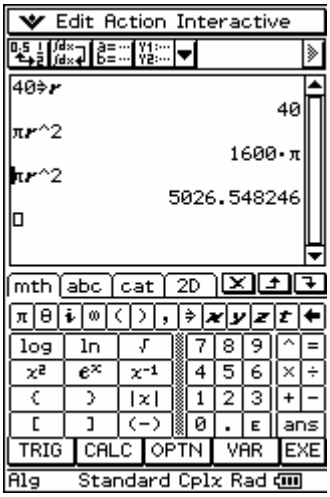
Then type πr^2, EXE. This gives the answer exactly.

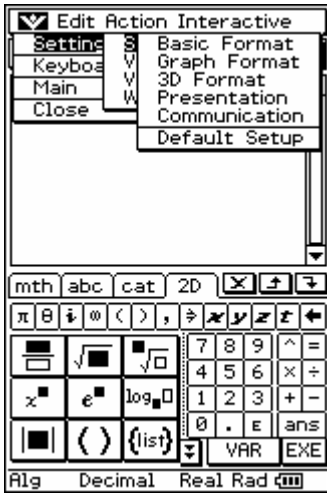
Or black exact answer and tap top left decimal icon for decimals.

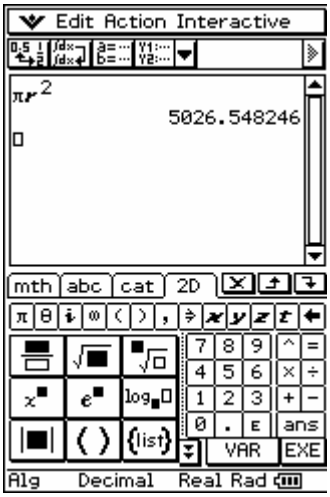
Alternatively, have the set up as decimals in the first place.

Go to settings (pointy icon top left), set up, basic format, tick decimal calculation.









Week 4–5 CAS

Areas of circles using geometry

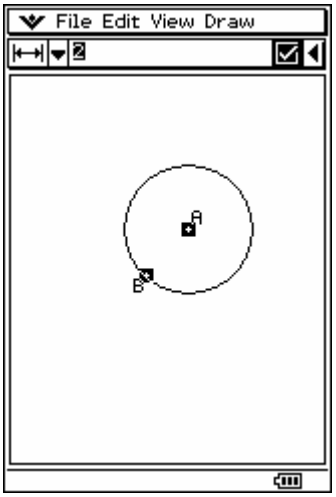
Example 4

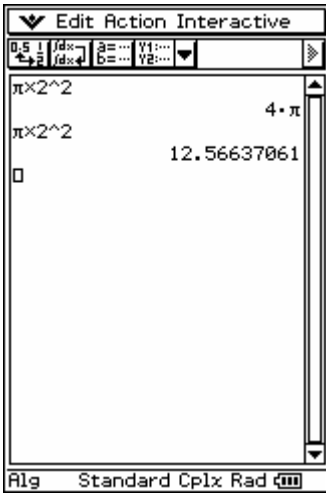
Find the area of the circle with radius of
2 mm = 4π mm^2 = 12.566 mm^2

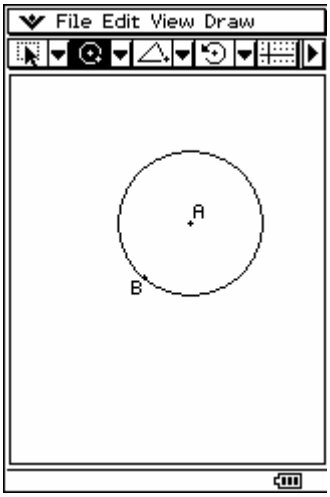
Alternatively, using Geometry, draw a circle.

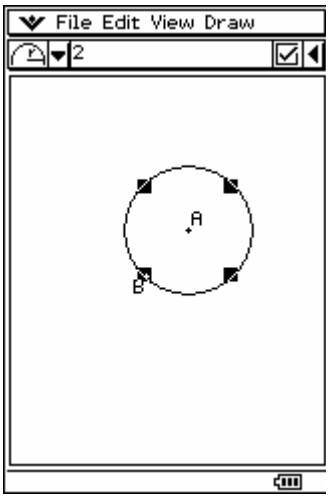
By tapping two points using the circle icon, the radius is constructed and the circle drawn. Use the measurement bar to fix radius at 2 mm.

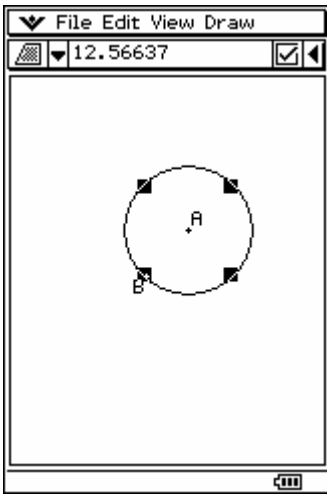
Area found as 12.566 square mm.











Timeline Semester 1	Level 6 Year 9 Topic	VELS Learning focus	CAS implementation
Week 6	**Pythagoras' theorem** • right-angled triangles • hypotenuse, other sides, angles • Pythagorean triads • exact and approx answers • simple shapes	*Space* • right-angled triangles • position, length and angle • location	Length of the hypotenuse Example 1 Formula for the length of the hypotenuse Example 2 Pythagoras' theorem in exact form Example 3 Pythagoras' theorem with coordinate geometry Example 4

Week 6 CAS **Length of the hypotenuse**

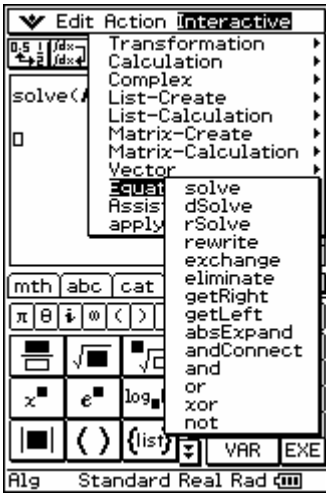
Example 1

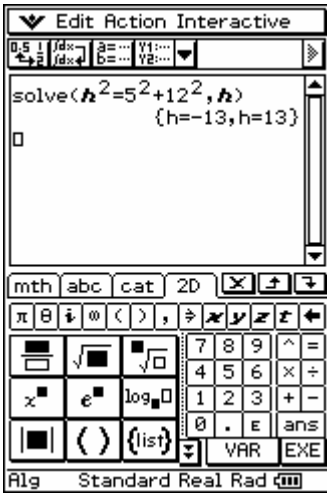
Find the length of the hypotenuse of the triangle with sides 5 and 12 (= 13).

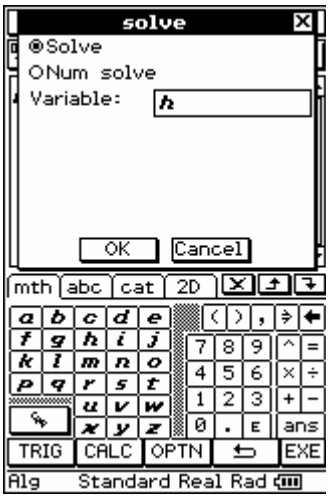
Type in equation $h^2 = 5^2 + 12^2$.

Tap Interactive, Equation/Inequality, Solve for *h*.

Take positive answer *h* =13.





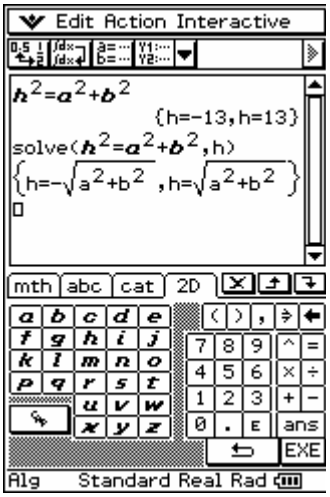


Week 6 CAS **Formula for the length of the hypotenuse**

Example 2

Solve the equation $h^2 = a^2 + b^2$ for *h*.

Answer: $h = \sqrt{a^2 + b^2}$ (take positive answer).



Week 6 CAS **Pythagoras' theorem in exact form**

Example 3

Find the length, *x*, of the 3rd side of a right-angled triangle with lengths 2 and 6 and the hypotenuse *x*.

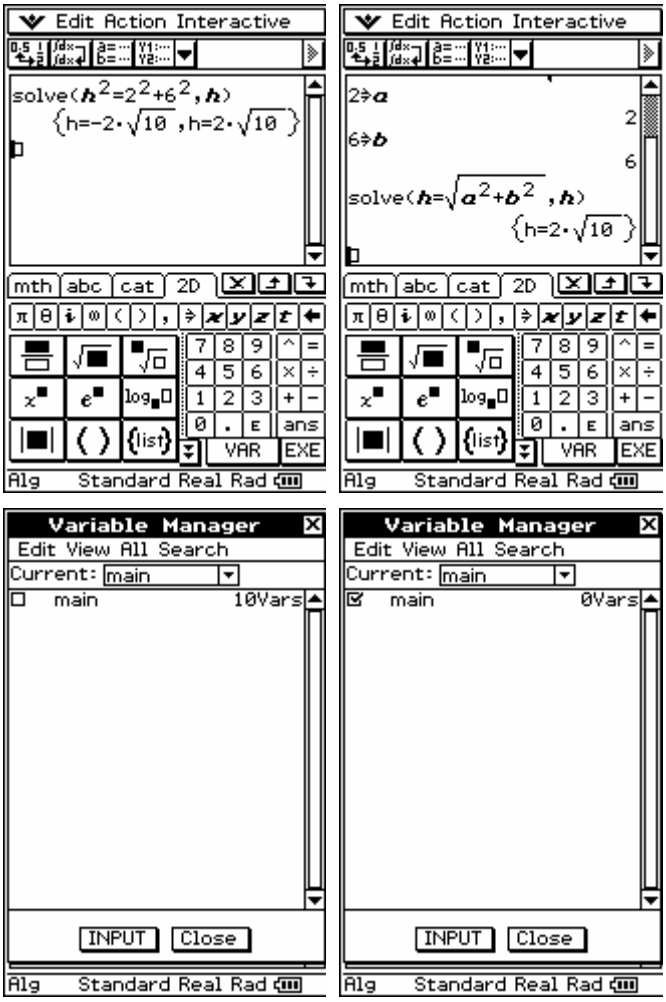
Answer: $x = 2\sqrt{10}$

Type in equation $h^2 = 2^2 + 6^2$. Tap Interactive, Equation/Inequality, Solve for h.

Take positive answer $h = 2\sqrt{10}$.

Alternatively, assign $2 \Rightarrow a, 6 \Rightarrow b$ and use formula $h = \sqrt{a^2 + b^2}$.

Remember, afterwards, to go to $a =, b =$ icon to clear the *a* and *b* you have defined.



Week 6 CAS **Pythagoras' theorem with coordinate geometry**

Example 4

Plot the points $A(1,3), B(2,5)$ onto a set of axes and find the distance between them.

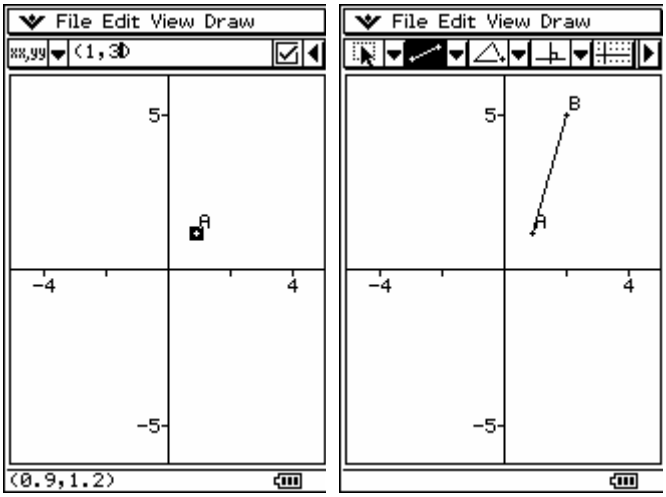
Answer: 3.956

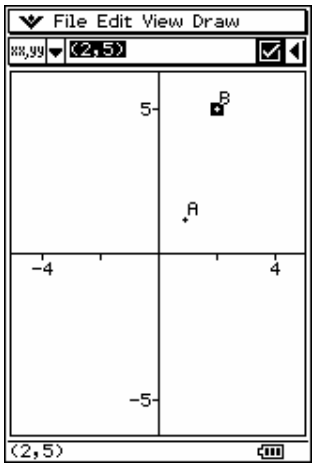
Using the Geometry icon in Menu, coordinates can be placed on axes and distance found in the Measurement bar.

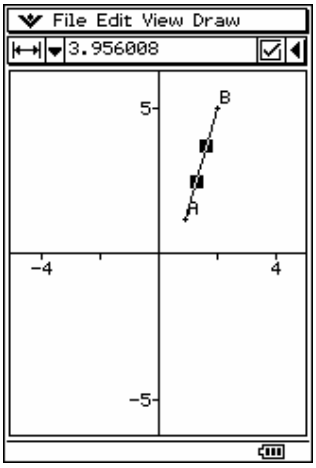
Tap the axes icon twice to get axes and points on axes. Then tap the pencil pointer and flip over to the measurement bar to define points A and B.

Tap line segment icon and tap points A and B to draw segment. Go to Measurement bar and find distance between A and B.

Distance between A and B is 3.956







Timeline Semester 1	Level 6 Year 9 Topic	VELS Learning focus	CAS implementation
Week 7–8	**Trigonometry** • right-angled triangles • sine, cosine, tangent ratio • finding sides and angles • sine, cosine graphs	*Space* • right-angled triangles • angles • location *Measurement, chance and data* • measure, estimate angle • units, formulas • degrees	Finding length of the opposite side, with sine Example 1 Finding the hypotenuse Example 2 Finding angles using sine and cosine Example 3 Trigonometry and bearings Example 4 Exploring circular function (trigonometric) graphs Example 5

Week 7–8 CAS

Finding length of the opposite side, with sine

Example 1

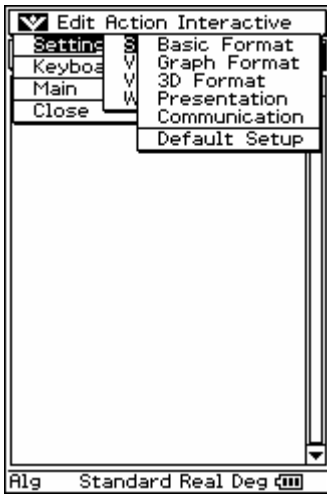
Find the length of the side in the right-angled triangle opposite the angle 40^0, with hypotenuse length 20 cm.

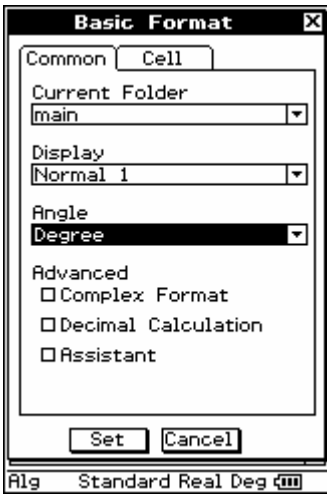
Answer: $\sin 40^0 = \frac{x}{20} \therefore x = 20\sin 40^0$

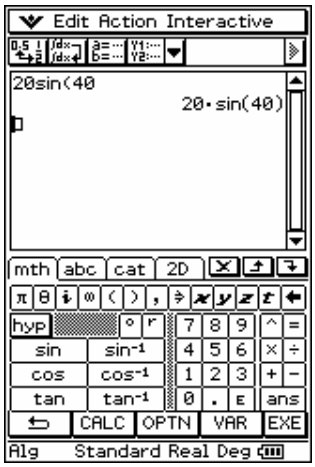
$\therefore x = 12.86$ cm

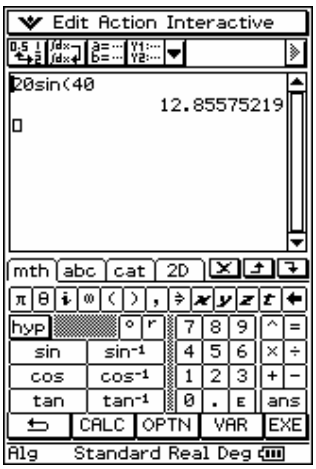
To work Trigonometry, first set the format from Radians to Degrees. Go to Settings, Setup, Basic Format, degrees. Find Trig under the soft keyboard mth, Trig.

Tapping decimal to fraction icon gives $20\sin 40^0 \approx 12.86$









Week 7–8 CAS

Finding the hypotenuse

Example 2

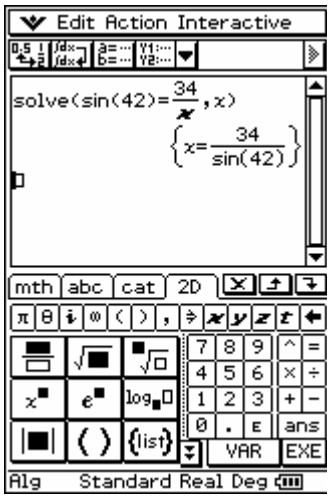
Find the length of the hypotenuse of a right-angled triangle, with a side of 34 cm opposite the angle of 42^0.

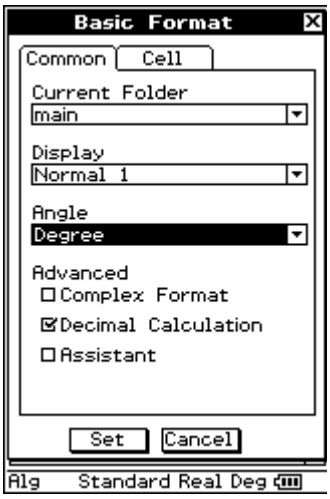
Answer: $\sin 42^{0^\circ} = \frac{34}{x} \therefore x = \frac{34}{\sin 42^{0^\circ}}$

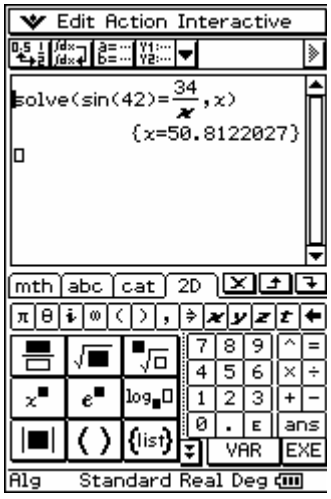
$\therefore x = 50.81$ cm

Make sure the format is in degrees and decimalise the answer. Or you can set the format to Decimal calculation at the beginning.

Length of side is 50.81 cm.







Week 7–8 CAS

Finding angles using sine and cosine

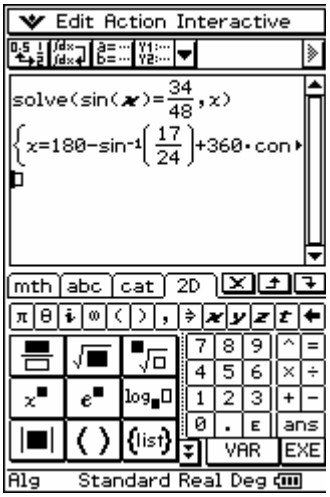
Example 3

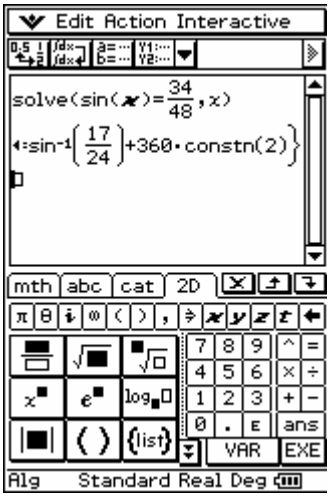
Find the unknown angle opposite the side length 34 cm, in a right-angled triangle with the hypotenuse of 48 cm.

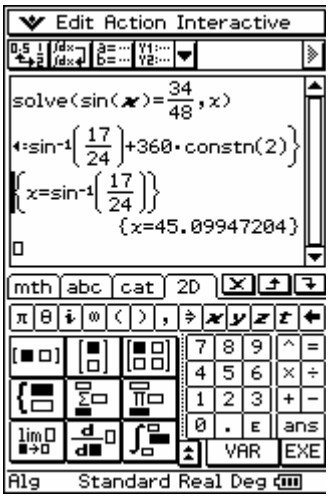
Answer: $\sin\theta^0 = \frac{34}{48} \therefore \theta = 45.10^0$

In the Main Menu, the answers to trigonometric equations need to be interpreted as general solutions with the parameter constn(1) and constn(2) …

Taking constants as zero, $\theta = 45.10^0$.







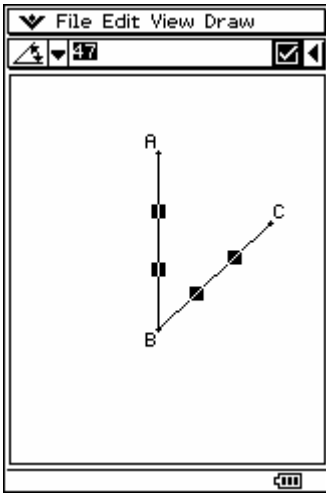
Week 7–8 CAS

Trigonometry and bearings

Example 4

Draw a diagram showing the bearing of 047^0T.

Angles between lines and true bearings are found in the Geometry section of the Menu.



Week 7–8 CAS

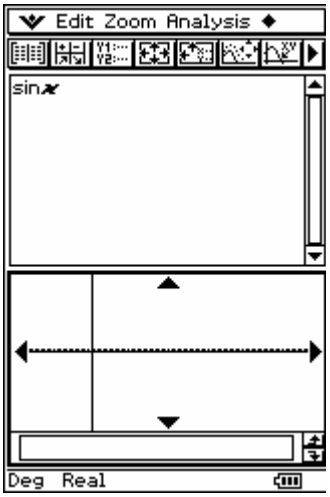
Exploring circular function (trigonometric) graphs

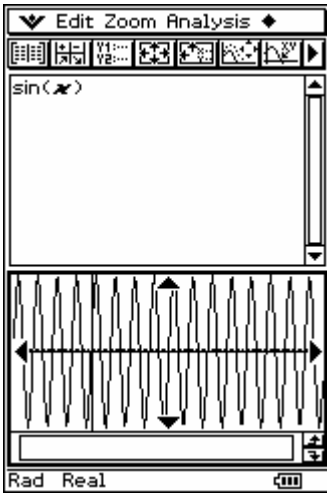
Example 5

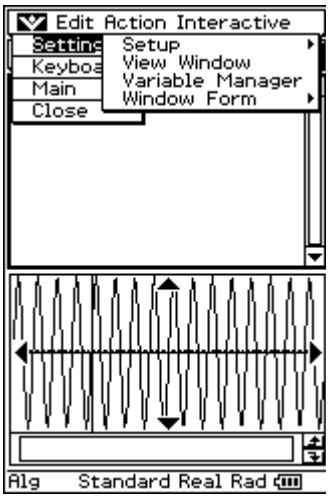
Sketch the graph $y = \sin x$.

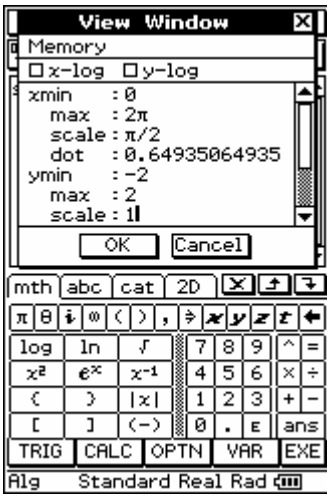
Type the expression $\sin x$, tap axes found in $y1 =, y2 =$ icon, which will pop up axes. Black the expression, $\sin x$, and drag it into the axes space.

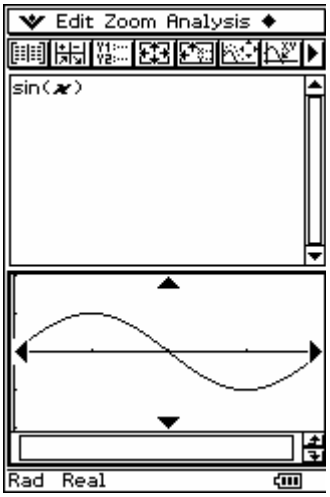
This is the graph that may present if you haven't defined the scale. Go to Settings, View Window and type the x-axis and y-axis scale and range you want.

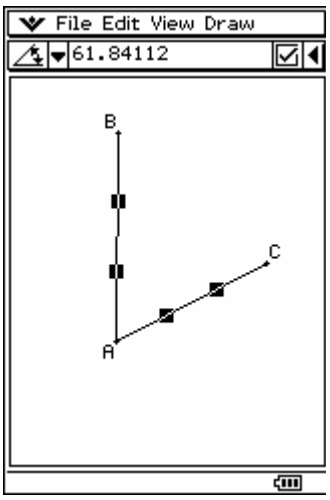
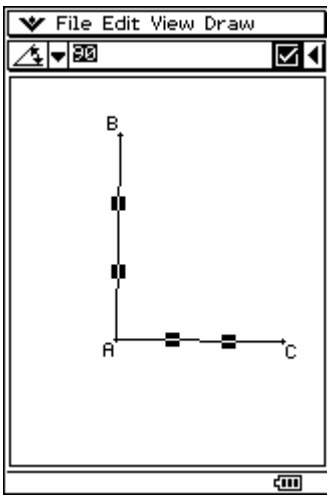
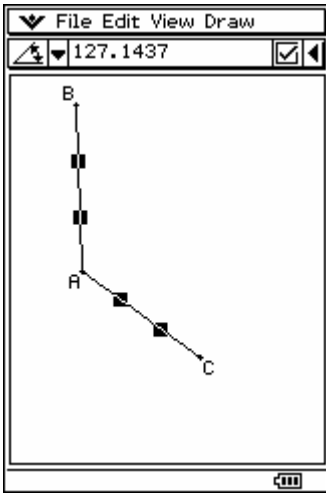


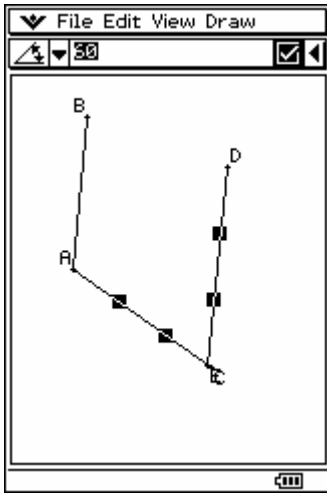
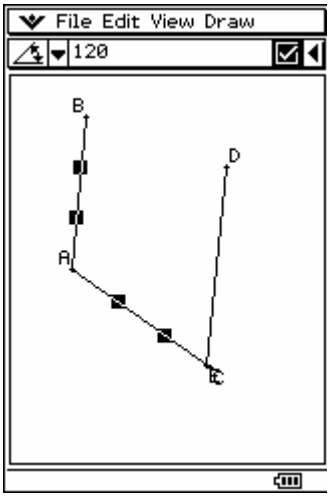
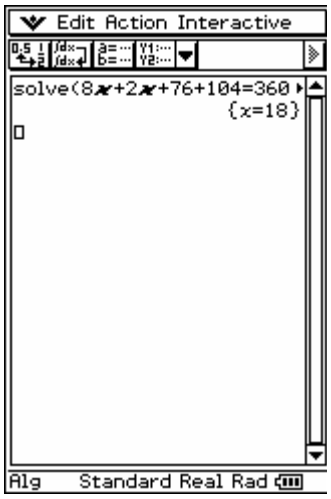








Timeline Semester 1	Level 6 Year 9 Topic	VELS Learning focus	CAS implementation
Week 9–12	**Geometry** • angles: acute, right, obtuse reflex, straight • complementary, supplementary angles • angles and parallel lines • polygons	*Space* • angles • polygons, circles, prisms • scale • location	Angle review Example 1 Angles and parallel lines Example 2 Polygon facts Example 3
Week 9–12 **CAS**	**Angle review** Example 1 Sketch an example of each of Acute, Right, and Obtuse angles. Answer: Tap the Geometry section of the Menu, draw two line segments, go to Measurement bar and show the angle as $61.84^0, 90^0, 127.14^0$.	  	

Week 9–12 CAS	**Angles and parallel lines** Example 2 Show that the angles at A and C, in a diagram formed by two parallel lines, are co-interior. Answer: First construct parallel lines by tapping the line segment icon and plotting four points A,B,C,D as in diagram. Show that the angle at A is 120^0 and the angle at C is 60^0, $\therefore$ supplementary, co-interior.	 
Week 9–12 CAS	**Polygon facts** Example 3 Find the value of the pronumeral in the diagram (contains angles of 8*x*, 2*x*, 76 and 104 around a point in the plane). Answer: $x = 18$ Solve the equation $8x + 2x + 76 + 104 = 360$. Go to Main Menu, Interactive, Equation/Inequality, Solve.	

Timeline Semester 1	**Level 6 Year 9 Topic**	**VELS Learning focus**	**CAS implementation**
Week 13–14	**Indices** • index laws • brackets, zero, -ve, fractional powers	*Structure* • expressions, formulas and equations • mental, by hand and technology-assisted and CAS methods *Number* • arithmetic computations	Index numbers Example 1 Index laws Example 2 Zero power Example 3 Negative indices Example 4 Fractional indices Example 5

Week 13–14 CAS

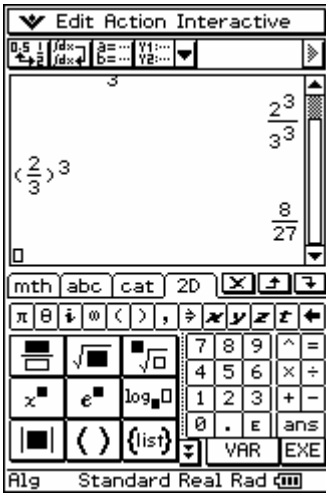
Index numbers

Example 1

Write $\left(\frac{2}{3}\right)^3$ in factor form and then evaluate:

Answer: $\frac{2}{3}\times\frac{2}{3}\times\frac{2}{3}=\frac{8}{27}$

In the Main Menu, using fraction and power in 2D on the soft keyboard, either tap Interactive, Transformation, factor to get $\frac{2^3}{3^3}$, or EXE to get $\frac{8}{27}$.



Week 13–14 CAS

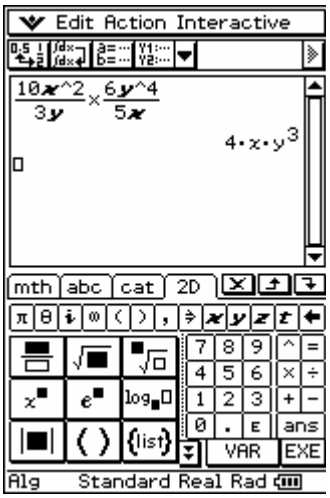
Index laws

Example 2

Simplify $\frac{10x^2}{3y}\times\frac{6y^4}{5x}$ as far as possible.

Answer: $4xy^3$

In the Main Menu, type $\frac{10x^2}{3y}\times\frac{6y^4}{5x}$, using fraction in 2D on the soft keyboard; press EXE for the answer.



Week 13–14 CAS

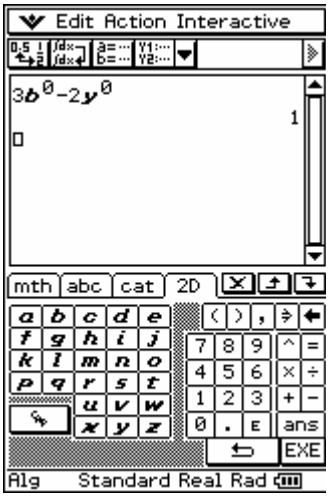
Zero power

Example 3

Simplify $3b^0-2y^0$

Answer: 1

In the Main Menu, type $3b^0-2y^0$ using the mth, VAR on the soft keyboard. (Letters that are pronumerals need the bold letters, so the ClassPad doesn't treat the letters as words.) Press EXE for the answer.



Week 13–14 CAS

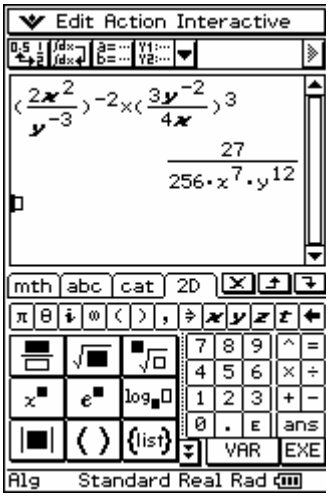
Negative indices

Example 4

Simplify $\left(\frac{2x^2}{y^{-3}}\right)^{-2} \times \left(\frac{3y^{-2}}{4x}\right)^3$

Answer: $\frac{27}{256x^7y^{12}}$

In the Main Menu, type $\left(\frac{2x^2}{y^{-3}}\right)^{-2} \times \left(\frac{3y^{-2}}{4x}\right)^3$, using fraction and power in 2D on the soft keyboard; press EXE for the answer.



Week 13–14 CAS

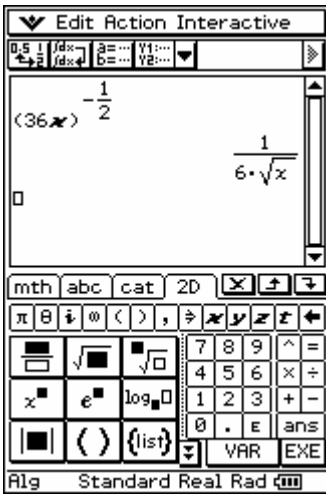
Fractional indices

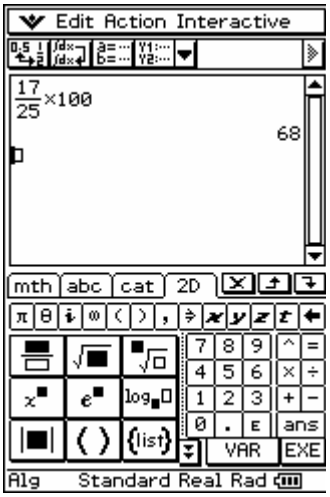
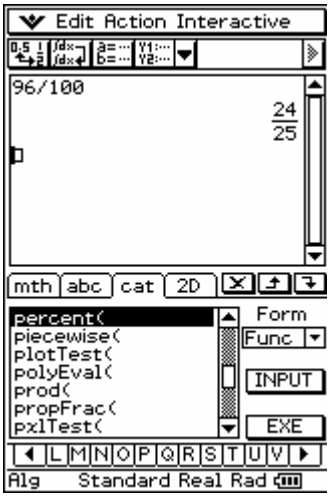
Example 5

Simplify $(36x)^{-\frac{1}{2}}$

Answer: $\frac{1}{6\sqrt{x}}$

In the Main Menu, type $(36x)^{-\frac{1}{2}}$, using fraction and power in 2D on the soft keyboard; press EXE for the answer.



Timeline Semester 1	Level 6 Year 9 Topic	VELS Learning focus	CAS implementation
Week 15–17	**Consumer maths** • business calculations, fractions, decimals, percentages • comparing options • profit and loss, commission • simple interest	*Number* • arithmetic computations (natural, integers, decimals, fractions) • estimates • decimal places, significant figures *Working mathematically* • generalisations by abstracting: words and symbols • test propositions • mental, by hand and technology-assisted methods • develop mathematical models, assumptions and constraints • practical, theoretical and historical problem-solving contexts • generalise and change constraints • use technology to develop mathematical ideas and problems • logical argument	Converting percentages Example 1 Example 2 Simple interest Example 3 Investment problems: technology activity Example 4
Week 15–17 **CAS**	**Converting percentages** Example 1 Change the fraction $\frac{17}{25}$ to a percentage. Answer: 68% Example 2 Change the percentage 96% to a fraction Answer: $\frac{24}{25}$ In the Main Menu, the calculator will cancel down for you.		

Week 15–17
CAS

Simple interest

Example 3

Find the simple interest paid when P = \$1000, R = 5% p.a., T = 2 years

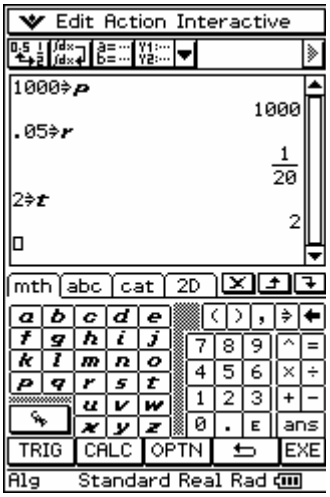
Answer: \$1

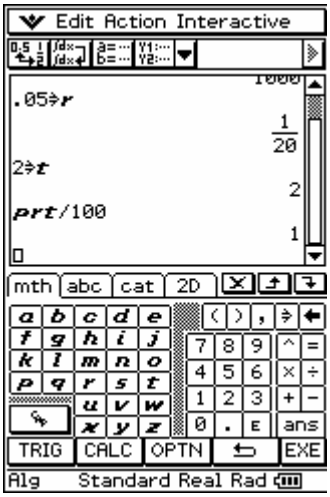
Use the simple interest formula $I = \frac{PRT}{100}$.

Either directly type in the number substitute or use the facility of defining variables.

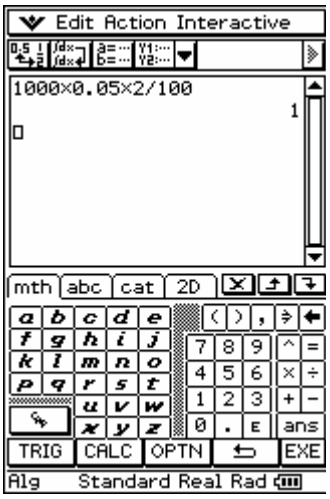
In the Main Menu, type $1000 \Rightarrow P$, using VAR in the mth keyboard.

Define each of the letters as so, and then type $\frac{PRT}{100}$, EXE.





or simply



Week 15–17 CAS

Investment problems: technology activity

Example 4

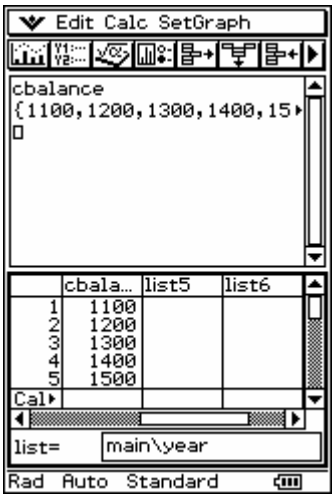
Exploring the relationship between opening balance interest and closing balance with Simple Interest.

One option is, using Menu, Statistics, enter the numbers in the lists. You can type in a name for each column with a word up to eight letters. Here columns are named year, *obalance* (opening balance), interest, *cbalance* (closing balance).

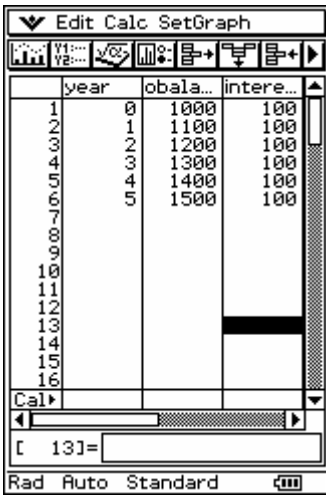
The other option is to open the List Editor by Main Menu, down arrow, the table icon and notice that the data is there in the lists for you with the titles clearly named as you named them previously.

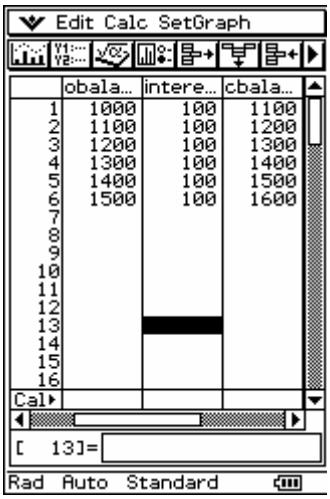
By typing the titles of the lists, your data appears as a set.

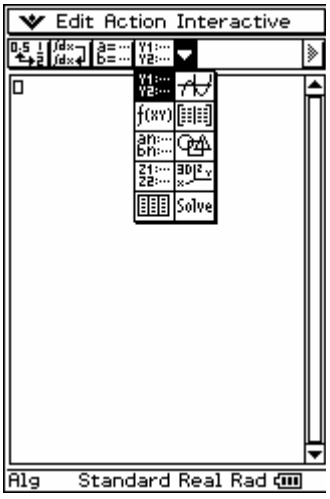
Adding the opening balance (*obalance*) to interest gives the closing balance (*cbalance*) you expected.

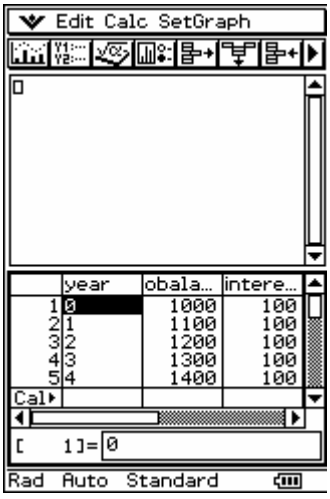


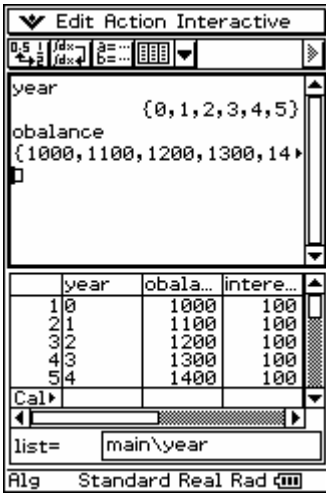
Closing balance of $1100, $1200, $1300, $1400, $1500, $1600

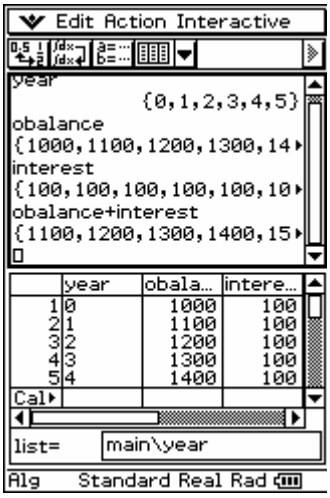


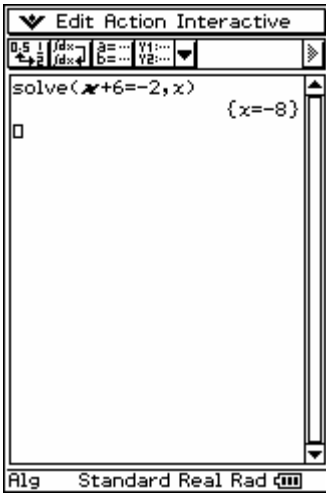










Timeline Semester 2	Level 6 Year 9 Topic	VELS Learning focus	CAS implementation
Week 1–3	**Linear equations** • solve 1,2,3-step linear equations • inequalities • literal equations **Linear formulas** • applying, transposing formulas **Ratios and rates** • rates and graphs	*Structure* • expressions, formulas and equations • functions: linear • solve equations $f(x) = k$, k real constant • mental, by hand and technology-assisted and CAS methods	Solving equations Example 1 Solving equations with fractions Example 2 Solving equations including several fractions Example 3 Inequalities Example 4 Literal equations Example 5 Applying formulas Example 6 Transposing formulas Example 7 Rates: distance, time speed Example 8 Gradient using geometry Example 9 Exploring rate of change graphs Example 10
Week 1–3 **CAS**	**Solving equations** Example 1 Solve the equation $x + 6 = -2$ Answer: $x = -8$ In the Main Menu, type the equation $x + 6 = -2$, black the equation; go to Interactive, Equation/Inequality, Solve, selecting variable x.		

Week 1–3
CAS

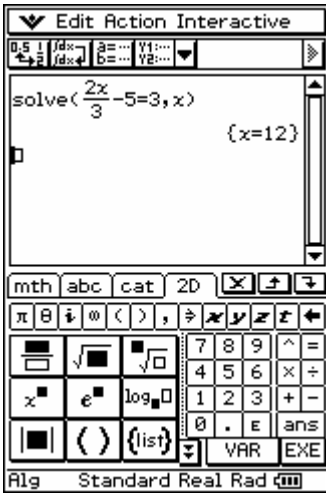
Solving equations with fractions

Example 2

Solve the equation $\frac{2x}{3} - 5 = 3$

Answer: $x = 12$

In the Main Menu, type the equation $\frac{2x}{3} - 5 = 3$, using 2D in the soft keyboard. Black the equation; go to Interactive, Equation/Inequality, Solve, selecting variable *x*.



Week 1–3
CAS

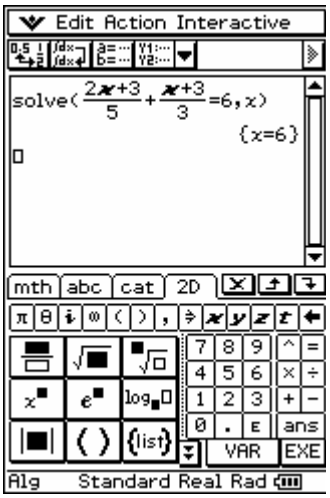
Solving equations including several fractions

Example 3

Solve the equation $\frac{2x+3}{5} + \frac{x+3}{3} = 6$

Answer: $x = 6$

In the Main Menu, type the equation $\frac{2x+3}{5} + \frac{x+3}{3} = 6$, using 2D in the soft keyboard. Black the equation; go to Interactive, Equation/Inequality, Solve, selecting variable *x*.



Week 1–3
CAS

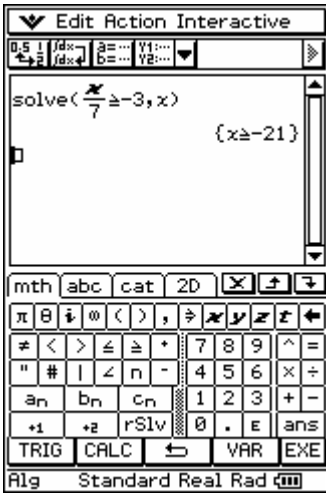
Inequalities

Example 4

Solve the inequality $\frac{x}{7} \geq -3$.

Answer: $x \geq -21$

In the Main Menu, type the inequality $\frac{x}{7} \geq -3$, using 2D in the soft keyboard. Find the $\geq$ sign in mth OPTN in the soft keyboard. Black the inequation; go to Interactive, Equation/Inequality, Solve, selecting variable *x*.



Week 1–3
CAS

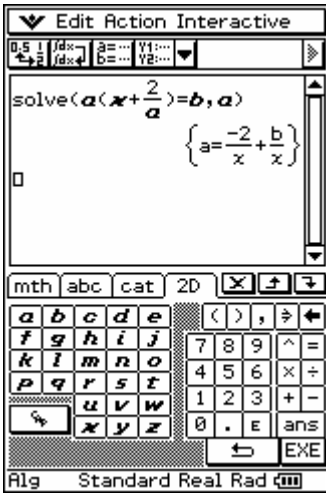
Literal equations

Example 5

Solve the equation $a\left(x+\frac{2}{a}\right)=b$ for a.

Answer: $a=\frac{-2}{x}+\frac{b}{x}$

In the Main Menu, type the equation, $a\left(x+\frac{2}{a}\right)=b$ using 2D for the fraction in the soft keyboard. Use the variables, VAR, in mth, also in the soft keyboard. Avoid the QWERTY keyboard for literal equations, as the ClassPad will think these are letters of a word, rather than variables for Maths. Black the equation; go to Interactive, Equation/Inequality, Solve, selecting variable *a*.



Week 1–3
CAS

Applying formulas

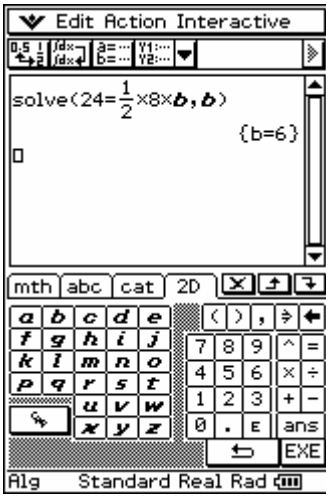
Example 6

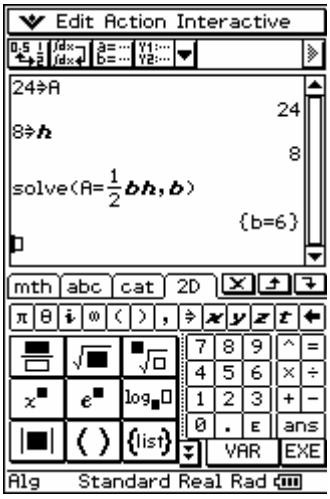
Substitute the given values in the formula $A=\frac{1}{2}bH$ where $A=24$, $h=8$ and solve for *b*.

Answer: $b=6$

In the Main Menu, either type the equation directly with the values, and EXE. Alternatively, assign 24 as *A* and 8 as *h* using the $\Rightarrow$ button.

Using 2D for the fraction in the soft keyboard, black the equation; go to Interactive, Equation/Inequality, Solve, selecting variable *b*.





Week 1–3
CAS

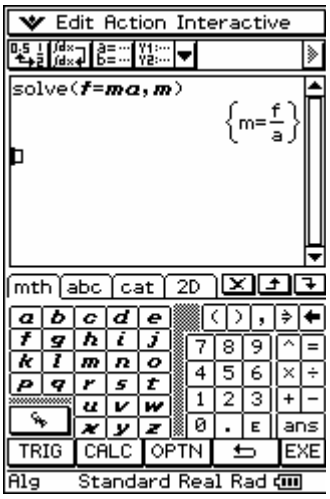
Transposing formulas

Example 7

Transpose the formula $F=ma$ making m the subject.

Answer: $m=\frac{F}{a}$

In the Main Menu, type the equation $F=ma$, black the equation; go to Interactive, Equation/Inequality, Solve, selecting variable *m*.



Week 1–3
CAS

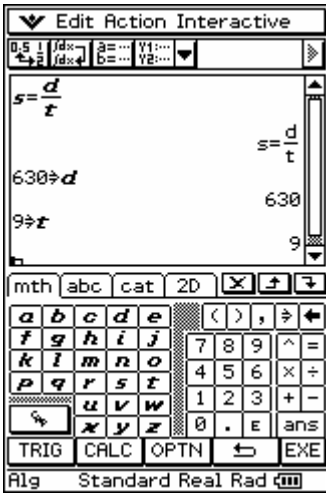
Rates: distance, time speed

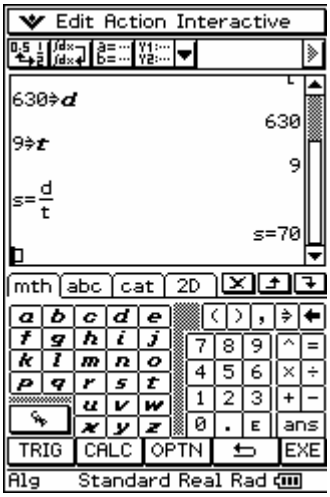
Example 8

Find the average speed of a motorcycle that travels 630 km in 9 hours.

Answer: 70 km/h

Assign $630 \Rightarrow d$, $9 \Rightarrow t$, using the soft keyboard, using $\Rightarrow$ and the variables (VAR) section of mth.





Week 1–3
CAS

Gradient using geometry

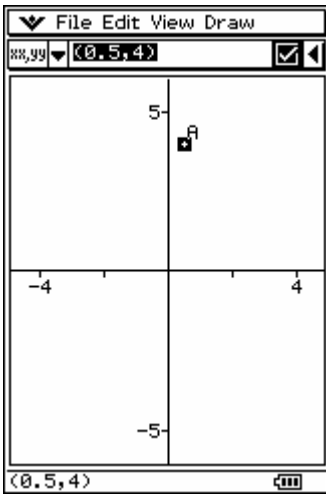
Example 9

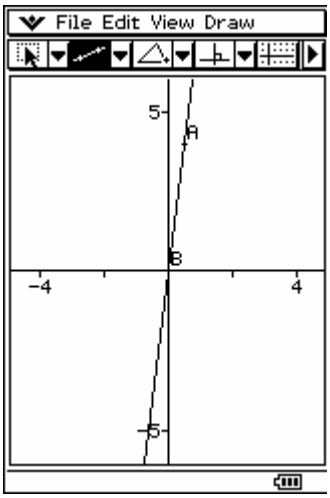
Find the gradient (slope) of the line in the distance time graph at a point with the distance at 4 km at the time at $\frac{1}{2}$ hour.

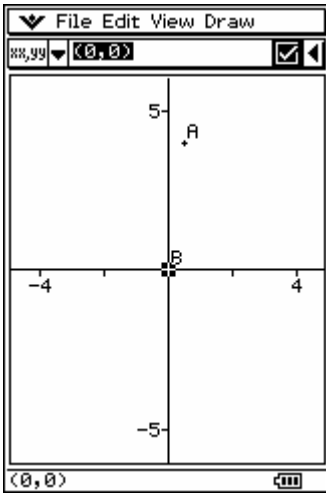
Answer: gradient
$= \frac{rise}{run} = \frac{4}{\frac{1}{2}} = 8$ km/h

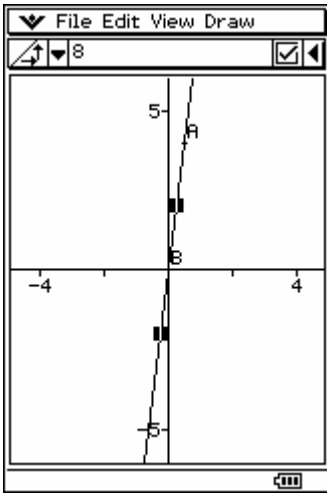
Using the geometry section of Menu, plot the line segments with lengths 4 and $\frac{1}{2}$. It is easier to use the axes to place the points. Tap the axes twice, zooming out/in to fit. Use the pencil pointer to plot the point $\left(\frac{1}{2}, 4\right)$ and $(0,0)$.

Using the Measurement bar, find the gradient between these two points.









gradient of 8.

Week 1–3
CAS

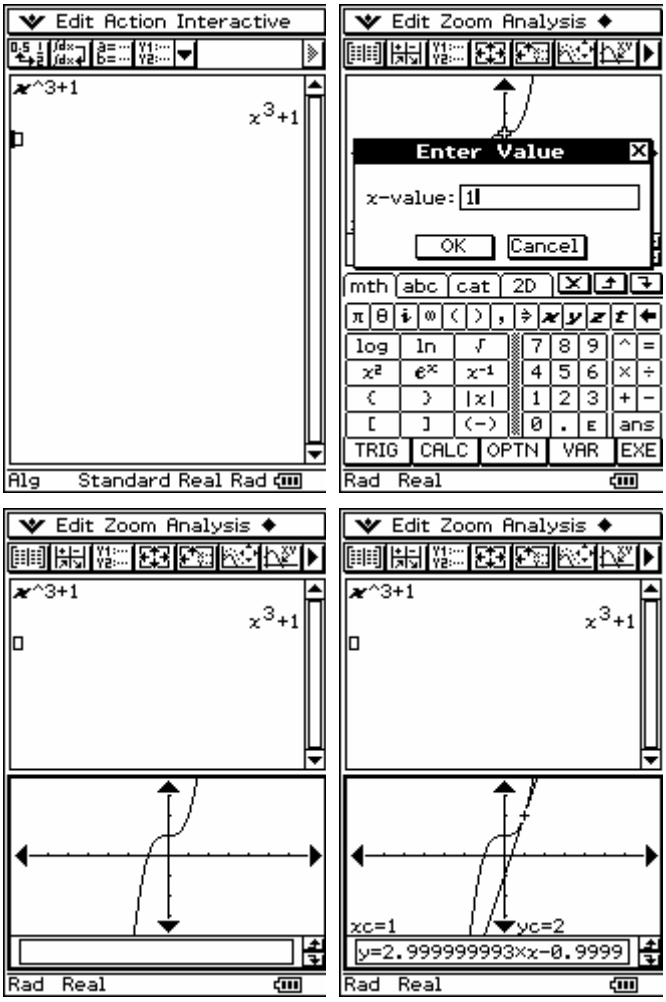
Exploring rate of change graphs

Example 10

Sketch the tangent line for the graph of $y = x^3 + 1$ at the point $x = 1$.

In the Main Menu, type in the expression $x^3 + 1$. Drag and drop this into the axes space. Set up axes by tapping the $y1 =, y2 =$ icon.

Tap Analysis, Sketch, to sketch a tangent. Type in the value $x = 1$ which is where you want the tangent.



Timeline Semester 2	Level 6 Year 9 Topic	VELS Learning focus	CAS implementation
Week 4–5	**Linear graphs** • Cartesian plane • plotting straight line graphs • axis intercepts, gradients • sketching straight line graphs • equation of a straight line **Ratios and rates** • rates of change: distance, time, speed • rates and graphs **Simultaneous equations** • graphing • substitution • elimination • worded questions	*Structure* • expressions, formulas and equations • diagrams, grids • functions: linear • transformations of these, graphs, and related algebraic properties • solve equations $f(x) = k$, k real constant • simultaneous linear: algebraic, numerical and graphical approaches • mental, by hand and technology-assisted and CAS methods *Working mathematically* • generalisations by abstracting: words and symbols • develop mathematical models, assumptions and constraints	Plotting points on the Cartesian plane Example 1 Plotting straight line graphs and finding the equation of a straight line Example 2 Lines on a calculator Example 3 Horizontal and vertical lines Example 4 Gradients of straight lines Example 5 Graphing simultaneous equations Example 6 Solving simultaneous equations Example 7 Using Matrices to solve simultaneous equations Example 8

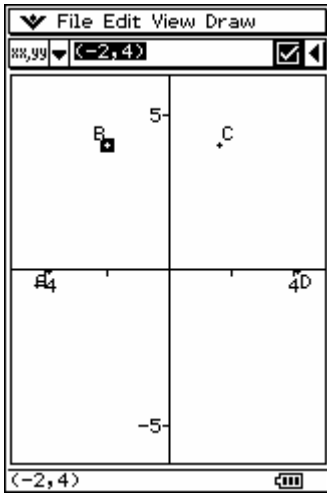
Week 4–5 CAS

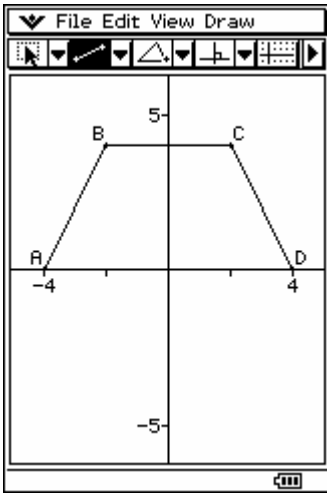
Plotting points on the Cartesian plane

Example 1

Plot the points $(-4,0),(-2,4),(2,4),(4,0)$ on a Cartesian plane. Join the points with straight lines.

In the Geometry Menu, tap the axes icon twice to get axes and a scale on the axes. Tapping the pointer icon plot the points A, B, C, D. Tapping the side arrow to get to the measurement bar, check the coordinates are correct. Tap the line segment icon and tap each of the points separately to join the points.





Week 4–5 CAS

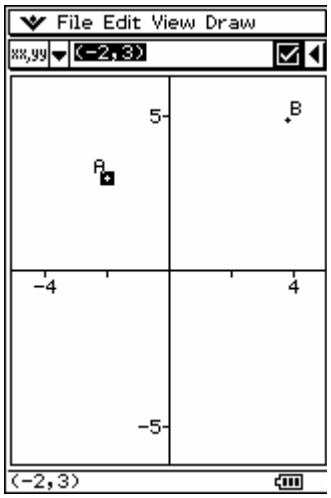
Plotting straight line graphs and finding the equation of a straight line

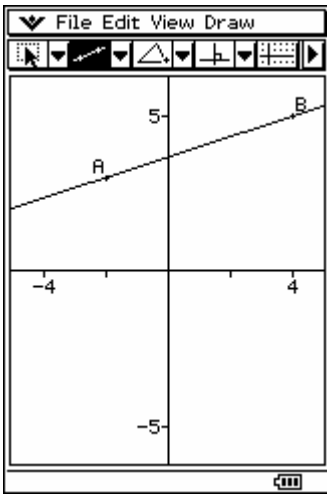
Example 2

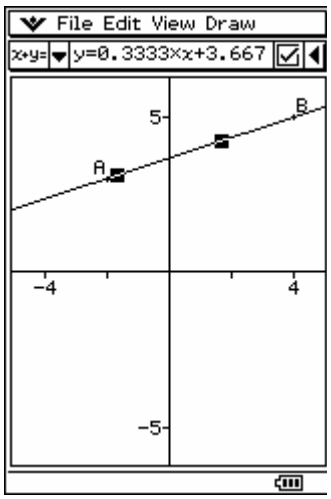
Plot a straight line through the points $(-2,3),(4,5)$ and find the equation of the line.

Answer: $y = \frac{1}{3}x + 3\frac{2}{3}$

In the Geometry Menu, tap the axes icon twice to get axes and a scale on the axes. Tapping the pointer icon, plot the points $(-2,3),(4,5)$. Tapping the side arrow to get to the measurement bar, check the coordinates are correct. Tap the line icon and tap each of the points separately to draw a line through the points. Again going to the measurement bar, find the equation of the line by tapping the line once.







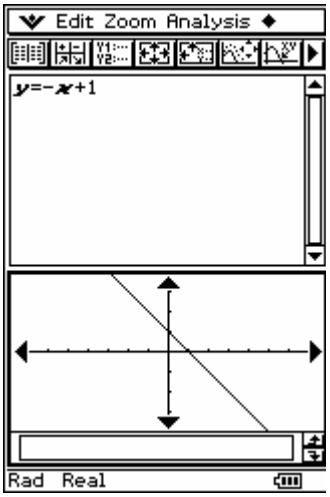
Week 4–5 CAS

Lines on a calculator

Example 3

Sketch the graph of the equation $y = -x + 1$.

In the Main Menu, type the equation $y = -x + 1$. Tap the $Y1, Y2$ icon; black the equation and drag into the axes.



Week 4–5 CAS

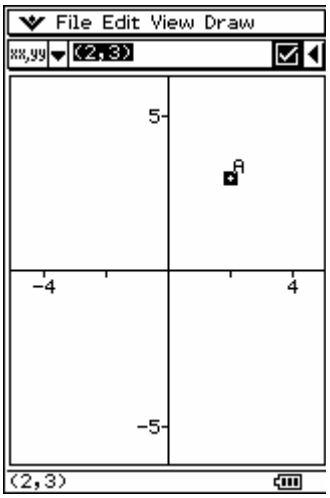
Horizontal and vertical lines

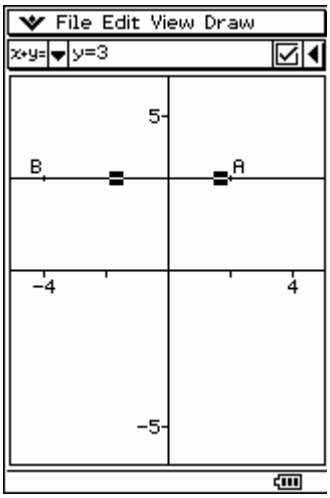
Example 4

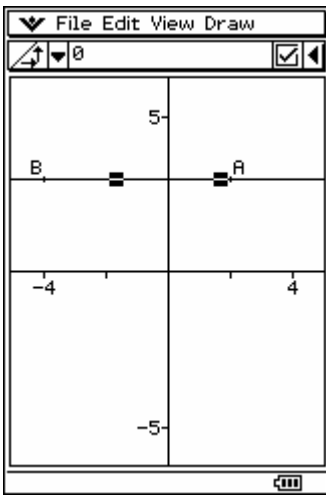
Find the equation of the line parallel to the *x*-axis, which passes through the point (2,3).

Answer: $y = 3$

In the Geometry Menu, tap the axes icon twice to get axes and a scale on the axes. Tapping the pointer icon, plot the points $(2,3)$. Tapping the side arrow to get to the measurement bar, check the coordinates are correct. Plot another point that gives the gradient of zero. Tap the line icon and tap each of the points separately to draw a line through the points. Again go to the measurement bar, and show the gradient is zero. Tapping the line once finds the equation of the line.







Week 4–5 CAS

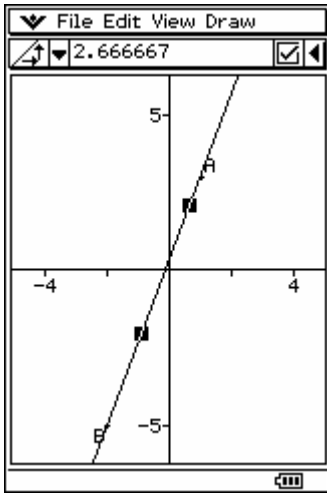
Gradients of straight lines

Example 5

Find the gradient of the line going through the points $(1,3),(-2,-5)$.

Answer: gradient = $\frac{8}{3}$

In the Geometry Menu, tap the axes icon twice to get axes and a scale on the axes. Tapping the pointer icon, plot the points $(1,3),(-2,-5)$. Tapping the side arrow to get to the measurement bar, check the coordinates are correct. Tap the line icon and tap each of the points separately to draw a line through the points. Again going to the measurement bar, find the gradient of the line by tapping the line once.



Week 4–5 CAS

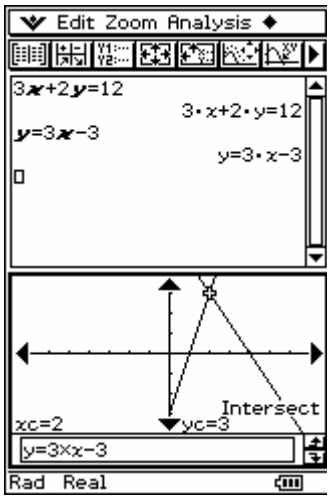
Graphing simultaneous equations

Example 6

Find the coordinates of the point where $3x+2y=12, y=3x-3$ intersect.

Answer: $(2,3)$

In the Main Menu, type the equations $3x+2y=12$ and $y=3x-3$. Tap the $Y1, Y2$ icon; black the equations and drag into the axes. Using Analysis, G-solve, intersect the point $(2,3)$ is displayed.



Week 4–5 CAS

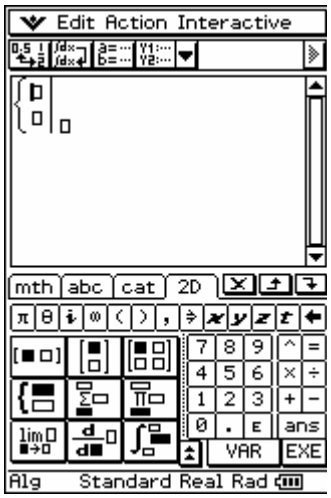
Solving simultaneous equations

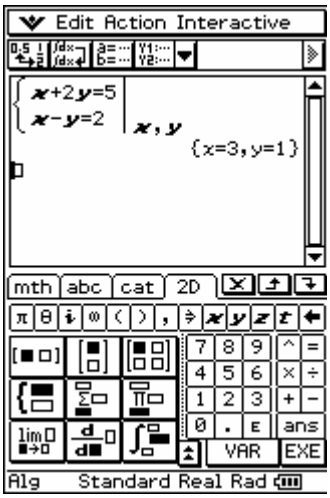
Example 7

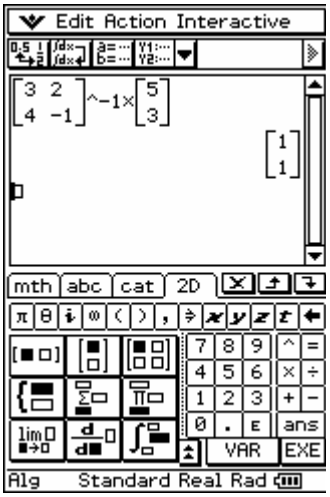
Find the coordinates of the point where $x+2y=5, x-y=2$ intersect.

Answer: $(3,1)$

In the Main Menu, use soft keyboard and 2D to insert the simultaneous equation icon. Type in the equations $x+2y=5, x-y=2$ and the variables, x, y, used.





Week 4–5 CAS	**Using matrices to solve simultaneous equations** Example 8 Use matrices to solve the simultaneous equations $3x + 2y = 5, 4x - y = 3$ Answer: $(1,1)$ The equations $3x + 2y = 5, 4x - y = 3$ can be written as the matrix equation $\begin{bmatrix} 3 & 2 \\ 4 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 5 \\ 3 \end{bmatrix}$. In 2D tap the matrix icon, enter the matrices, using the power ^–1 for the inverse, and solve.	

Timeline Semester 2	**Level 6 Year 9 Topic**	**VELS Learning focus**	**CAS implementation**
Week 6–8	**Algebra techniques** • simplify and expand expressions • difference of two squares • perfect squares • factorisation: common factor, quadratic trinomial • algebraic fractions • quadratic equations • worded questions	*Structure* • expressions, formulas and equations • algebraic properties: closure, associative, commutative, identity, inverse, distributive • mental, by hand and technology-assisted and CAS methods *Working mathematically* • generalisations by abstracting: words and symbols • test propositions, formal mathematical arguments and modify as required • develop mathematical models, assumptions and constraints • practical, theoretical and historical problem-solving contexts • generalise and change constraints • use technology to develop mathematical ideas and problems • logical argument • mental, by hand and technology-assisted methods	Simplifying expressions Example 1 Expanding expressions Example 2 Difference of two squares and perfect squares Example 3 Example 4 Factorisation with a common factor Example 5 Factorising difference of two squares Example 6 Factorising the perfect square Example 7 Factorising quadratic trinomials Example 8 Simplifying algebraic fractions Example 9 Quadratic equations Example 10

Week 6–8 CAS

Simplifying expressions

Example 1

Simplify the expression $7rk - rk + 5r^4$ by combining like terms.

Answer: $6rk + 5r^4$

In the Main Menu, type $7rk - rk + 5r^4$, using the soft keyboard and the VAR in the mth keyboard. (If ordinary letters are used that are not in the VAR Menu, then the ClassPad will treat the letters as a word and not pronumerals.) Pressing EXE gives the simplified expression.

Week 6–8 CAS

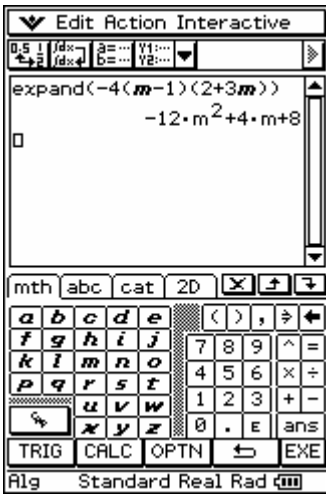
Expanding expressions

Example 2

Expand and simplify the expression $-4(m-1)(2+3m)$.

Answer: $-12m^2 + 4m + 8$

In the Main Menu, type $-4(m-1)(2+3m)$, using the soft keyboard and the VAR in the mth keyboard. (If ordinary letters are used that are not in the VAR Menu, then the ClassPad will treat the letters as a word and not pronumerals.) Tap Interactive, Transformation, Expand. Pressing EXE gives the expanded and simplified expression.



Week 6–8 CAS

Difference of two squares and perfect squares

Example 3
Expand and simplify the expression $(a-4)(a+4)$.

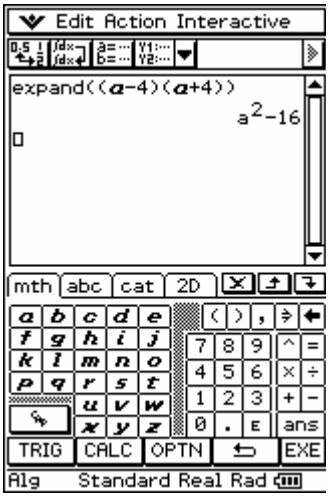
Answer: $a^2 - 16$

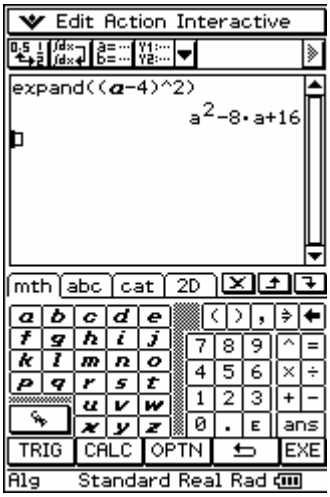
In the Main Menu, type $(a-4)(a+4)$, using the soft keyboard and the VAR in the mth keyboard. Tap Interactive, Transformation, Expand. Pressing EXE gives the expanded and simplified expression.

Example 4
Expand and simplify the expression $(a-4)^2$.

Answer: $a^2 - 8a + 16$

In the Main Menu, type $(a-4)^2$, using the soft keyboard and the VAR in the mth keyboard. Tap Interactive, Transformation, Expand. Pressing EXE gives the expanded and simplified expression.





Week 6–8 CAS

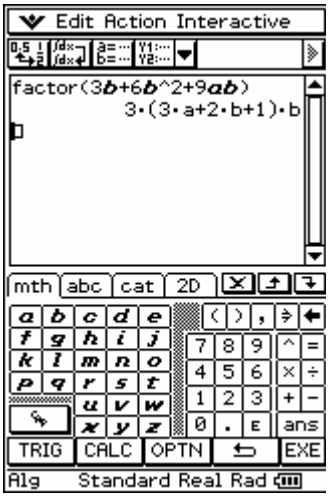
Factorisation with a common factor

Example 5

Factorise the expression
$3b + 6b^2 + 9ab$

Answer: $3b(3a + 2b + 1)$

In the Main Menu, type
$3b + 6b^2 + 9ab$, using the soft keyboard and the VAR in the mth keyboard. Tap Interactive, Transformation, Factor. Pressing EXE gives the factorised expression.



Week 6–8 CAS

Factorising difference of two squares

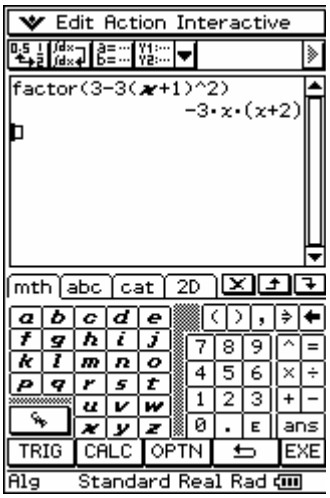
Example 6

Factorise the expression $3 - 3(x+1)^2$

Answer:

$$3 - 3(x+1)^2$$
$$= 3\left(1 - (x+1)^2\right)$$
$$= 3(1 - x - 1)(1 + x + 1)$$
$$-3x(x+2)$$

In the Main Menu, type $3 - 3(x+1)^2$. Tap Interactive, Transformation, Factor. Pressing EXE gives the factorised expression.



Week 6–8 CAS

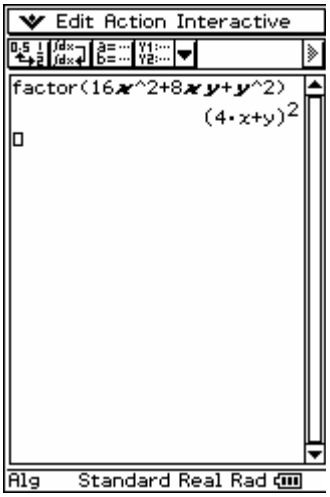
Factorising the perfect square

Example 7

Factorise the expression
$16x^2 + 8xy + y^2$

Answer: $(4x + y)^2$

In the Main Menu, type
$16x^2 + 8xy + y^2$. Tap Interactive, Transformation, Factor. Pressing EXE gives the factorised expression.



Week 6–8 CAS

Factorising quadratic trinomials

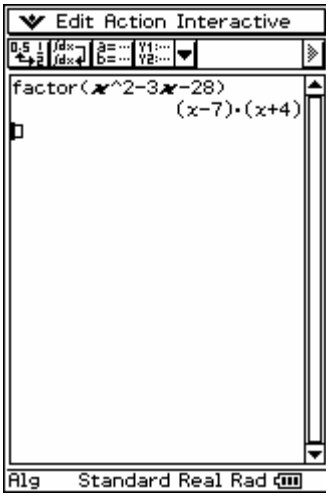
Example 8

Factorise the expression $x^2 - 3x - 28$.

Answer: $(x-7)(x+4)$

In the Main Menu, type $x^2 - 3x - 28$. Tap Interactive, Transformation, Factor. Pressing EXE gives the factorised expression.

(Note that rfactor means 'root' and is used when the factors have surds in them.)



Week 6–8 CAS

Simplifying algebraic fractions

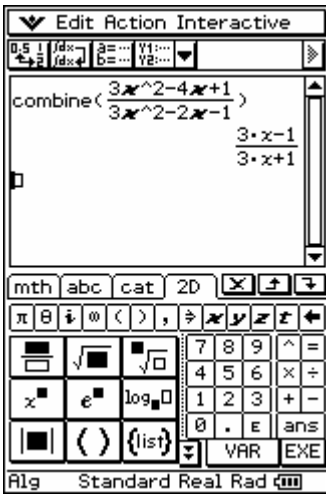
Example 9

Simplify the expression $\dfrac{3x^2 - 4x + 1}{3x^2 - 2x - 1}$

Answer:

$$\frac{(3x-1)(x-1)}{(3x+1)(x-1)}$$
$$= \frac{3x-1}{3x+1}$$

In the Main Menu, type $\dfrac{3x^2 - 4x + 1}{3x^2 - 2x - 1}$, using 2D on the soft keyboard. Tap Interactive, Transformation, Combine. Pressing EXE gives the simplified expression. Note that Combine is useful for all common denominator questions.



Week 6–8 CAS

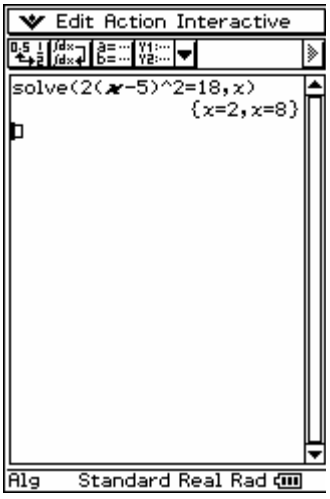
Quadratic equations

Example 10

Solve the equation $2(x-5)^2 = 18$.

Answer: $x = 8, x = 2$

In the Main Menu, type $2(x-5)^2 = 18$. Tap Interactive, Equation/Inequality, Solve. Use the variable *x* when asked.



Timeline Semester 2	Level 6 Year 9 Topic	VELS Learning focus	CAS implementation
Week 9–12	**Quadratic functions** • plotting parabolas • sketching parabolas	*Structure* • functions: quadratic • mental, by-hand and technology assisted and CAS methods	Plotting parabolas Example 1 Sketching parabolas Example 2

Week 9–12
CAS

Plotting parabolas

Example 1

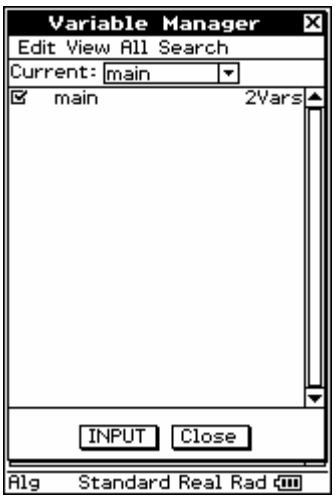
Complete a table of values for $y = 3x^2 + 1$ for $-3 \le x \le 3$ and plot the graph.

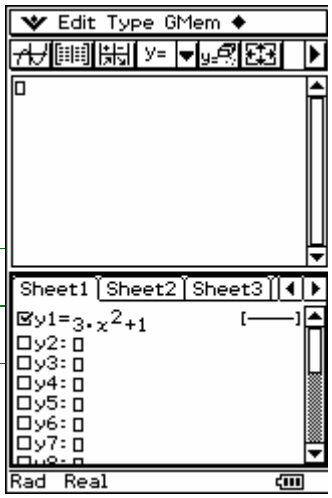
Answer:

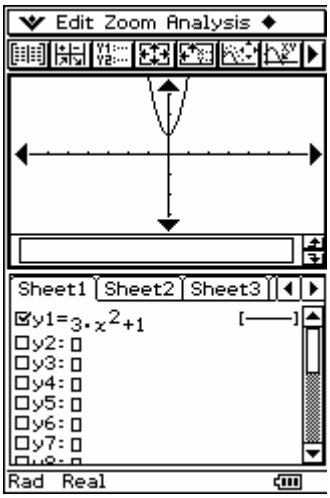
x	–3	–2	–1	0	1	2	3
y	28	13	4	1	4	13	28

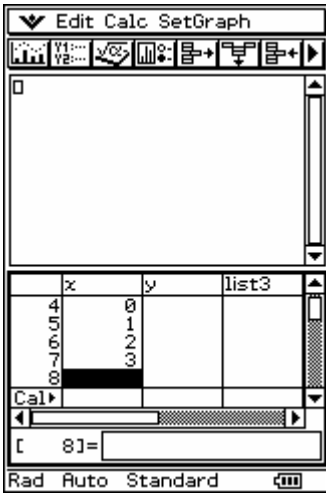
In the Main Menu, tap the Y1..Y2.. icon, which will bring up the Sheet 1, Sheet 2… screen as in the first screen below. Type in the equation $y1 = 3x^2 + 1$, which will bring a tick against that equation. Then tap the axes and black the equation Y1, dragging it into the axes.

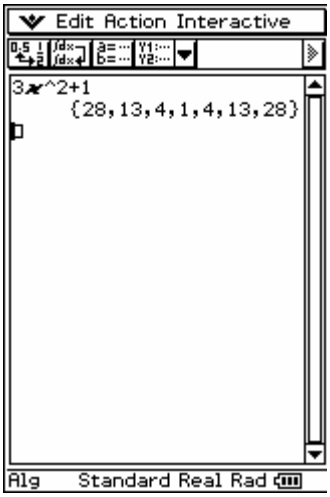
Alternatively, go to the lists, name list 1 *x*, and fill the *x* list with the numbers –3,–2,–1,0,1,2,3. Then, typing the expression $3x^2 + 1$, the *y*-values will be shown. Remember to clear the variables after, going to *a*=, *b*=, Edit, Delete, Vars.











Week 9–12
CAS

Sketching parabolas

Example 2

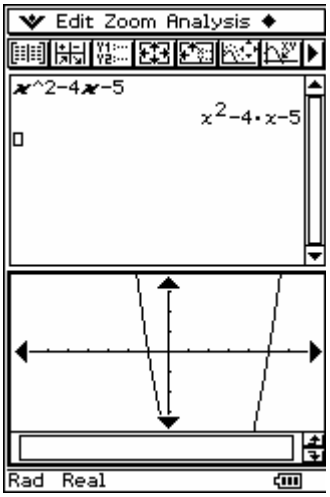
For the parabola $y = x^2 - 4x - 5$, find:

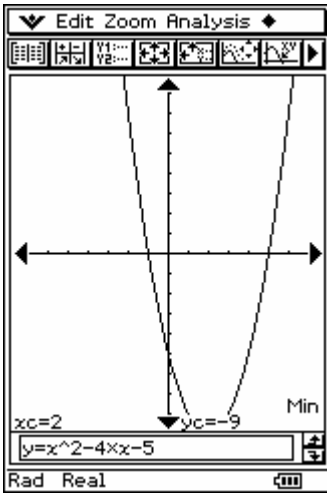
a) the *y*-intercept
b) the *x*-intercept
c) the axis of symmetry
d) the turning point
e) hence sketch the graph.

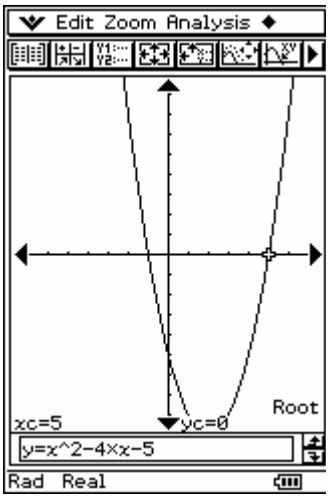
Answer:

a) $(0,-5)$
b) $(-1,0),(5,0)$
c) $x = 2$
d) $(2,-9)$
e) graph

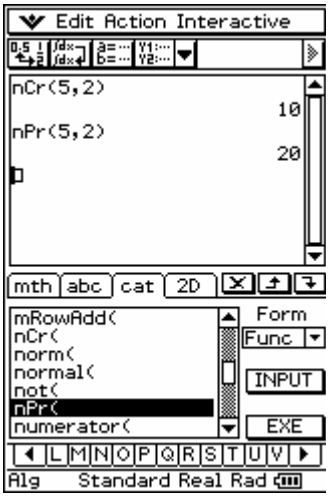
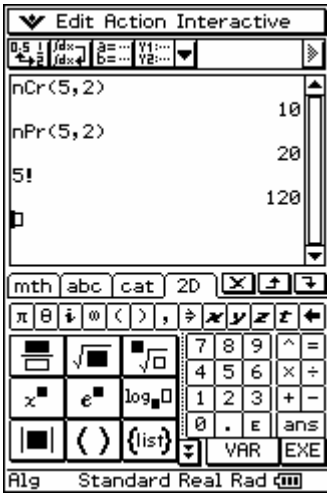
In the Main Menu, type the expression $x^2 - 4x - 5$. Tap the diamond next to the Y1..Y2.. icon, which will bring up the axes. Black the expression and drag into the axes. If you want a full picture of the axes, tap the resize below the screen. Analysis, g-solve will give a full analysis of the graph.

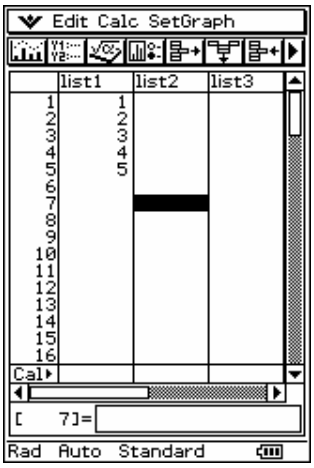
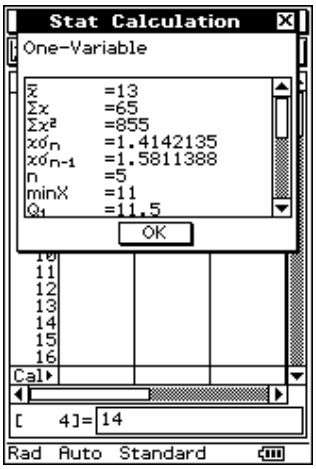


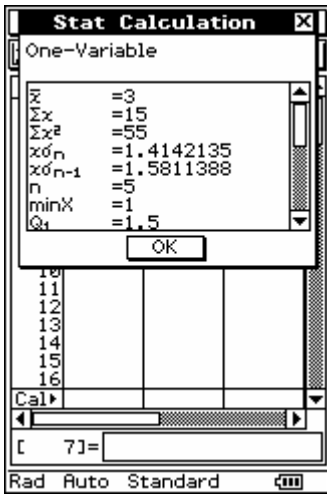




Timeline Semester 2	Level 6 Year 9 Topic	VELS Learning focus	CAS implementation
Week 13–14	**Probability** • event space • odds	*Measurement, chance and data* • chance, risk, event space *Structure* • set operations: complement, union, intersection, inclusion	Probability notation Example 1 Example 2

Week 13–14 **CAS**	**Probability notation** Example 1 Evaluate ${}^5C_2$ and ${}^5P_2$ Answer: 10 and 20. In the Main Menu, type ${}^5C_2$ and ${}^5P_2$, using the cat (catalogue) list on the soft keyboard. Press EXE for answer. Example 2 Evaluate 5! Answer: 120		

Timeline **Semester 2**	**Level 6** **Year 9 Topic**	**VELS Learning focus**	**CAS implementation**
Week 15–17	**Statistics** • histograms, bar graphs • mean and range • cumulative frequency • stemplots • boxplots • measures of spread	*Measurement, chance and data* • display data • mean, median, mode *Working mathematically* • generalisations by abstracting: words and symbols • develop mathematical models, assumptions and constraints • practical, theoretical and historical problem-solving contexts	The mean Example 1 Example 2 Boxplots Example 3 Practical statistics Example 4
Week 15–17 **CAS**	**The mean** Example 1 Find the Mean of the numbers 1,2,3,4,5. Answer: 3 In the Statistics Menu, type the numbers 1,2,3,4,5 in list 1. Press Calc, One-Variable and EXE for the mean $\bar{x}$. Example 2 Find the Sum and minimum value of the list of numbers 11,12,13,14,15. Answer: 65 and 11. In the Statistics Menu, type the numbers 1,2,3,4,5 in list 1. Press Calc, One-Variable and EXE for the Sum $\sum x = 65$ and the min X=11.		



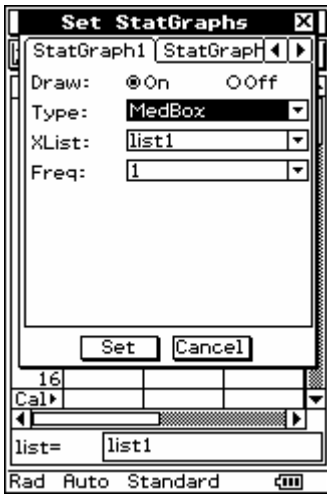
Week 15–17 CAS

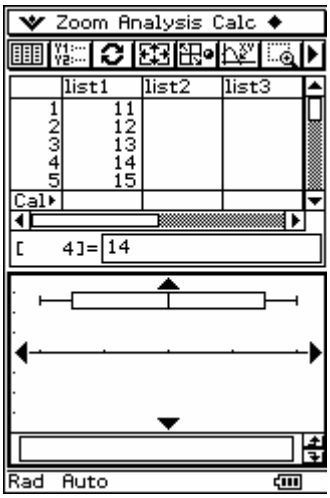
Boxplots

Example 3

Sketch a median boxplot for the numbers 11,12,13,14,15.

In the Statistics Menu, type the numbers 11,12,13,14,15 in list 1. Tap Set StatGraphs, MedBox using list 1.





Week 15–17 CAS

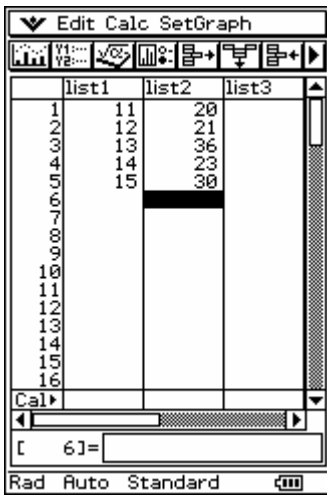
Practical statistics

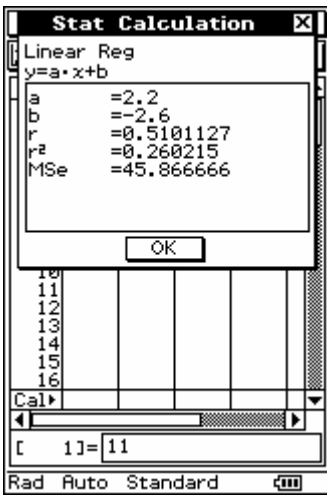
Example 4

Find the linear regression for the numbers 11,12,13,14,15 and 20,21,36,23,30

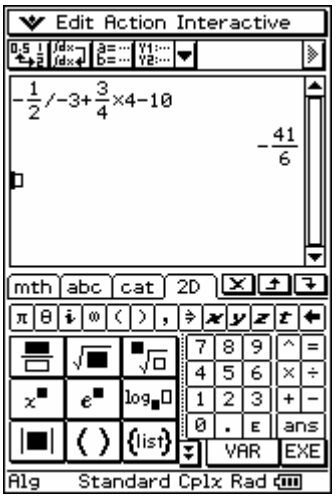
Answer: $y = 2.2x - 2.6$

In the Statistics Menu, type the two lists of numbers in list 1 and list 2. Tap Calc, Two-Variable, list 1 and list 2, choosing Linear Reg.





Year 10 program

Timeline Semester 1	Level 6 Year 10 Topic	VELS Learning focus	CAS implementation
Week 1–3	**Number systems** • the real number system • arithmetic with *N*, *Z*, *Q* (fractions and decimals, irrationals) • surds operations: +, –, ×, rationalise denominators with conjugate surds • 2 × 2 matrices *Ratio and rates* • ratio, rates of change: distance, time, speed, density • rates and graphs	*Number* • set of real numbers • irrationals • surds, golden ratio, pi • arithmetic computations (natural, integers, decimals, fractions, irrationals) • decimal places, significant figures • factorials *Structure* • properties of real number system (natural, integers, rationals, irrationals) • use surds in calculations	Order of operations Example 1 Prime factors Example 2 Substitution with integers Example 3 Integers and fractions Example 4 Absolute value Example 5 Fractions to decimals Example 6 Factorial notation Example 7 Simplifying surds Example 8 Multiplying surds Example 9 Rationalising denominators with conjugate surds Example 10 Matrices Example 11
Week 1–3 **CAS**	**Order of operations** Example 1 Calculate $-\frac{1}{2} \div -3 + \frac{3}{4} \times 4 - 10 = -\frac{41}{6}$ A CAS deals with the order of operations. In the Main Menu, type the number, then EXE.		

Week 1–3 CAS

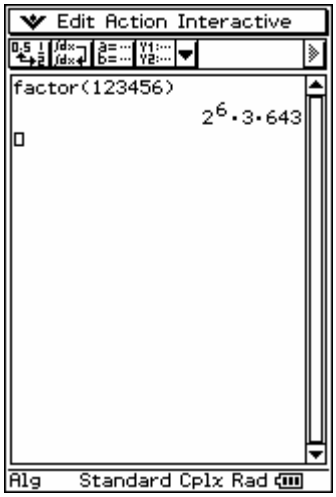
Prime factors

Example 2

Express 123456 as a product of its primes = $2^6 \times 3^1 \times 643$.

A CAS can express numbers as the product of their prime factors.

In the Main Menu, type the number, then go to Interactive, Transformation and Factor.



Week 1–3 CAS

Substitution with integers

Example 3

If $a = 10, b = -4, c = -2$, evaluate

$a^2 + b^2 - c^2$

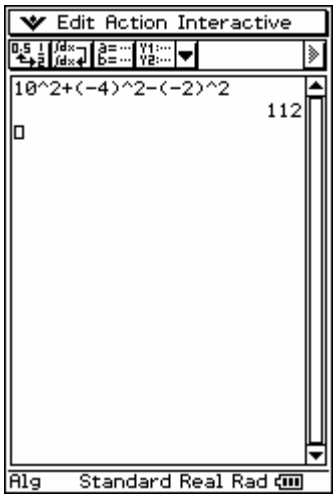
Answer: 112

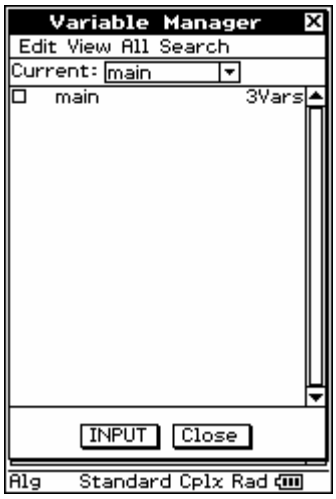
Either directly type in the number substitute or use the facility of defining variables.

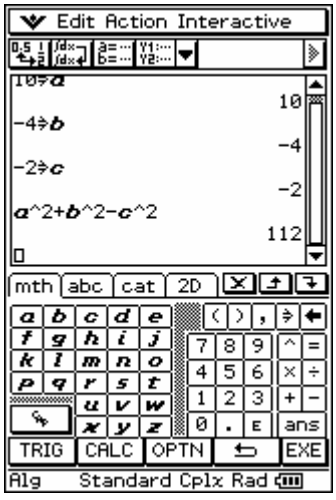
In the Main Menu, type $10 \Rightarrow a$, using VAR in the mth keyboard.

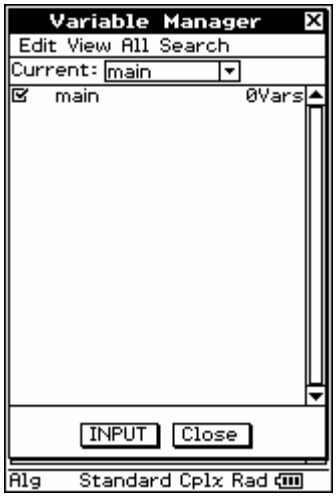
Define each of the letters as so, and then type $a^2 + b^2 - c^2$, EXE.

To clear these variables go to *a* =, *b*=, showing 3 variables are defined. Clear these by ticking main and edit, deleting, Even though it will say it is locked, the variables will be cleared, until they are defined the next time.









Week 1–3 CAS

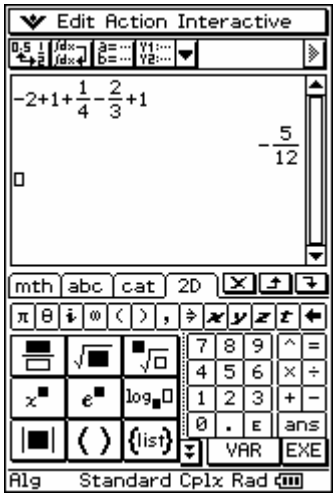
Integers and fractions

Example 4

Evaluate $-2+1\frac{1}{4}-\frac{2}{3}+1=-\frac{5}{12}$

Mixed numbers are typed as $1+\frac{1}{4}$.

Use keyboard 2D to type in a fraction.



Week 1–3 CAS

Absolute value

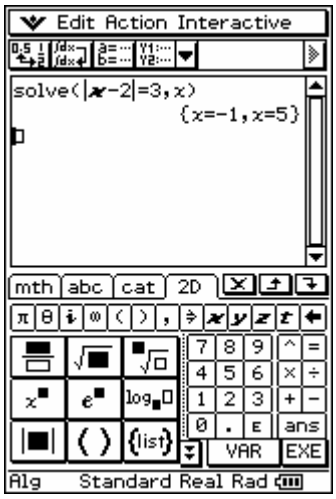
Example 5

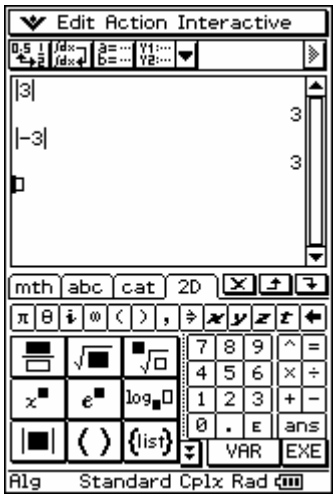
Solve $|x-2|=3$

Answer: $x = –1, x = 5$

Use the soft keyboard, and 2D, to locate the absolute value icon, $|\ |$.

Type the equation $|x-2|=3$. Black the equation and tap Interactive, Equation/Inequality, Solve with variable x, then EXE to get the answer of $x = –1, x = 5$





Week 1–3 CAS

Fractions to decimals

Example 6

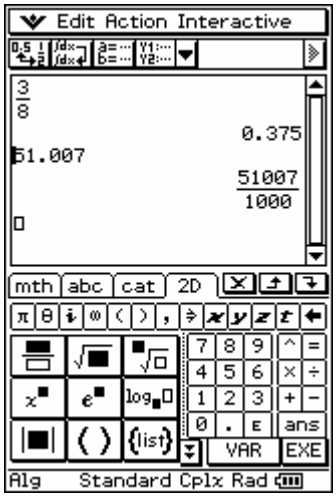
Write $\frac{3}{8}$ as a decimal and 51.007 as a fraction.

Answer: 0.375 and $\frac{51007}{1000}$

Type in 3/8 and EXE and black the answer. Then tap the top left 0.5 to ½ icon.

Type in 51.007 and EXE.

A fraction will result.



Week 1–3 CAS

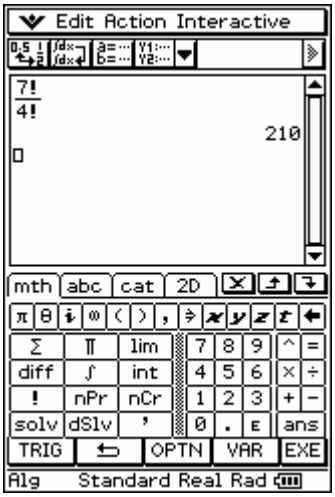
Factorial notation

Example 7

Evaluate $\frac{7!}{4!}$

Answer: 210

The factorial (!) symbol can be found in mth, calc, !. Type the fraction using 2D, also on the soft keyboard.



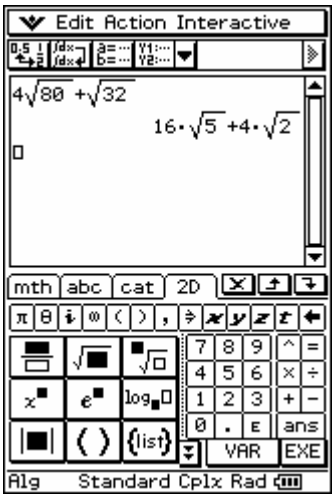
Week 1–3 CAS

Simplifying surds

Example 8

Simplify $4\sqrt{80}+\sqrt{32}=16\sqrt{5}+4\sqrt{2}$

Using soft Keyboard 2D.



Week 1–3 CAS

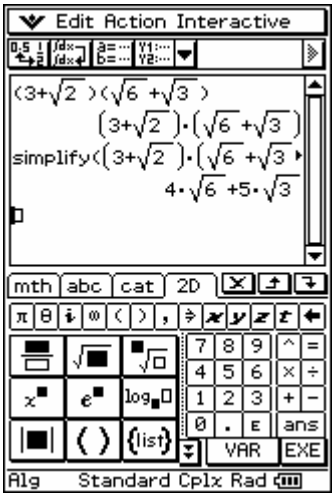
Multiplying surds

Example 9

Expand and express in simplest form $(3+\sqrt{2})(\sqrt{6}+\sqrt{3})$

Answer: $4\sqrt{6}+5\sqrt{3}$

Using soft Keyboard 2D, Interactive, Transformation and Simplify.



Week 1–3 CAS

Rationalising denominators with conjugate surds

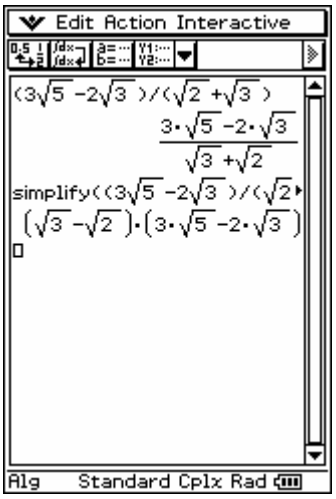
Example 10

Express $\dfrac{3\sqrt{5}-2\sqrt{3}}{\sqrt{2}+\sqrt{3}}$

with a rational denominator

Answer: $\left(\sqrt{3}-\sqrt{2}\right)\left(3\sqrt{5}-2\sqrt{3}\right)$

Using Keyboard 2D, then Interactive, Transformation and Simplify.



Week 1–3 CAS

Matrices

Example 11

Add matrices $\begin{bmatrix}1 & -2\\ 3 & 0\end{bmatrix}$ and $\begin{bmatrix}0 & 3\\ -2 & -1\end{bmatrix}$

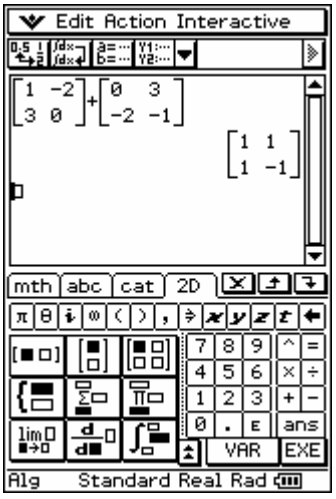
Answer: $\begin{bmatrix}1 & 1\\ 1 & -1\end{bmatrix}$

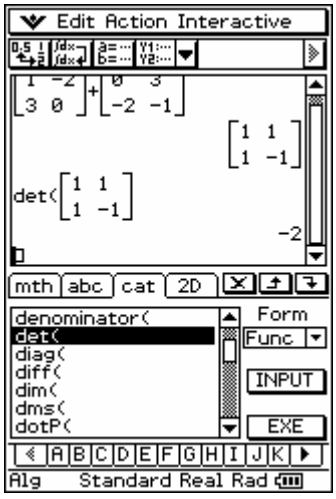
Using soft keyboard 2D, find the 2×2 matrices icon and type in the matrices required. Then EXE gives the answer $\begin{bmatrix}1 & 1\\ 1 & -1\end{bmatrix}$.

Using the matrix from the previous example, the ClassPad300 can find the determinant of the matrix $\begin{bmatrix}1 & 1\\ 1 & -1\end{bmatrix}$.

Answer: $\det\begin{bmatrix}1 & 1\\ 1 & -1\end{bmatrix} = -2$

Using cat from the soft keyboard locate det, by typing in D in the alphabet below. Tap the word det and enter the matrix required.





Timeline Semester 1	Level 6 Year 10 Topic	VELS Learning focus	CAS implementation
Week 4–5	**Measurement** • Pythagoras' theorem • perimeters of polygons, circles and arc lengths • area of polygons, circles and sectors • simple and composite shapes • volume and surface area of cylinders, cones, pyramids spheres • capacity	*Measurement, chance and data* • Pythagoras' theorem • measure, estimate • perimeter, area, surface area, angles, rates of speed density and concentration • units, errors • formulas: perimeter, area, angles, surface area, volume • degrees, radians	Formula for the length of the hypotenuse Example 1 Circumferences and arc lengths Example 2 Areas of shapes Example 3 Areas of circles Example 4 Areas of circles using geometry Example 5

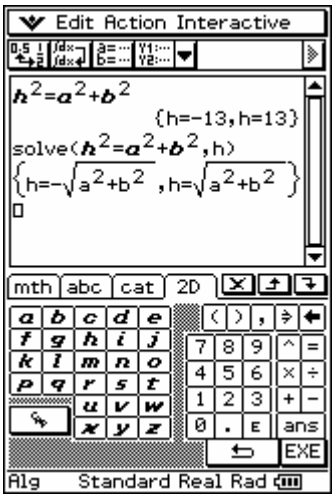
Week 4–5 CAS

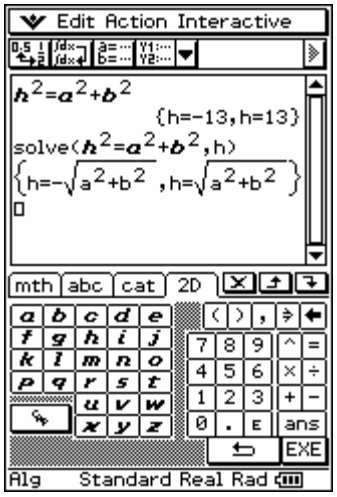
Formula for the length of the hypotenuse

Example 1

Solve the equation $h^2 = a^2 + b^2$ for *h*.

Answer: $h = \sqrt{a^2 + b^2}$ (take positive answer).





Week 4–5 CAS

Circumferences and arc lengths

Example 2

Find the circumference of the circle with radius of 10.5 m = 21π cm $\approx$ 65.97 cm

Circumference of circle is $C = 2\pi r$

Either directly type in the number substitute, or use the facility of defining variables.

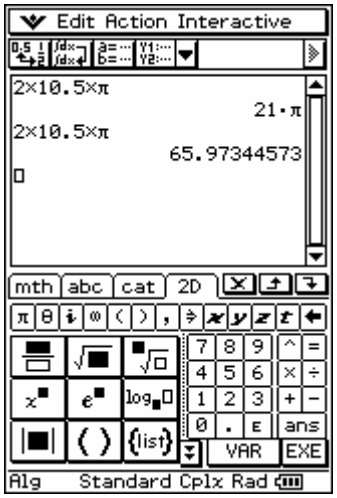
In the Main Menu type $10.5 \Rightarrow r$ using VAR in the mth keyboard.

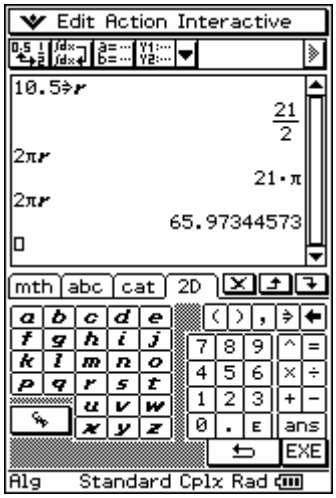
Then type $2\pi r$, EXE. This gives answer exactly.

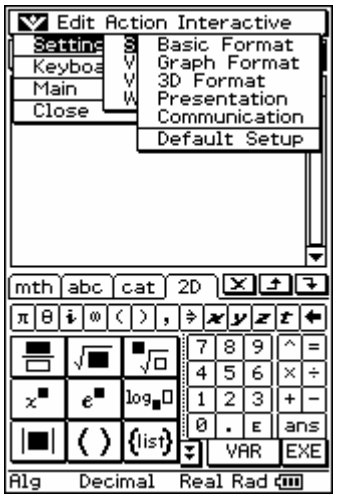
Or black exact answer and tap top left decimal icon for decimals.

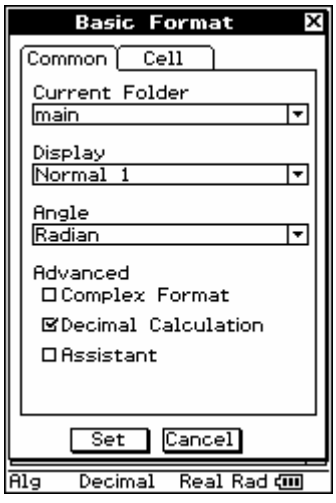
Alternatively, have the set up as decimals in the first place.

Go to settings (pointy icon top left), set up, basic format, tick decimal calculation.









Week 4–5 CAS

Areas of shapes

Example 3

Find the length of the hypotenuse and the area of a right-angled triangle with shorter sides 6 m and 8 m.

Answer: 10 m and 24 m^2

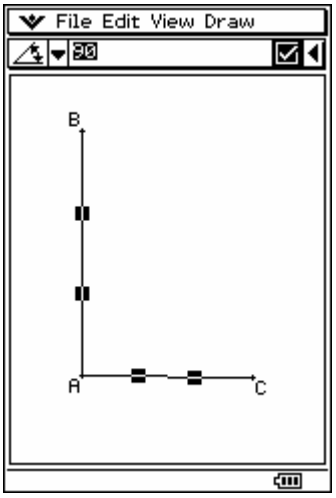
Use fraction, $\sqrt{\ }$ and x^{power} in 2D on the soft keyboard.

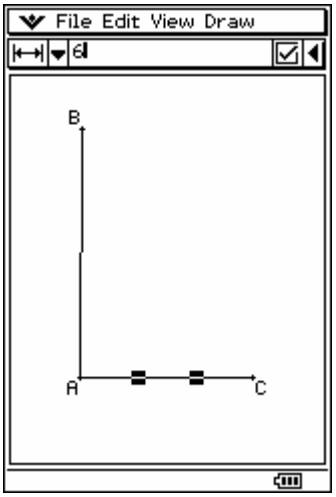
Alternatively, tap the Geometry icon on the Menu.

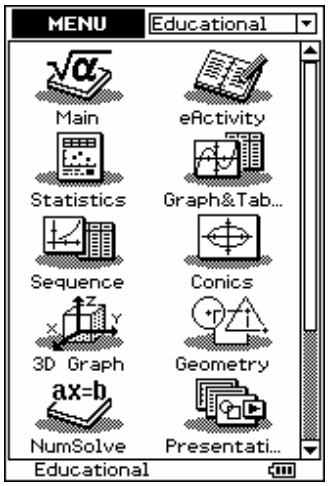
Tap the line segment icon and draw line segment AB. Add the line segment AC.

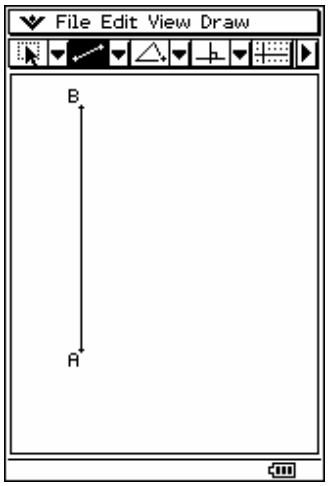
The side arrow gets to the Measurement bar, allowing you to enter measurements.

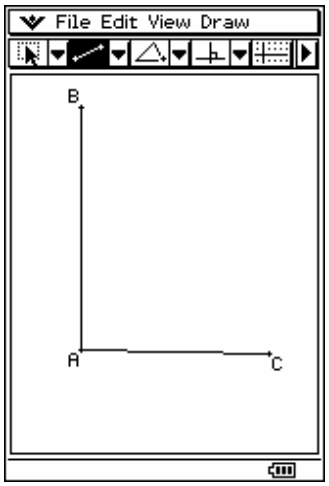
And fix a right angle at A and define the lengths as 6 and 8. Add hypotenuse.

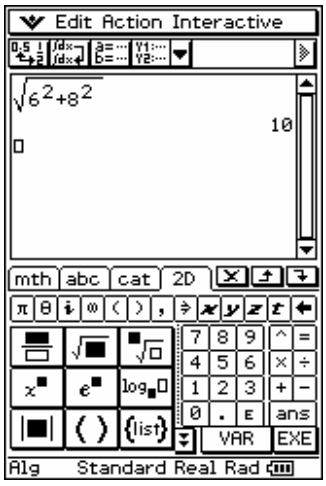


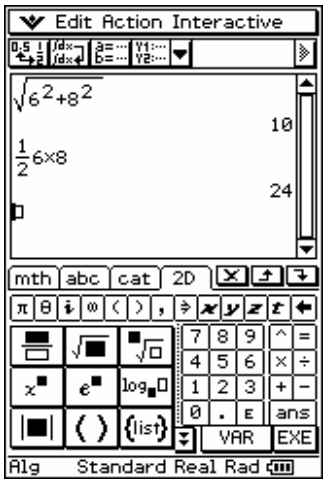


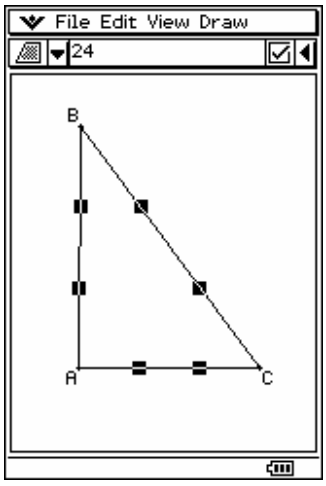




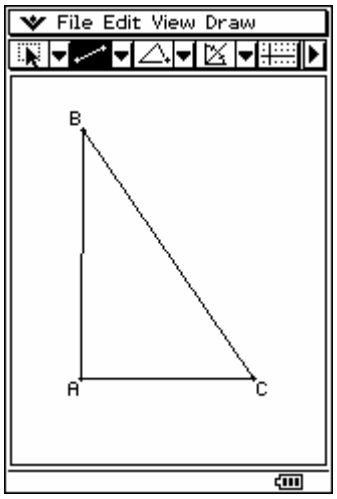








and using the measurement bar, the area = 24 m^2



Week 4–5 CAS

Areas of circles

Example 4

Find the area of the circle with radius of 10.5 m = $\frac{441\pi}{4}$ cm^2 ≈ 346.36

Area of circle is $A = \pi r^2$

Either directly type in the number substitute, or use the facility of defining variables.

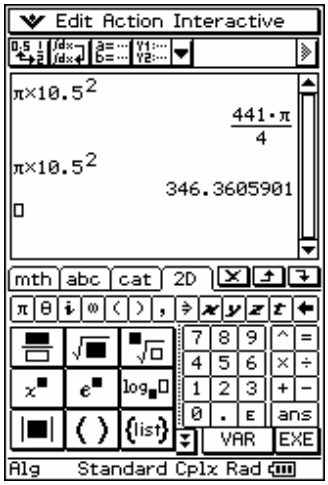
In the Main Menu, type $10.5 \Rightarrow r$, using VAR in the mth keyboard.

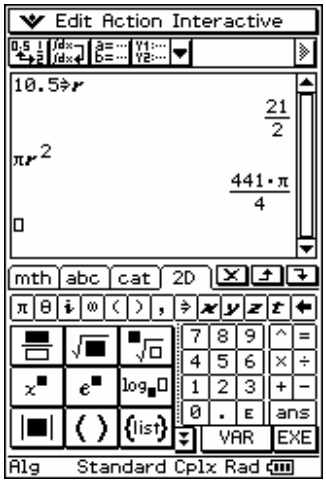
Then type πr^2, EXE. This gives answer exactly.

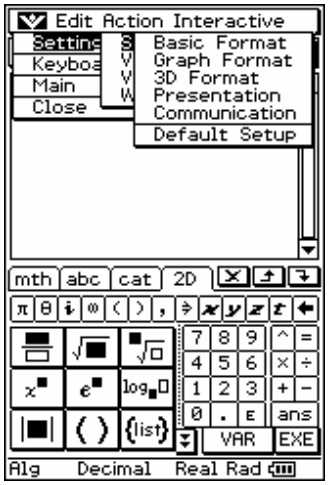
Or black exact answer and tap top left decimal icon for decimals.

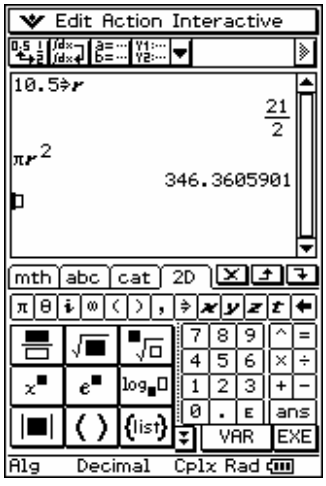
Alternatively, have the set up as decimals in the first place.

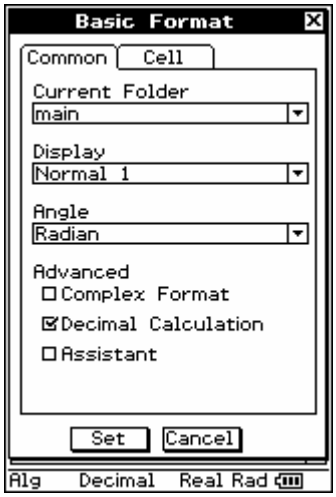
Go to settings (pointy icon top left), set up, basic format, decimal calculation.

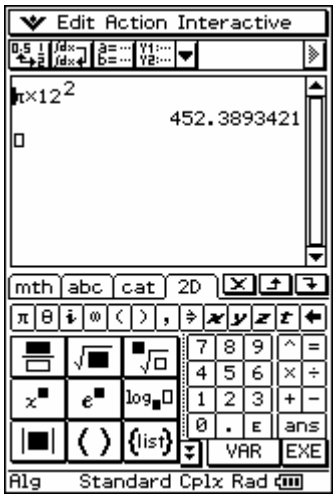
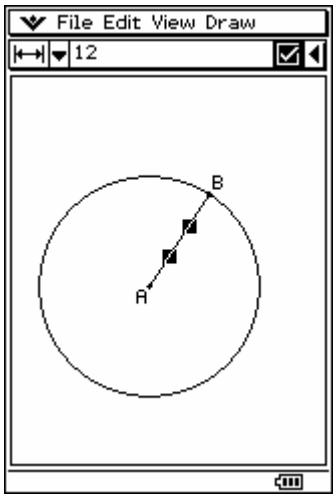
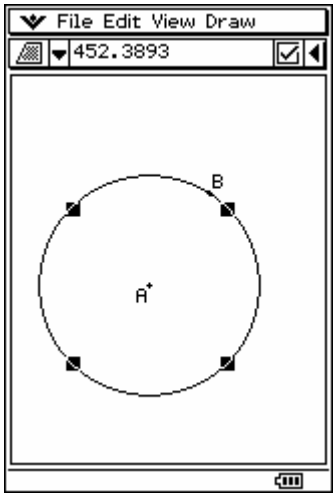
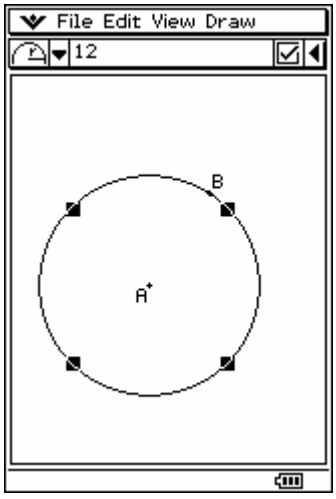










Week 4–5 CAS	**Areas of circles using geometry** Example 5 Find the area of the circle with radius of 12 mm = 12π mm^2 = 452.389 mm^2 Alternatively, using Geometry, draw a circle. By tapping two points using the circle icon, the radius is constructed and the circle drawn. Use the measurement bar to fix radius at 2 mm. Area found as 452.389 mm^2	   	

Timeline Semester 1	**Level 6 Year 10 Topic**	**VELS Learning focus**	**CAS implementation**
Week 6	**Coordinate geometry** • coordinate axes	*Space* • position, length and angle • location	Coordinate geometry Example 1

Week 6 CAS **Coordinate geometry**

Example 1

Plot the points $A(-1,3), B(2,-5)$ onto a set of axes and find the distance between them.

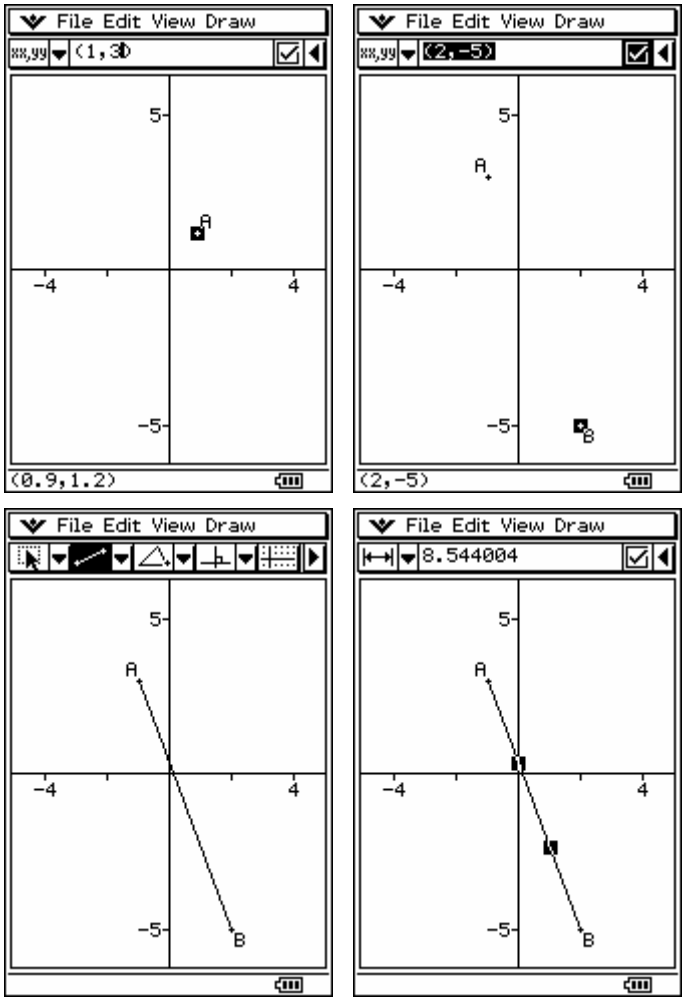
Answer: 8.544

Using the Geometry icon in the Menu, coordinates can be placed on axes and distance found in the Measurement bar.

Tap the axes icon twice to get axes and points on axes. Then tap the pencil pointer and flip over to the measurement bar to define points A and B.

Tap line segment icon and tap points A and B to draw segment. Go to Measurement bar and find distance between A and B.

Distance between A and B is 8.544 units.



Timeline Semester 1	Level 6 Year 10 Topic	VELS Learning focus	CAS implementation
Week 7–8	**Trigonometry** • sine, cosine, tangent ratio • finding sides and angles • angles of elevation and depression • unit circle • sine, cosine graphs	*Space* • angles • location *Measurement, chance and data* • measure, estimate angle • units, formulas • degrees, radians	Finding length of the side Example 1 Finding the hypotenuse Example 2 Finding angles using degrees and radians Example 3 Trigonometry and bearings Example 4 Trigonometry in 3-D Example 5 Circular function (trigonometric) graphs Example 6 Circular function (trigonometric) identities Example 7

Week 7–8 CAS

Finding length of the side

Example 1

Find the length of the side in the right-angled triangle opposite the angle 40.23^0 , and hypotenuse length 10 cm.

Answer:

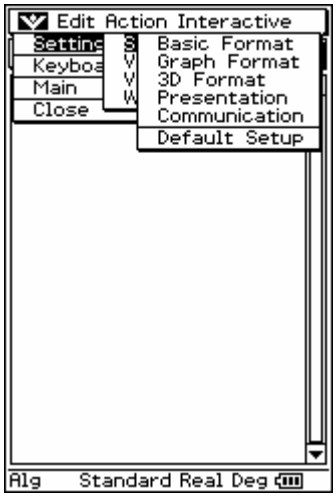
$$\sin 40.23 = \frac{x}{10}$$

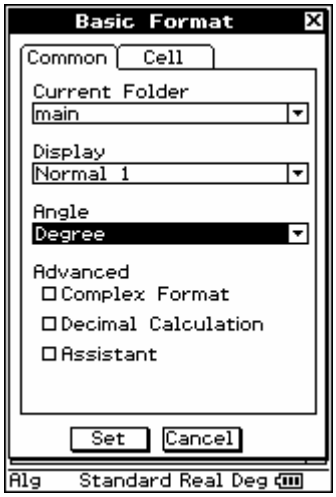
$\therefore x = 10\sin 40.23$

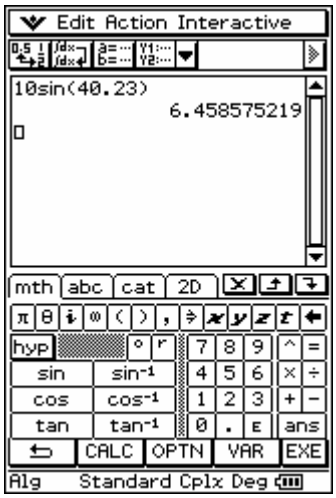
$\therefore x = 6.46$ cm

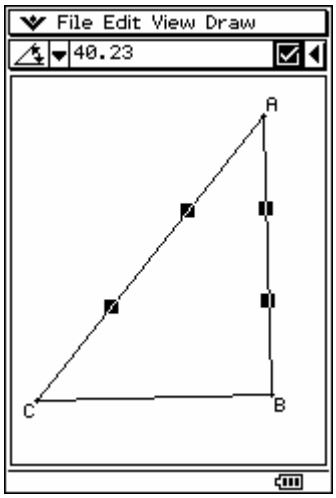
To work Trigonometry in degrees, first set the format from Radians to Degrees. Go to Settings, Setup, Basic Format, degrees. Find Trig under the soft keyboard mth, Trig.

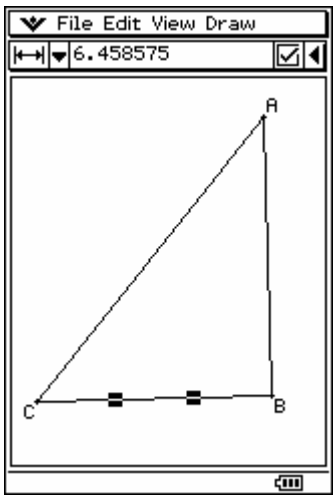
Tapping decimal to fraction icon gives $10\sin 40.23 \approx 6.46$.











Week 7–8
CAS

Finding the hypotenuse

Example 2

Find the length of the hypotenuse of a right-angled triangle, with a side of 40 cm opposite the angle of 40.23^0.

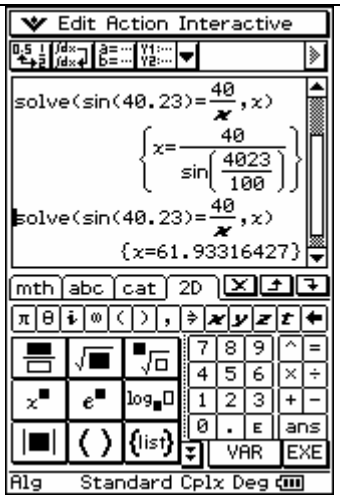
Answer:

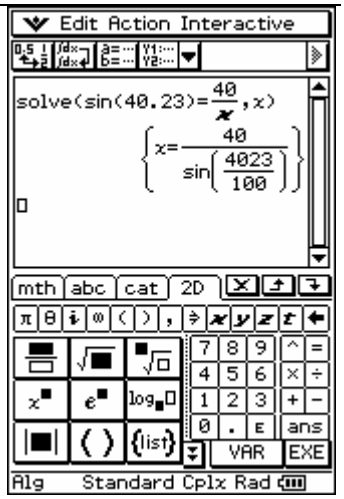
$$\sin 40.23^0 = \frac{40}{x} \therefore x = \frac{40}{\sin 40.23^0}$$

$\therefore x = 61.93$ cm

Make sure the format is in degrees and decimalise the answer. Or you can set the format to Decimal calculation at the beginning.

Length of side is 61.93 cm.





Week 7–8
CAS

Finding angles using degrees and radians

Example 3

Find the unknown angle opposite the side length 34 cm, in a right-angled triangle with the hypotenuse of 48 cm.

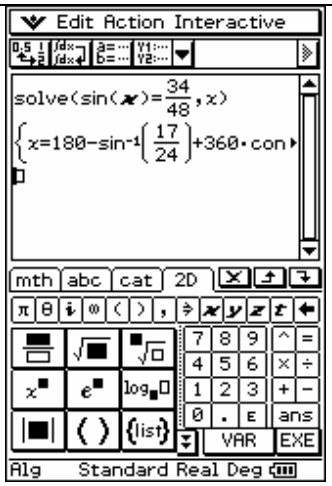
Answer: $\sin\theta^0 = \frac{34}{48} \therefore \theta = 45.10^0$

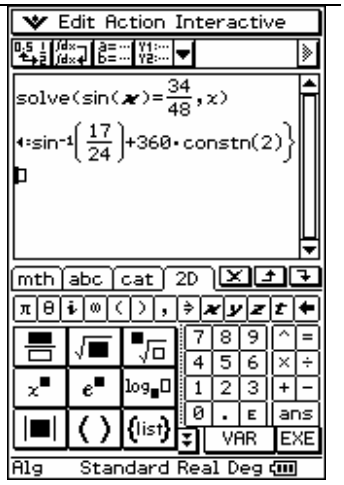
In the Main Menu, the answers to trigonometric equations need to be interpreted as general solutions with the parameter constn(1) and constn(2) …

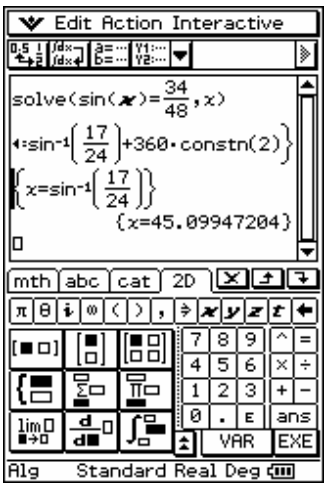
Taking constants as zero, $\theta = 45.10^0$.

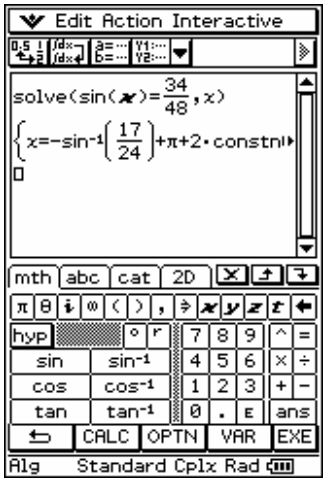
Alternatively, using radians as a measure of the angle

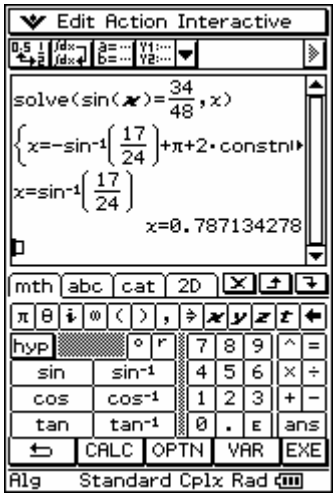
$$\sin\theta^c = \frac{34}{48} \therefore \theta = 0.787^c$$











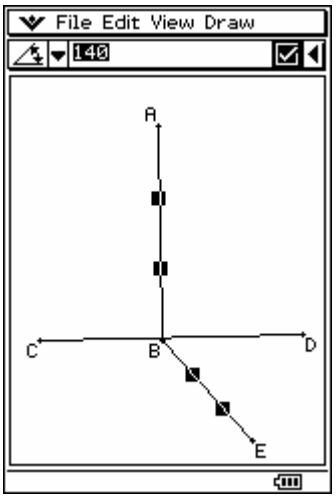
Week 7–8 CAS

Trigonometry and bearings

Example 4

Draw a diagram showing the bearing of $140^0 T$.

Angles between lines and true bearings are found in the Geometry section of the Menu.



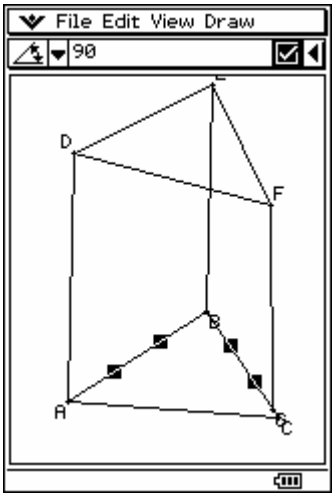
Week 7–8 CAS

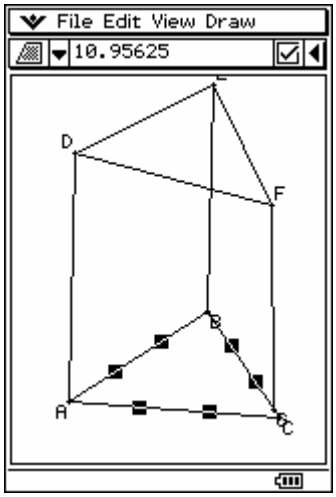
Trigonometry in 3-D

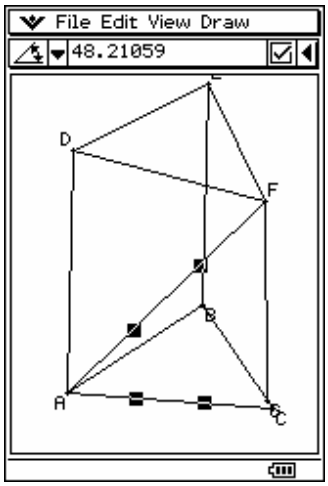
Example 5

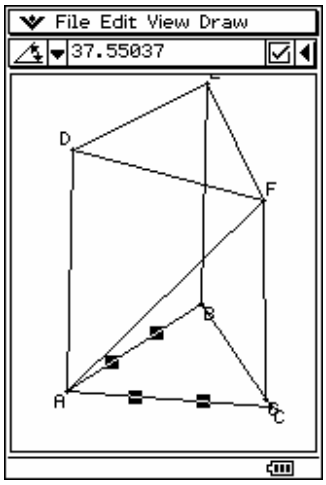
Explore the angles and lengths n a right triangular prism.

Angles between lines, areas and the ability to construct 3-D shapes are found in the Geometry section of the Menu.









Week 7–8 CAS

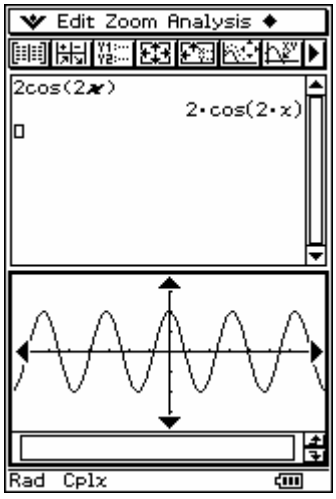
Circular function (trigonometric) graphs

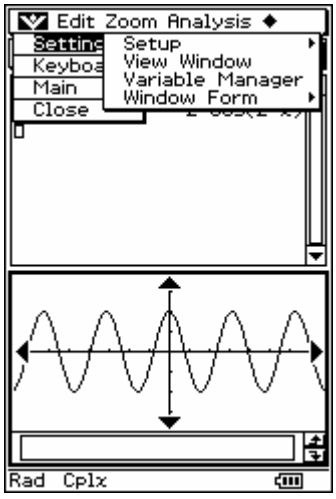
Example 6

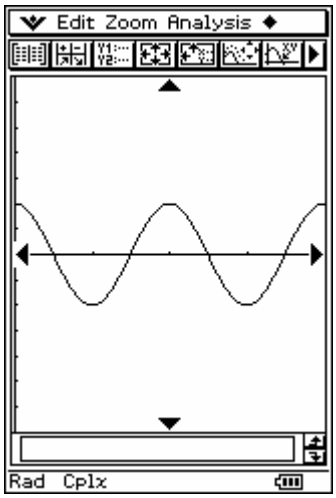
Sketch the graph $y = 2\cos 2x$.

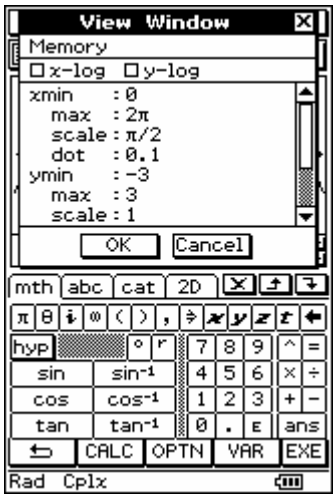
Type the expression $2\cos 2x$, tap axes found in $y1 =$, $y2$ icon, which will pop up axes. Black the expression, $2\cos 2x$, and drag it into the axes space.

This is the graph that may present if you haven't defined the scale. Go to Settings, View Window and type the x-axis and y-axis scale and range you want.









Week 7–8
CAS

Circular function (trigonometric) identities

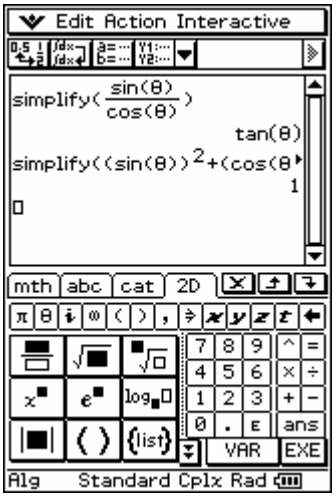
Example 7

Explore the identities:

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

$\frac{\sin\theta}{\cos\theta} = \tan\theta$

Using Keyboard 2D, then Interactive, Transformation and Simplify.



Timeline Semester 1	Level 6 Year 10 Topic	VELS Learning focus	CAS implementation
Week 9–12	**Geometry** • angles: acute, right, obtuse reflex, straight • polygons • congruence and similarity • similar triangles • 2-D, 3-D problems • platonic solids • networks	*Space* • 2-D, 3-D • angles • polygons, circles, prisms, polyhedra, platonic solids • congruence, similarity • similar triangles • transformations: rotations, reflections, translations • symmetry, tessellations: regular and composite shapes • scale • location	Transformations of shapes Example 1 Similar triangles Example 2

Week 9–12
CAS

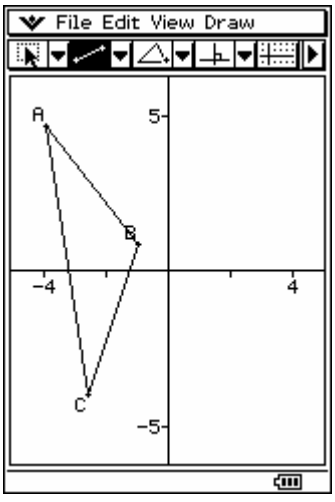
Transformations of shapes

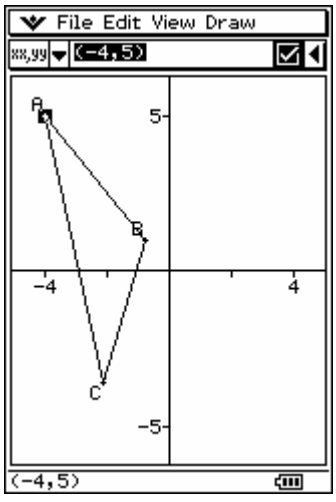
Example 1

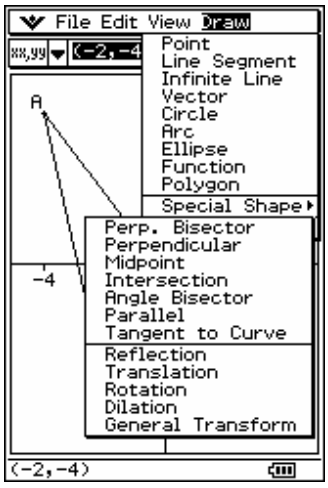
Reflect the triangle ABC in a vertical line.

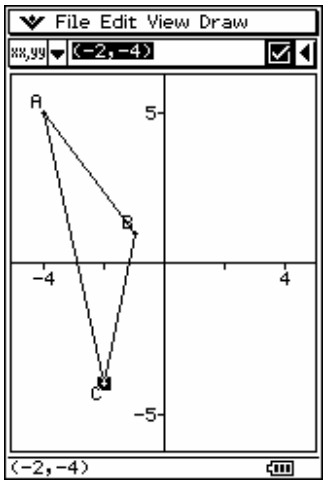
Answer: Tap the Geometry section of the Menu, draw triangle ABC, go to Measurement bar and check the coordinates as shown.

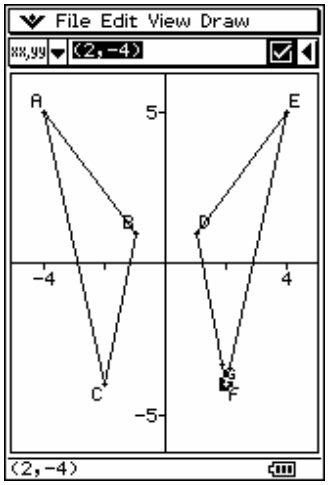
Tap Draw, Reflection and the reflected triangle is drawn.











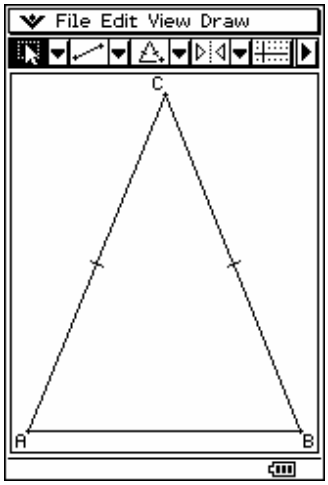
Week 9–12 CAS

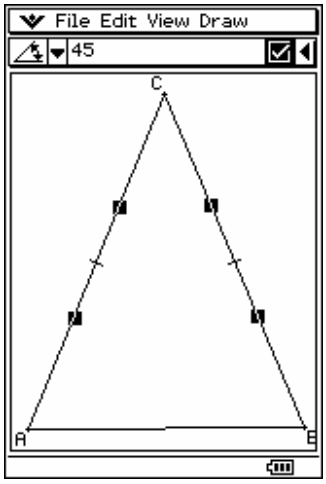
Similar triangles

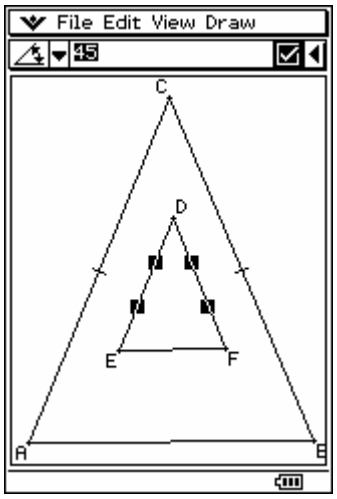
Example 2

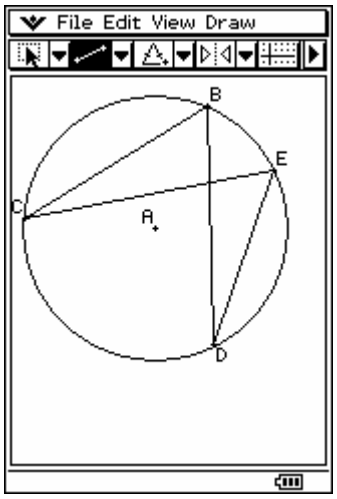
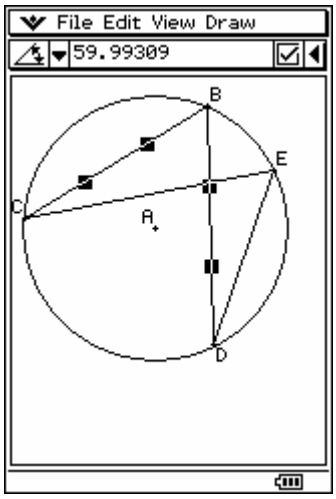
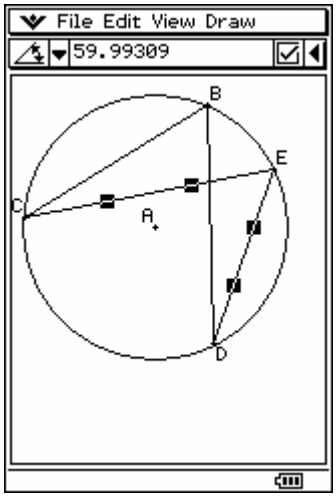
Explore the rule that triangles are similar if the corresponding angles are the same and the corresponding sides are in the same ratio.

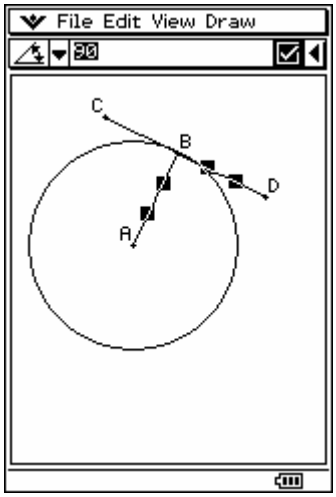
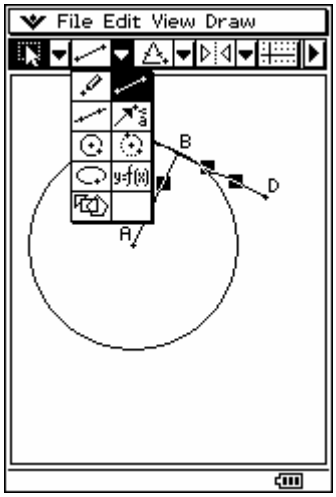
Answer: First construct an isosceles triangle by tapping the triangle icon. Fix the angles between the two equal sides as 45^0. Construct another triangle with ratio sides and 45^0 in the similar position.







Timeline Semester 1	Level 6 Year 10 Topic	VELS Learning focus	CAS implementation
Week 13–14	**Circle geometry and location** • angles: acute, right, obtuse reflex, straight • circle geometry • polygons	*Space* • angles • polygons, circles,	Angles on the same arc Example 1 Tangent to a circle Example 2
Week 13–14 **CAS**	**Angles on the same arc** Example 1 First construct a circle by tapping the circle icon. Fix points on the same arc and go to the Measurement bar to see if they are equal as stated.		 

Week 13–14 **CAS**	**Tangent to a circle** Example 2 First construct a circle by tapping the circle icon. Fix a tangent to the circle and go to the Measurement bar to fix the right angel between the radius and the tangent.		

Timeline **Semester 1**	**Level 6** **Year 10 Topic**	**VELS Learning focus**	**CAS implementation**
Week 15–17	**Business maths** • business calculations, fractions, decimals, percentages • percentage change: loss and gain, increase, decrease, appreciation, depreciation, mark-up and discount • comparing options • profit and loss, commission • simple interest • budgeting	*Number* • arithmetic computations (natural, integers, decimals, fractions, irrationals) • estimates • decimal places, significant figures *Working mathematically* • generalisations by abstracting: words and symbols • test propositions • mental, by hand and technology-assisted methods • develop mathematical models, assumptions and constraints • practical, theoretical and historical problem-solving contexts • generalise and change constraints • use technology to develop mathematical ideas and problems • logical argument	Percentage change Example 1 Example 2 Simple interest Example 3 Investment problems: technology activity Example 4

Week 15–17 CAS

Percentage change

Example 1

Find the percentage increase when the price of a dress goes up from \$40 to \$45

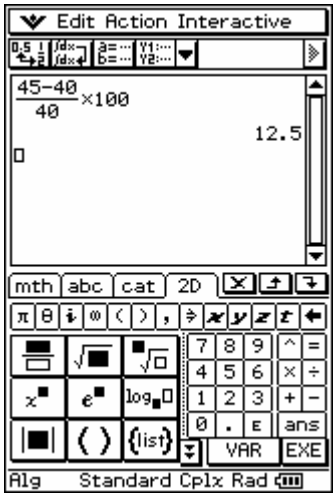
Answer: 12.5%

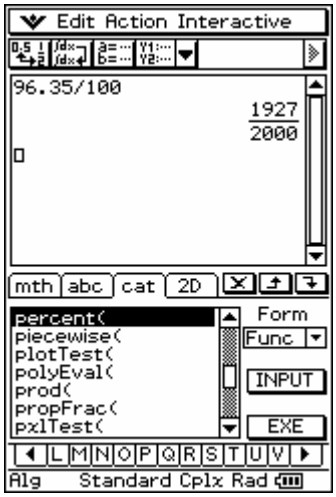
Example 2

Change the percentage 96.35% to a fraction

Answer: $\frac{1927}{2000}$

In the Main Menu, the calculator will cancel down for you.





Week 15–17 CAS

Simple interest

Example 3

Find the simple interest paid when

P = \$1000, R = 5% p.a., T = 2 years

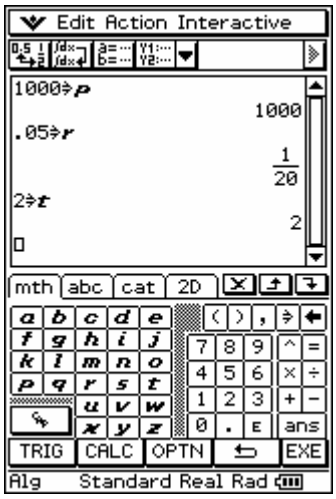
Answer: \$1

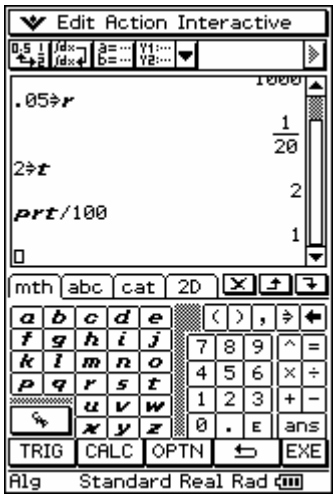
Use the simple interest formula $I = \frac{PRT}{100}$.

Either directly type in the number substitute or use the facility of defining variables.

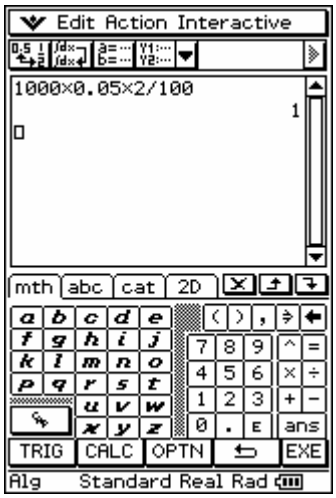
In the Main Menu, type $1000 \Rightarrow P$, using VAR in the mth keyboard.

Define each of the letters as so, and then type $\frac{PRT}{100}$, EXE.





or simply



Week 15–17 CAS

Investment problems: technology activity

Example 4

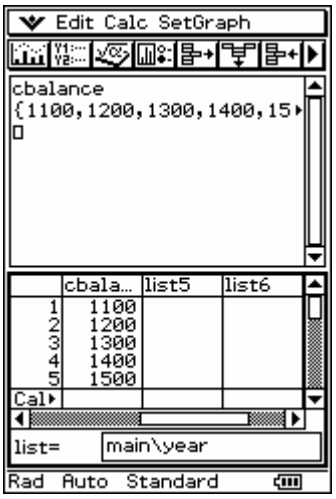
Explore the relationship between opening balance interest and closing balance with simple interest.

One option is, using Menu, Statistics, enter the numbers in the lists. You can type in a name for each column with a word up to eight letters. Here columns are named year, *obalance* (opening balance), interest, *cbalance* (closing balance).

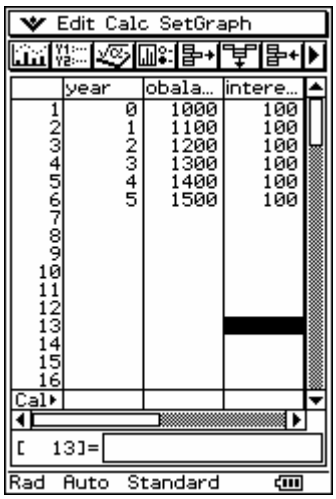
The other option is to open the List Editor by Main Menu, down arrow, the table icon and notice that the data is there in the lists for you with the titles clearly named as you named them previously.

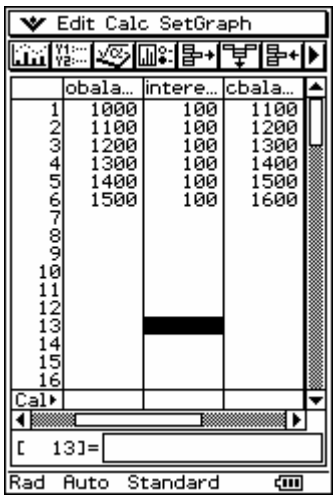
By typing the titles of the lists, your data appears as a set.

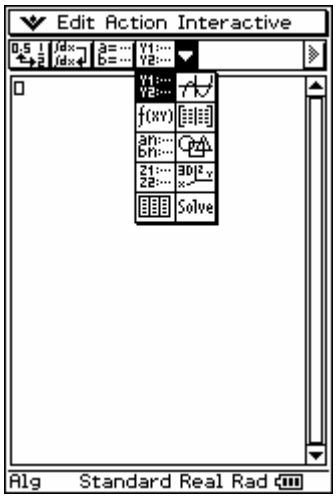
Adding the opening balance (*obalance*) to interest gives the closing balance (*cbalance*) you expected.

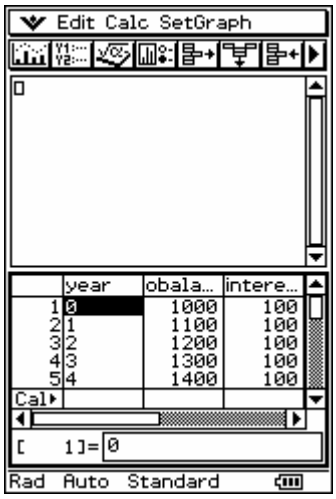


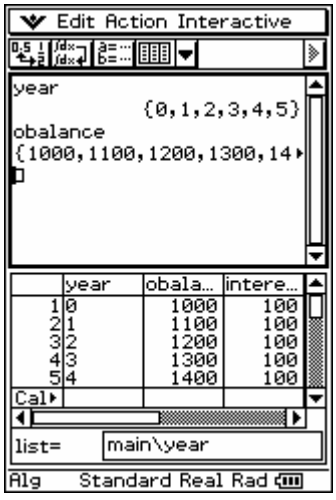
Closing balance of $1100, $1200, $1300, $1400, $1500, $1600

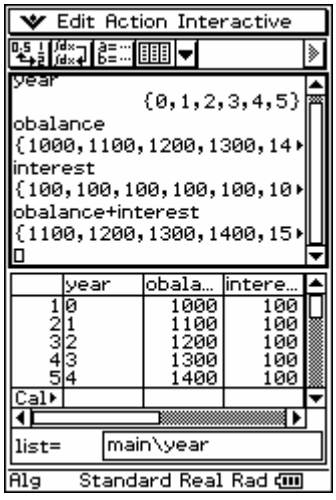


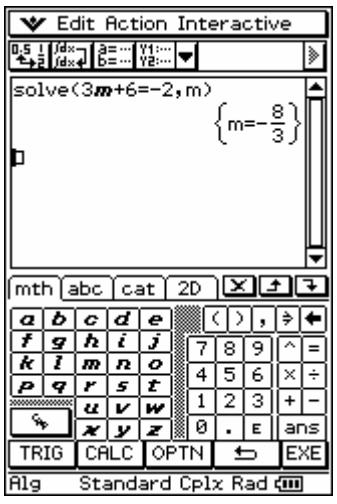
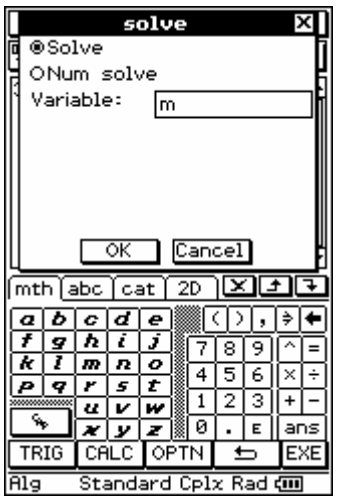










Timeline Semester 2	Level 6 Year 10 Topic	VELS Learning focus	CAS implementation
Week 1–3	**Linear equations** • solve 1,2,3-step linear equations • inequalities • literal equations **Linear formulas** • applying, transposing formulas **Ratios and rates** • rates of change: distance, time, speed • rates and graphs **Linear graphs** • Cartesian plane • plotting straight line graphs • axis intercepts, gradients • sketching straight line graphs • equation of a straight line **Ratios and rates** • rates of change: distance, time, speed • rates and graphs **Simultaneous equations** • graphing • substitution • elimination • worded questions • non-solution models	*Structure* • expressions, formulas and equations • connectives, implication and equivalence • functions: linear • transformations of these, graphs, and related algebraic properties • mental, by hand and technology-assisted and CAS methods *Structure* • diagrams, grids • simultaneous linear: algebraic, numerical and graphical approaches • mental, by hand and technology-assisted and CAS methods *Working mathematically* • generalisations by abstracting: words and symbols • test propositions, formal mathematical arguments and modify as required • develop mathematical models, assumptions and constraints	Solving basic linear equations Example 1 Solving equations including several fractions and brackets Example 2 Inequalities Example 3 Literal equations Example 4 Rates: distance, time speed Example 5 Gradient Example 6 Plotting straight line graphs and finding the equation of a straight line Example 7 Lines on a calculator Example 8 Horizontal and vertical lines Example 9 Graphing simultaneous equations Example 10 Solving simultaneous equations Example 11 Using matrices to solve simultaneous linear equations Example 12 Exploring rate of change graphs Example 13
Week 1–3 CAS	**Solving basic linear equations** Example 1 Solve the equation $3m + 6 = -2$ Answer: $x = -\frac{8}{3}$ In the Main Menu, type the equation $3m + 6 = -2$, using the bold alphabet, in the soft keyboard. Black the equation; go to Interactive, Equation/Inequality, Solve, selecting variable *m*.		

Week 1–3 CAS

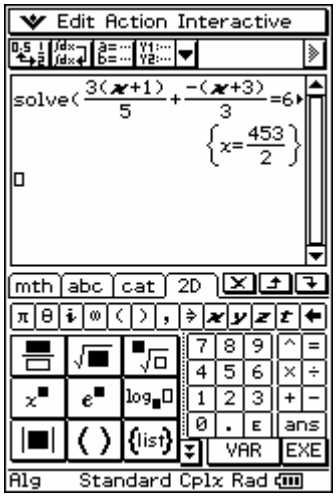
Solving equations including several fractions and brackets

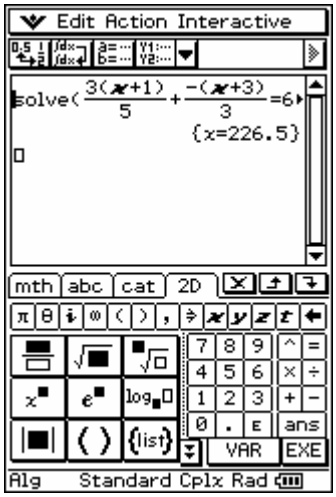
Example 3

Solve the equation $\frac{3(2x+1)}{5}+\frac{-(x+3)}{3}=60$

Answer: $x=\frac{453}{2}$

In the Main Menu, type the equation $\frac{3(2x+1)}{5}+\frac{-(x+3)}{3}=60$ using 2D in the soft keyboard. Black the equation; go to Interactive, Equation/Inequality, Solve, selecting variable *x*.





The answer can also be expressed as a decimal.

Week 1–3 CAS

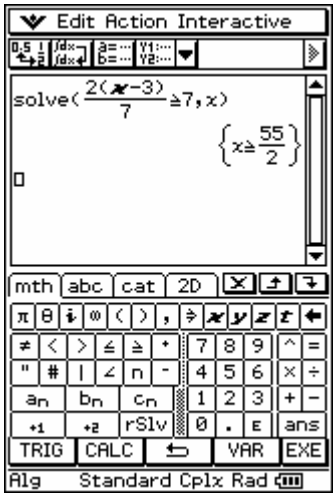
Inequalities

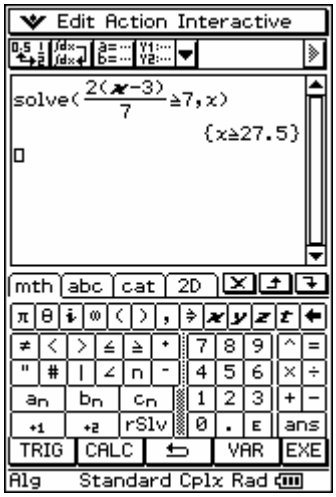
Example 3

Solve the inequality $\frac{2(x-3)}{7}\geq 7$

Answer: $x\geq\frac{55}{2}$

In the Main Menu, type the inequality $\frac{2(x-3)}{7}\geq 7$, using 2D in the soft keyboard. Find the $\geq$ sign in mth OPTN in the soft keyboard. Black the inequation; go to Interactive, Equation/Inequality, Solve, selecting variable *x*.





The answer can also be expressed as a decimal.

Week 1–3 CAS

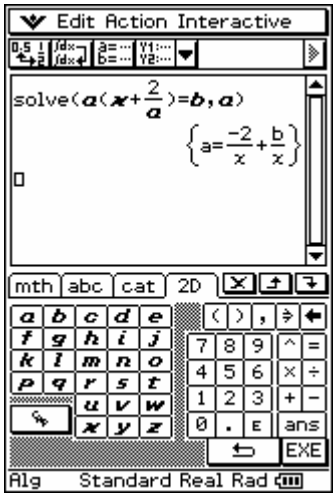
Literal equations

Example 4

Solve the equation $a(x+\frac{2}{a})=b$ for *a*.

Answer: $a=\frac{-2}{x}+\frac{b}{x}$

In the Main Menu, type the equation, $a(x+\frac{2}{a})=b$ using 2D for the fraction in the soft keyboard. Use the variables, VAR, in mth, also in the soft keyboard. Avoid the QWERTY keyboard for literal equations, as the ClassPad will think these are letters of a word, rather than variables for Maths. Black the equation; go to Interactive, Equation/ Inequality, Solve, selecting variable *a*.



Week 1–3 CAS

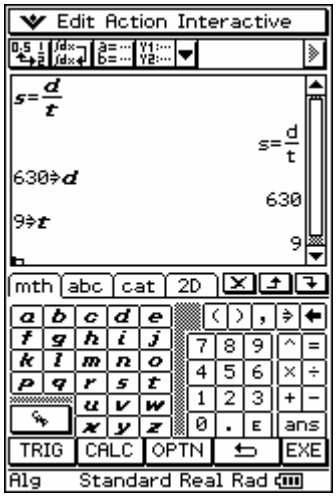
Rates: distance, time speed

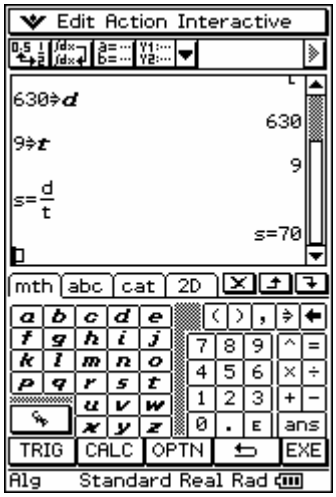
Example 5

Find the average speed of a motorcycle that travels 630 km in 9 hours.

Answer: 70 km/h

Assign $630 \Rightarrow d, 9 \Rightarrow t$, using the soft keyboard, using $\Rightarrow$ and the variables (VAR) section of mth.





Week 1–3 CAS

Gradient

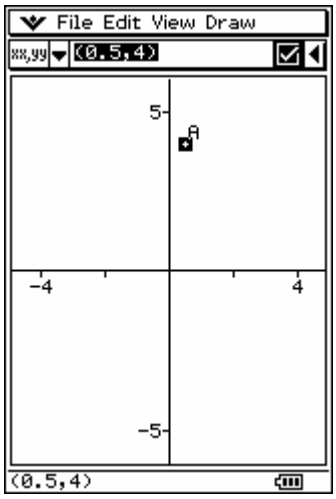
Example 6

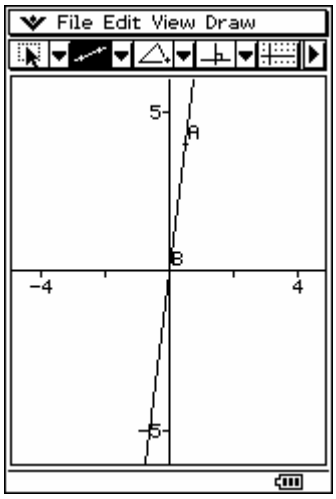
Find the gradient (slope) of the line in the distance time graph at a point with the distance at 4 km at the time at $\frac{1}{2}$ hour.

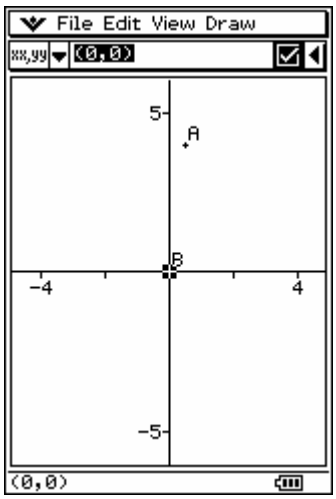
Answer: gradient = $\frac{rise}{run} = \frac{4}{\frac{1}{2}} = 8$ km/h

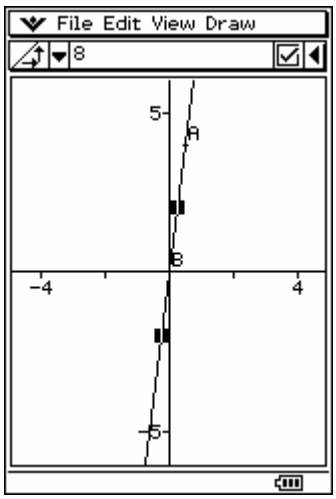
Using the geometry section of the Menu, plot the line segments with lengths 4 and $\frac{1}{2}$. It is easier to use the axes to place the points. Tap the axes twice, zooming out/in to fit. Use the pencil pointer to plot the point $\left(\frac{1}{2}, 4\right)$ and $(0,0)$.

Using the Measurement bar, find the gradient between these two points.









gradient of 8.

Week 1–3 CAS

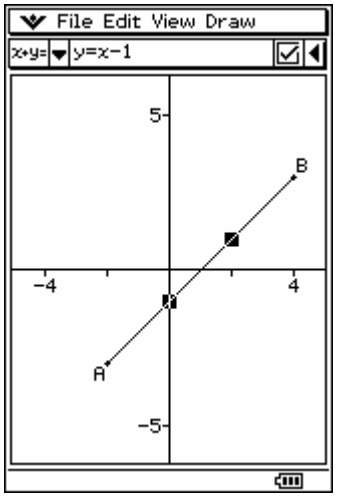
Plotting straight line graphs and finding the equation of a straight line

Example 7

Plot a straight line through the points $(-2,-3),(4,3)$ and find the equation of the line.

Answer: $y = x - 1$

In the Geometry Menu, tap the axes icon twice to get axes and a scale on the axes. Tapping the pointer icon, plot the points $(-2,-3),(4,3)$. Tapping the side arrow to get to the measurement bar, check the coordinates are correct. Tap the line icon and tap each of the points separately to draw a line through the points. Again going to the measurement bar, find the equation of the line by tapping the line once.



Week 1–3 CAS

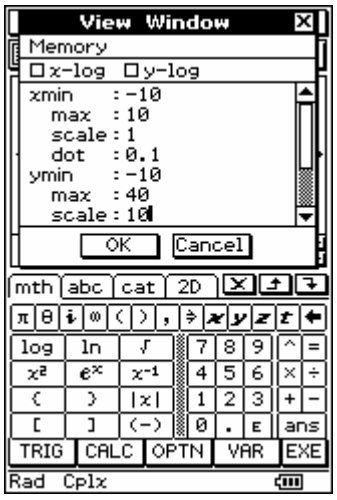
Lines on a calculator

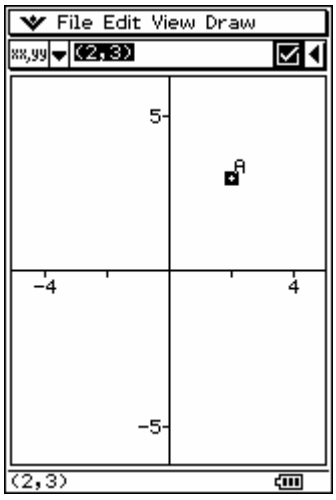
Example 8

Sketch the graph of the equation

$$y = -\frac{1}{3}x + 20$$

In the Main Menu, type the equation $y = -\frac{1}{3}x + 20$. Tap the $Y1, Y2$ icon; black the equation and drag into the axes. Change view window to suit.





Week 1–3 CAS

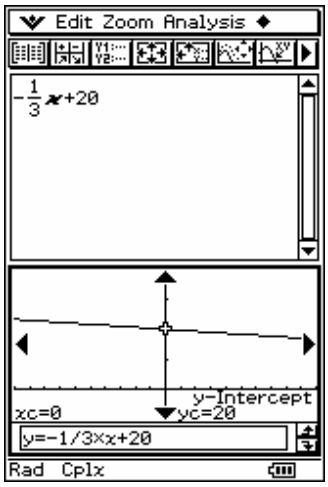
Horizontal and vertical lines

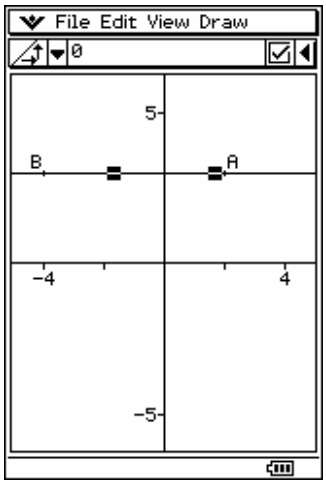
Example 9

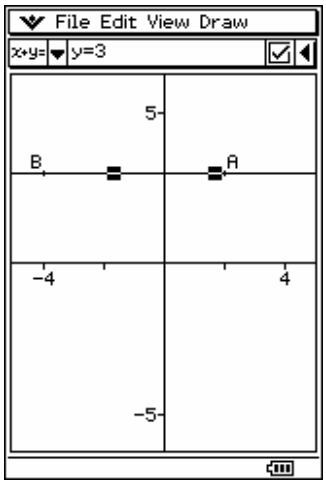
Find the equation of the line parallel to the *x*-axis, which passes through the point (2,3).

Answer: $y = 3$

In the Geometry Menu, tap the axes icon twice to get axes and a scale on the axes. Tapping the pointer icon, plot the points $(2,3)$. Tapping the side arrow to get to the measurement bar, check the coordinates are correct. Plot another point that gives the gradient of zero. Tap the line icon and tap each of the points separately to draw a line through the points. Again going to the measurement bar, and show the gradient is zero. Tapping the line once find the equation of the line.







Week 1–3 CAS

Graphing simultaneous equations

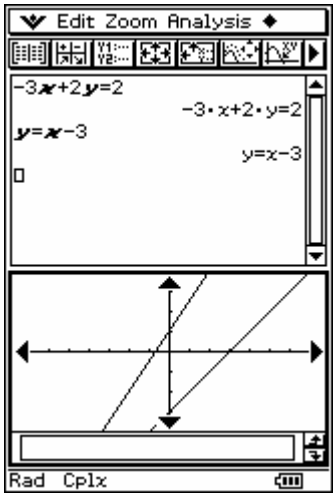
Example 10

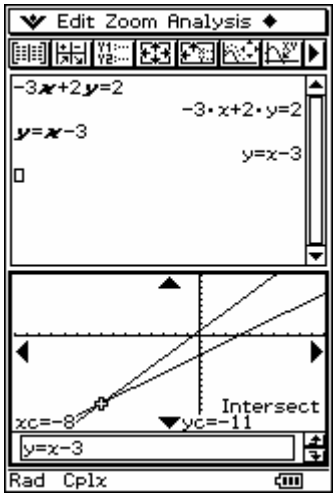
Find the coordinates of the point where $-3x + 2y = 2, y = x - 3$ intersect.

Answer: $(-8,-11)$

In the Main Menu, type the equations $3x + 2y = 12$ and $y = 3x - 3$. Change viewing window to suit.

Tap the $Y1, Y2$ icon; black the equations and drag into the axes. Using Analysis, G-solve, intersect the point $(-8,-11)$ is displayed.





Week 1–3 CAS

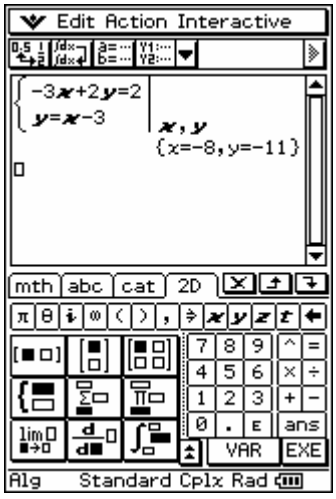
Solving simultaneous equations

Example 11

Find the coordinates of the point where $-3x + 2y = 2, y = x - 3$ intersect.

Answer: $(-8,-11)$

In the Main Menu, use soft keyboard and 2D to insert the simultaneous equation icon. Type in the equations $-3x + 2y = 2, y = x - 3$ and the variables *x*, *y* used.



Week 1–3 CAS

Using matrices to solve simultaneous linear equations

Example 12

Use matrices to solve the simultaneous equations $-3x + 2y = 2, y = x - 3$

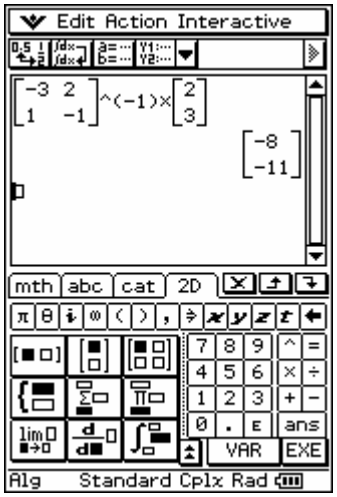
Answer: $(-8,-11)$

The equations $-3x + 2y = 2, y = x - 3$

can be written as the matrix equation

$$\begin{bmatrix} -3 & 2 \\ 1 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 2 \\ 3 \end{bmatrix}.$$

In 2D tap the matrix icon, enter the matrices, using the power ^–1 for the inverse, and solve.



Week 1–3 CAS

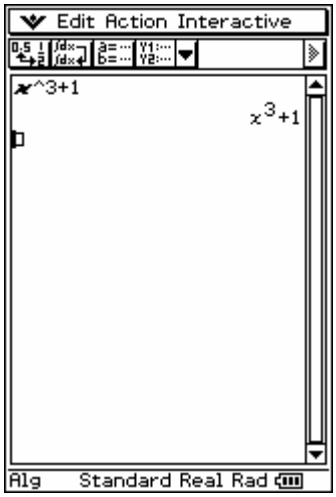
Exploring rate of change graphs

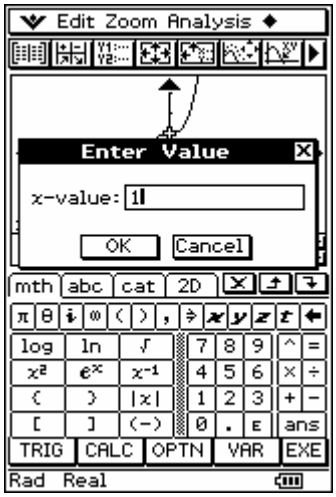
Example 13

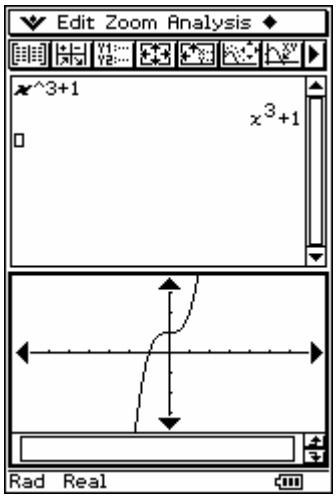
Sketch the tangent line for the graph of $y = x^3 + 1$ at the point $x = 1$.

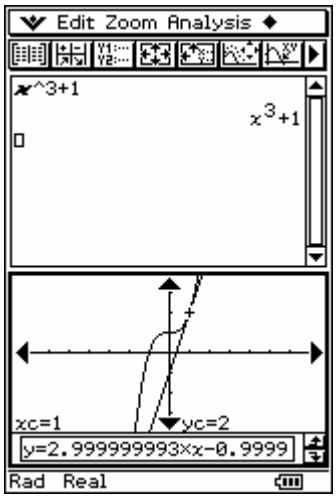
In the Main Menu, type in the expression $x^3 + 1$. Drag and drop this into the axes space. Set up axes by tapping the $y1 =, y2 =$ icon.

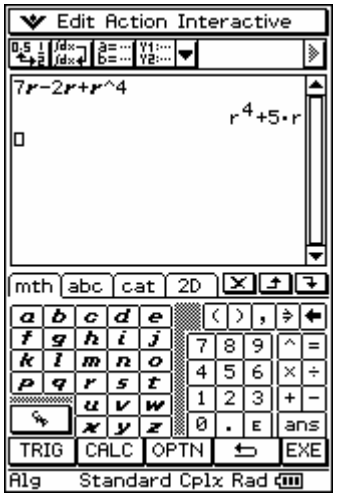
Tap Analysis, Sketch, to sketch a tangent. Type in the value $x = 1$ where you want the tangent.









Timeline Semester 2	Level 6 Year 10 Topic	VELS Learning focus	CAS implementation
Week 4–6	**Algebra techniques** • simplify and expand expressions • factorise expressions • difference of two squares • perfect squares • factorisation: common factor, quadratic trinomial • algebraic fractions	*Structure* • expressions, formulas and equations • mental, by hand and technology-assisted and CAS methods *Working mathematically* • generalisations by abstracting: words and symbols • test propositions, formal mathematical arguments and modify as required • develop mathematical models, assumptions and constraints • practical, theoretical and historical problem-solving contexts • generalise and change constraints • use technology to develop mathematical ideas and problems • logical argument • mental, by hand and technology-assisted methods	Simplifying expressions Example 1 Expanding expressions Example 2 Difference of two squares and perfect squares Example 3 Example 4 Factorisation with a common factor Example 5 Factorising difference of two squares Example 6 Example 7 Factorising the perfect square Example 8 Factorising quadratic trinomials Example 9 Simplifying algebraic fractions Example 10 Transposing formulas Example 11 Formulas Example 12
Week 4–6 **CAS**	**Simplifying expressions** Example 1 Simplify the expression $7r - 2r + r^4$ by combining like terms. Answer: $5r + r^4$ In the Main Menu, type $7r - 2r + r^4$, using the soft keyboard and the VAR in the mth keyboard. (If ordinary letters are used that are not in the VAR Menu, then the ClassPad will treat the letters as a word and not pronumerals.) Pressing EXE gives the simplified expression.		

Week 4–6 CAS

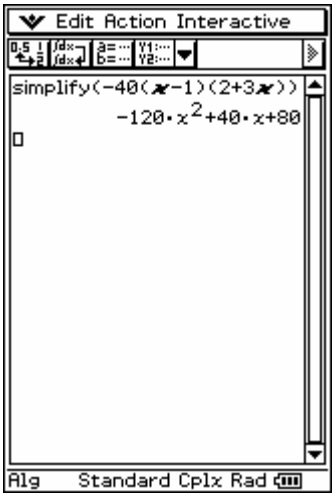
Expanding expressions

Example 2

Expand and simplify the expression $-40(x-1)(2+3x)$.

Answer: $-120x^2+40x+80$

In the Main Menu, type $-40(x-1)(2+3x)$, using the soft keyboard. Tap Interactive, Transformation, Expand. Pressing EXE gives the expanded and simplified expression.



Week 4–6 CAS

Difference of two squares and perfect squares

Example 3

Expand and simplify the expression $(a-4)(a+4)$.

Answer: a^2-16

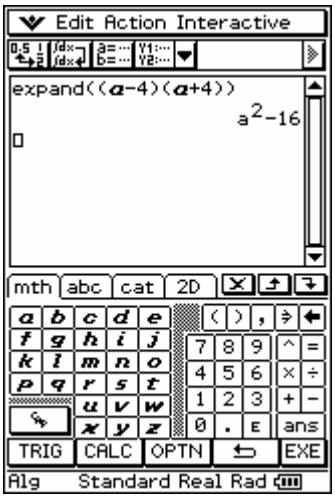
In the Main Menu, type $(a-4)(a+4)$, using the soft keyboard and the VAR in the mth keyboard. Tap Interactive, Transformation, Expand. Pressing EXE gives the expanded and simplified expression.

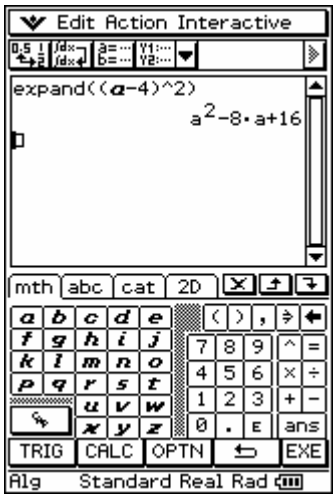
Example 4

Expand and simplify the expression $(a-4)^2$.

Answer: $a^2-8a+16$

In the Main Menu, type $(a-4)^2$, using the soft keyboard and the VAR in the mth keyboard. Tap Interactive, Transformation, Expand. Pressing EXE gives the expanded and simplified expression.





Week 4–6 CAS

Factorisation with a common factor

Example 5

Factorise the expression $3ax + 6ax^2 + 9ax^3$.

Answer: $3ax\left(3x^2 + 2x + 1\right)$

In the Main Menu, type $3ax + 6ax^2 + 9ax^3$, using the soft keyboard and the VAR in the mth keyboard. Tap Interactive, Transformation, Factor. Pressing EXE gives the factorised expression.

Week 4–6 CAS

Factorising difference of two squares

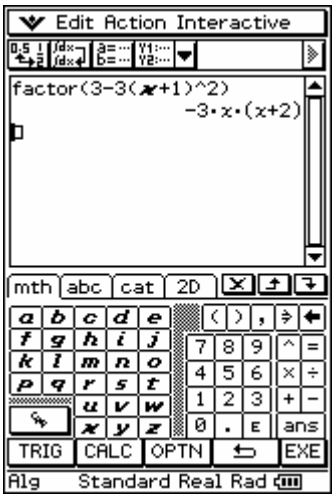
Example 6

Factorise the expression $3 - 3(x+1)^2$.

Answer:

$$3 - 3(x+1)^2$$
$$= 3\left(1 - (x+1)^2\right)$$
$$= 3(1 - x - 1)(1 + x + 1)$$
$$-3x(x+2)$$

In the Main Menu, type $3 - 3(x+1)^2$. Tap Interactive, Transformation, Factor. Pressing EXE gives the factorised expression.

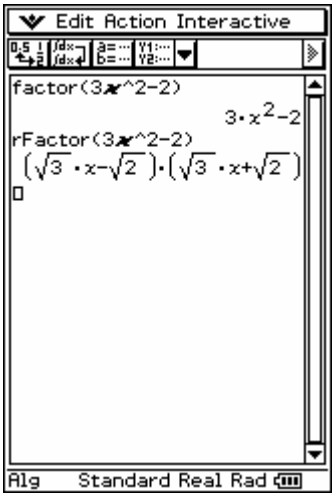


Note that rfactor in the ClassPad300 means 'root' factor and this gives the surd or complex roots, depending on how the basic format is set up.

Example 7

Factorise the expression $3x^2 - 2$ over Reals.

Answer: $\left(\sqrt{3}x - \sqrt{2}\right)\left(\sqrt{3}x + \sqrt{2}\right)$



Week 4–6 CAS

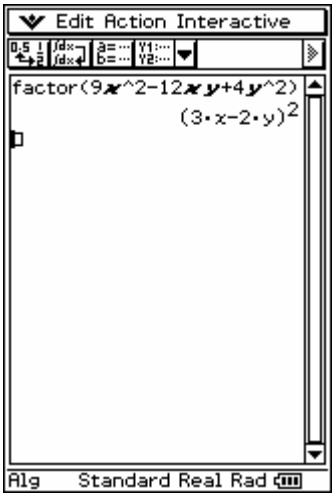
Factorising the perfect square

Example 8

Factorise the expression $9x^2 - 12xy + 4y^2$.

Answer: $(3x - 2y)^2$

In the Main Menu, type $9x^2 - 12xy + 4y^2$. Tap Interactive, Transformation, Factor. Pressing EXE gives the factorised expression



Week 4–6 CAS

Factorising quadratic trinomials

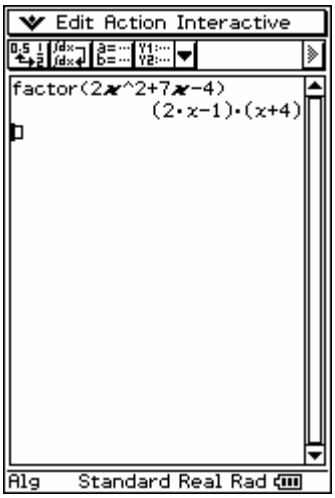
Example 9

Factorise the expression $2x^2 + 7x - 4$.

Answer: $(2x - 1)(x + 4)$

In the Main Menu, type $2x^2 + 7x - 4$. Tap Interactive, Transformation, Factor. Pressing EXE gives the factorised expression.

(Note that rfactor means finding the 'root' of an equation allowing the answer to include surds.)



Week 4–6 CAS

Simplifying algebraic fractions

Example 10

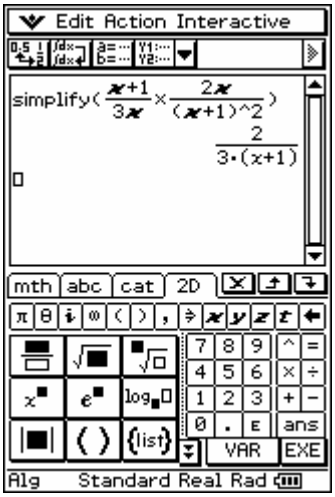
Simplify the expression $\frac{x+1}{3x} \times \frac{2x}{x^2+2x+1}$.

Answer:

$$\frac{(x+1)}{(x+1)^2} \times \frac{2}{3}$$

$$= \frac{2}{3(x+1)}$$

In the Main Menu, type $\frac{x+1}{3x} \times \frac{2x}{x^2+2x+1}$, using 2D on the soft keyboard. Tap Interactive, Transformation, Combine. Pressing EXE gives the simplified expression. Note that Combine is useful for all common denominator questions.



Week 4–6 CAS

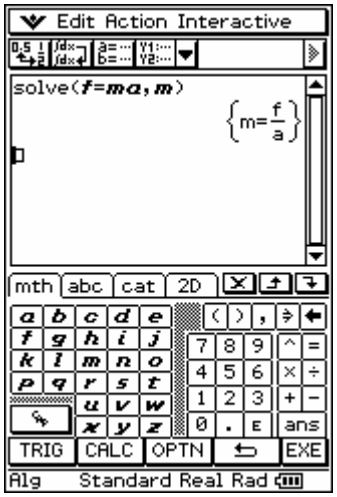
Transposing formulas

Example 11

Transpose the formula $F = ma$ making m the subject.

Answer: $m = \frac{F}{a}$

In the Main Menu, type the equation $F = ma$, black the equation; go to Interactive, Equation/Inequality, Solve, selecting variable *m*.



Week 4–6 CAS

Formulas

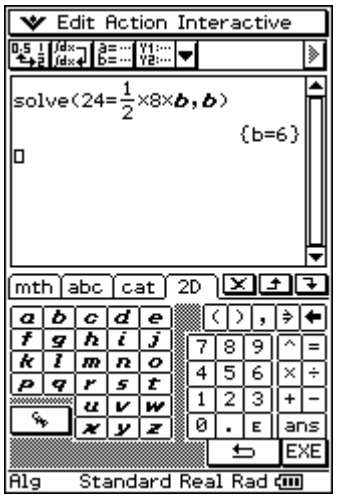
Example 12

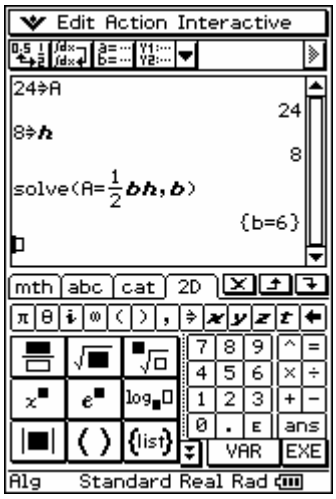
Substitute the given values in the formula $A = \frac{1}{2}bH$ where $A = 24$, $h = 8$ and solve for *b*.

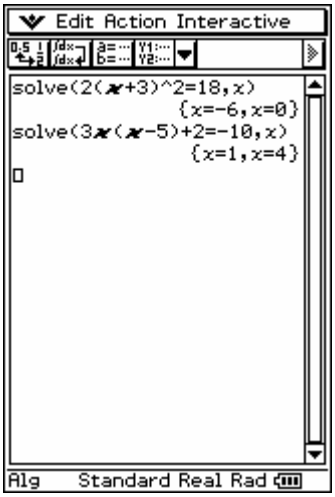
Answer: $b = 6$

In the Main Menu, either type the equation directly with the values, and EXE. Alternatively, assign 24 as A and 8 as *h* using the $\Rightarrow$ button.

Using 2-D for the fraction in the soft keyboard, black the equation; go to Interactive, Equation/Inequality, Solve, selecting variable *b*.





Timeline Semester 2	Level 6 Year 10 Topic	VELS Learning focus	CAS implementation
Week 7–8	**Quadratic equations** • quadratic equations • worded questions	*Structure* • expressions, formulas and equations • quadratic functions • mental, by hand and technology-assisted and CAS methods *Working mathematically* • generalisations by abstracting: words and symbols • test propositions, formal mathematical arguments and modify as required • develop mathematical models, assumptions and constraints • practical, theoretical and historical problem-solving contexts • generalise and change constraints • use technology to develop mathematical ideas and problems • logical argument • mental, byhand and technology-assisted methods	Quadratic equations Example 1 Example 2 The quadratic formula Example 3
Week 7–8 **CAS**	**Quadratic equations** Example 1 Solve the equation $2(x+3)^2 = 18$. Answer: $x = -6, x = 0$ In the Main Menu, type $2(x+3)^2 = 18$. Tap Interactive, Equation/Inequality, Solve. Use the variable *x* when asked. Example 2 Solve the equation $3x(x-5)+2 = -10$ Answer: $x = 4, x = 1$		

Week 7–8 CAS

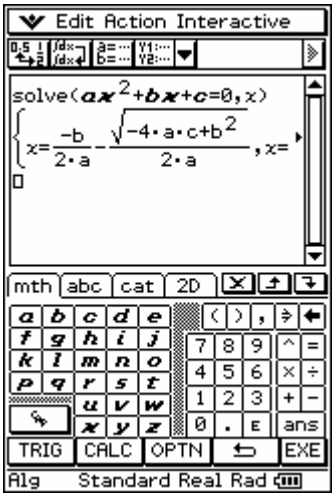
The quadratic formula

Example 3

Solve the equation $ax^2 + bx + c = 0$ for *x*.

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

In the Main Menu, type $ax^2 + bx + c = 0$. Tap Interactive, Equation/Inequality, Solve. Use the variable *x* when asked. When typing the coefficients, the QWERTY alphabet is not used as this would be treated as the alphabet. Use mth, VAR for the bold alphabet for constants and variables in equations. The well-known quadratic formula is shown. Press the side arrow for the second answer.



Timeline Semester 2	Level 6 Year 10 Topic	VELS Learning focus	CAS implementation
Week 9–12	**Quadratic functions** • plotting parabolas • turning point, intercepts • +ve, -ve • translation and dilation • sketching parabolas **Ratios and rates** • rates of change: distance, time, speed • rates and graphs • rate of change graphs	*Structure* • functions: quadratic • transformations of these, graphs, and related algebraic properties • mental, by hand and technology-assisted and CAS methods	Plotting parabolas Example 1 Sketching parabolas Example 2 Exploring turning point form Example 3 Substitution in parabolas Example 4 Solving quadratic inequalities Example 5

Week 9–12
CAS

Plotting parabolas

Example 1

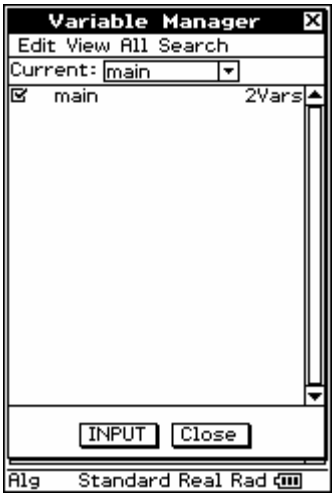
Complete a table of values for $y = 3x^2 + 1$ for $-3 \le x \le 3$ and plot the graph.

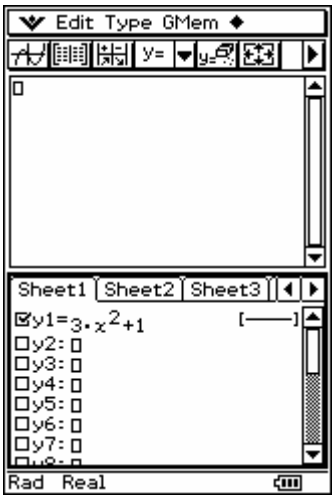
Answer:

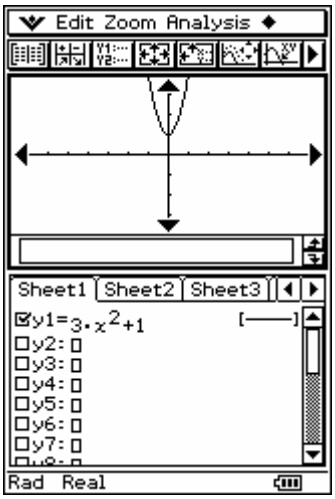
x	–3	–2	–1	0	1	2	3
y	28	13	4	1	4	13	28

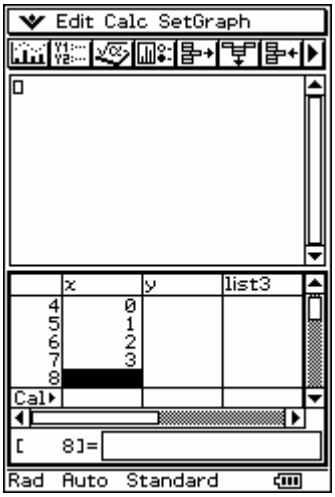
In the Main Menu, tap the Y1..Y2.. icon, which will bring up the Sheet 1, Sheet 2 … screen as in the first screen below. Type in the equation $y1 = 3x^2 + 1$, which will bring a tick against that equation. Then tap the axes and black the equation Y1, dragging it into the axes.

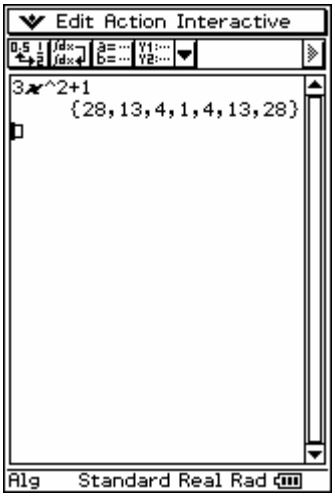
Alternatively, go to the lists, name list 1 *x*, and fill the *x* list with the numbers –3,–2,–1,0,1,2,3. Then, typing the expression $3x^2 + 1$, the *y*-values will be shown. Remember to clear the variables after, going to *a* =, *b* =, Edit, Delete, Vars.











Week 9–12 CAS

Sketching parabolas

Example 2

For the parabola $y = x^2 - 4x - 5$, find:

the *y*-intercept

the *x*-intercept

the axis of symmetry

the turning point

hence sketch the graph.

Answer:

a) $(0,-5)$

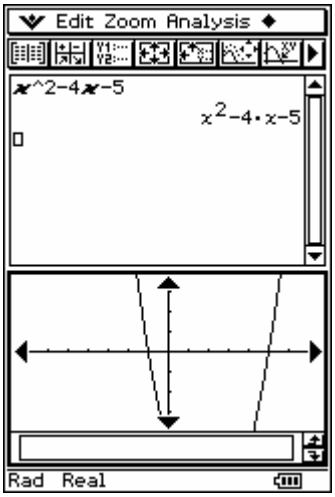
b) $(-1,0),(5,0)$

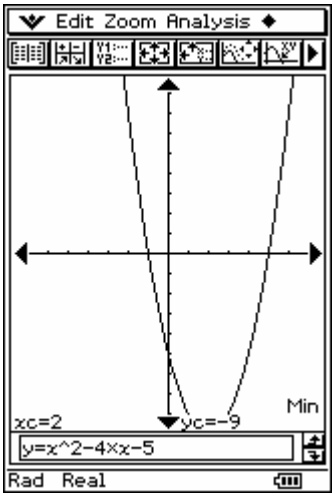
c) $x = 2$

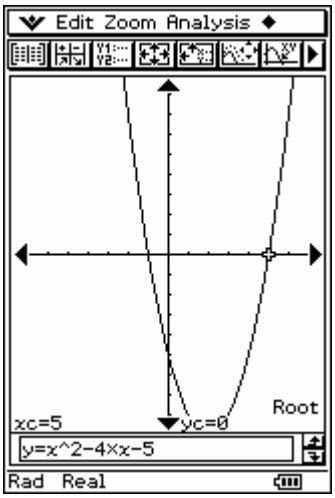
d) $(2,-9)$

e) graph

In the Main Menu, type the expression $x^2 - 4x - 5$. Tap the diamond next to the Y1..Y2.. icon, which will bring up the axes. Black the expression and drag into the axes. If you want a full picture of the axes, tap the resize below the screen. Analysis, g-solve will give a full analysis of the graph.







Week 9–12 CAS

Exploring turning point form

Example 3

For the parabola $y = 2(x-3)^2 - 5$, $y = 2(x-3)^2 - 3.5$, $y = 2(x-3)^2 - 2$ find:

the coordinates of the turning points

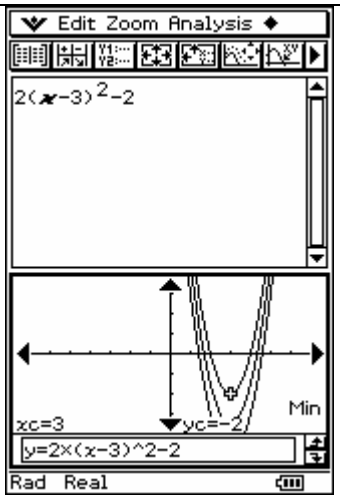
sketch the graphs on the same axes.

Answer:

a) $(3,-5)$ $(3,-3.5)$ $(3,-2)$

b) graph

In the Main Menu, type the expression $2(x-3)^2 - 5$. Tap the diamond next to the Y1..Y2.. icon, which will bring up the axes. Black the expression and drag into the axes. If you want a full picture of the axes, tap the resize below the screen. Analysis, g-solve , min will give the turning point of the graph.



Week 9–12 CAS

Substitution in parabolas

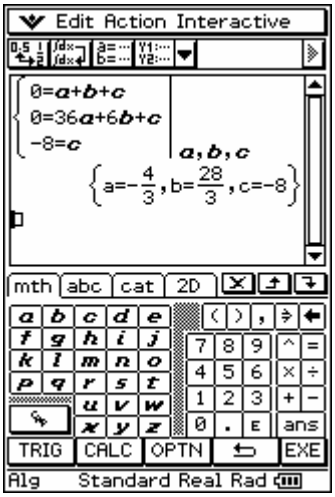
Example 4

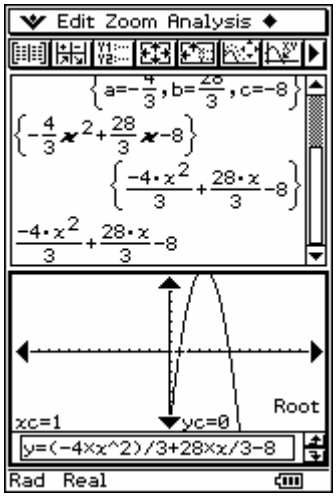
A parabola of the form $y = ax^2 + bx + c$ has x-intercepts $x = 1, x = 6$ and *y*-intercept $y = -8$. Find the values of a, b, c and hence sketch the graph.

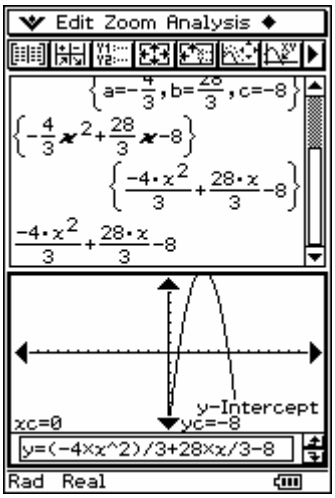
Answer: $a = -\frac{4}{3}, b = \frac{28}{3}, c = -8$

Directly type in the number substitute into the equation $y = ax^2 + bx + c$ and create 3 equations in a, b, c. Use the simultaneous equation icon in 2D in the soft keyboard, creating 3 lines by tapping once and then again. Make sure you type the a, b, c using the mth, VAR for algebraic working.

Black the answers and rearrange into parabola form. Insert axes and black the equation, dragging the graph into the axes. Analysis, g-solve, shows the *y* and *x*-intercepts are correct.







Week 9–12 CAS

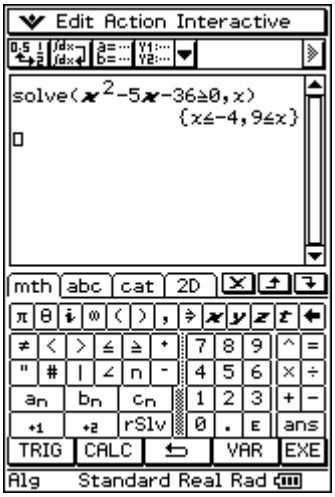
Solving quadratic inequalities

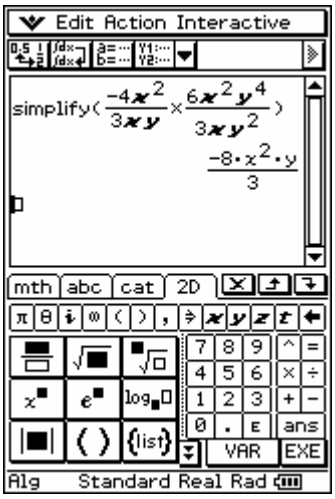
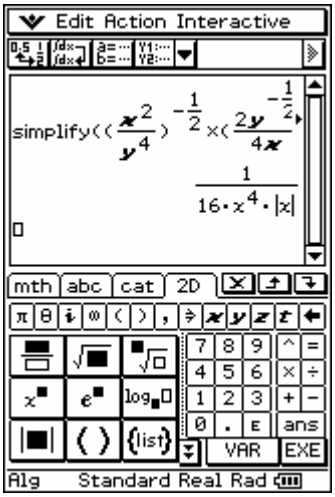
Example 5

Solve the inequality $x^2 - 5x - 36 \geq 0$

Answer: $x \leq -4, x \geq 9$

In the Main Menu, type the inequality $x^2 - 5x - 36 \geq 0$, using 2D in the soft keyboard. Find the $\geq$ sign in mth OPTN in the soft keyboard. Black the inequality; go to Interactive, Equation/Inequality, Solve, selecting variable *x*.



Timeline Semester 2	Level 6 Year 10 Topic	VELS Learning focus	CAS implementation
Week 13–14	**Exponential and logarithmic relations** • index laws • brackets, zero, -ve fractional powers • log laws • index equations • log equations • equivalence	*Structure* • expressions, formulas and equations • algebraic properties: closure, associative, commutative, identity, inverse, distributive • implication and equivalence • mental, by hand and technology-assisted and CAS methods *Number* • arithmetic computations	Index laws Example 1 Negative and fractional indices Example 2 Exponential functions Example 3 Exploring log laws Example 4 Logarithmic equations Example 5
Week 13–14 CAS	**Index laws** Example 1 Simplify $\frac{-4x^2}{3xy} \times \frac{6x^2y^4}{3xy^2}$ as far as possible. Answer: $\frac{-8x^2y}{3}$ In the Main Menu, type $\frac{-4x^2}{3xy} \times \frac{6x^2y^4}{3xy^2}$, using fraction in 2D on the soft keyboard; press EXE for the answer.		
Week 13–14 CAS	**Negative and fractional indices** Example 2 Simplify $\left(\frac{x^2}{y^4}\right)^{-\frac{1}{2}} \times \left(\frac{2y^{-\frac{1}{2}}}{4x}\right)^4$ Answer: $\frac{1}{16x^4\lvert x\rvert}$ In the Main Menu, type $\left(\frac{x^2}{y^4}\right)^{-\frac{1}{2}} \times \left(\frac{2y^{-\frac{1}{2}}}{4x}\right)^4$, using fraction and power in 2D on the soft keyboard; press EXE for the answer.	 Note that the absolute value $\lvert x\rvert$ is the way the CAS deals with $\left(\frac{x^2}{y^4}\right)^{-\frac{1}{2}}$	

Week 13–14 CAS

Exponential functions

Example 3

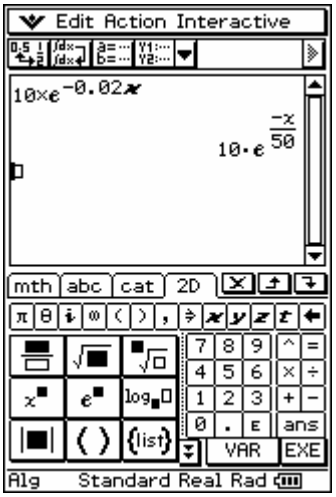
A radioactive substance decays at a rate that is proportional to the mass present at time, *t* years. The mass, *M* grams, is given by $M = 10 \times e^{-0.02t}$. Find

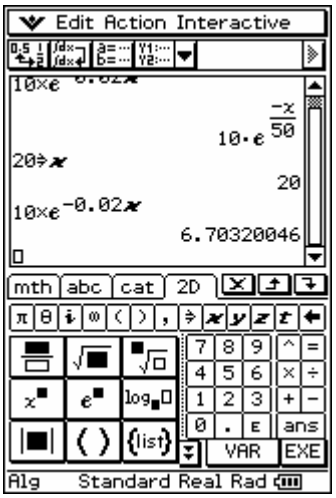
the initial mass present

the mass after 20 years.

Answer: $M = 10$, $M = 6.7$

In the Main Menu, type the expression $10 \times e^{-0.02t}$, using the e in 2D on the soft keyboard. Substitute *t* = 20 by applying the variable $20 \Rightarrow x$ and press EXE for the answer.





Week 13–14 CAS

Exploring log laws

Example 4

Simplify the expression
$\log_2 8 + \log_2 32 - 3\log_2 2$

Answer: 5

This expression actually equals

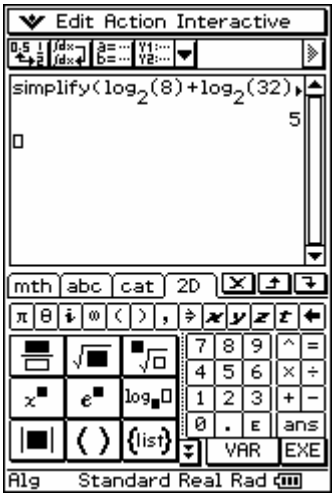
$\log_2 2^3 + \log_2 2^5 - 3\log_2 2$

$= 3\log_2 2 + 5\log_2 2 - 3\log_2 2$

$= 3 + 5 - 3$

$= 5$

This is because $\log_2 2 = 1$



Week 13–14
CAS

Logarithmic equations

Example 5

Solve the equation $\log_b 81 = 4$ for b.

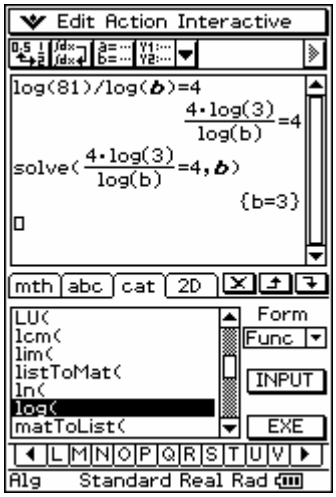
Answer: $b = 3$

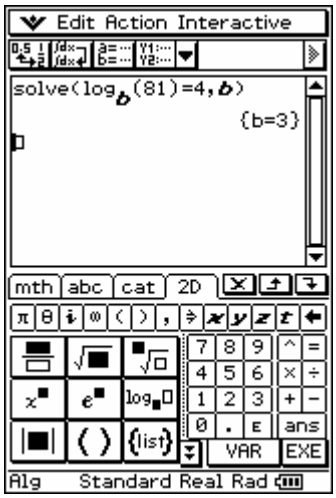
In the Main Menu, type $\log_b 81 = 4$, by using the change of base formula

$$\log_b 81 \Leftrightarrow \frac{\log 81}{\log b}.$$

The log is in cat on the soft keyboard.

Alternatively, use $\log_b 81$ in 2D in the soft keyboard.





Timeline Semester 2	Level 6 Year 10 Topic	VELS Learning focus	CAS implementation
Week 15	**Variation**		Direct variation Example 1

Week 15
CAS

Direct variation

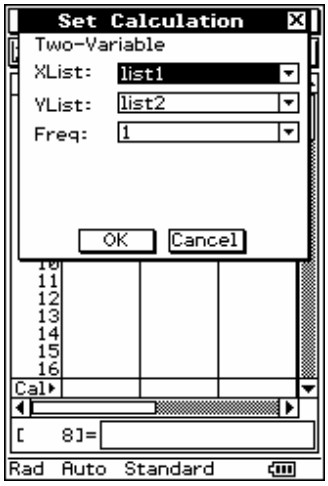
Example 1

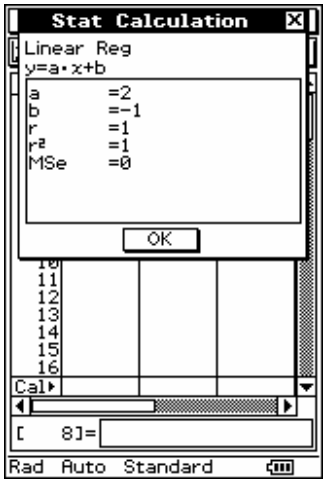
Use the table of values $-3 \le x \le 3$ to find the relationship between x and y.

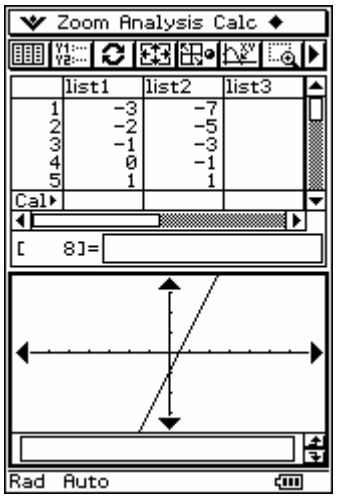
x	–3	–2	–1	0	1	2	3
y	–7	–5	–3	1	1	3	5

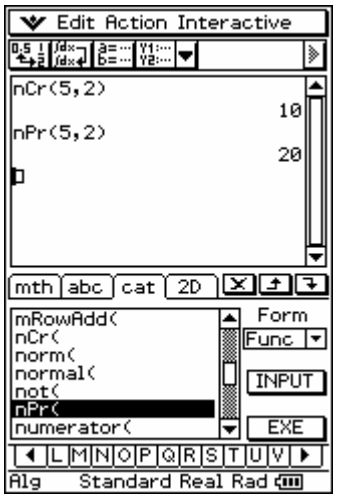
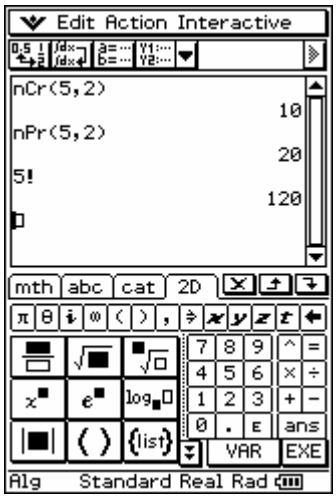
Answer: $y = 2x - 1$

In the Statistics Menu, enter the x and y lists in list 1 and list 2. Tap calc, linear regression for the equation $y = 2x - 1$. Tapping the graph icon will draw the line.







Timeline Semester 2	Level 6 Year 10 Topic	VELS Learning focus	CAS implementation
Week 16–17	**Probability** • event space • complementary events • addition law • mutually exclusive and independent events • odds	*Measurement, chance and data* • chance, risk, event space • compound, independent and dependent events • expected value *Structure* • set operations: complement, union, intersection, inclusion	Probability notation Example 1 Example 2 Markov sequences Example 3
Week 16–17 **CAS**	**Probability notation** Example 1 Evaluate ${}^5C_2$ and ${}^5P_2$ Answer: 10 and 20. In the Main Menu, type ${}^5C_2$ and ${}^5P_2$, using the cat (catalogue) list on the soft keyboard. Press EXE for answer. Example 2 Evaluate 5! Answer: 120		

Week 16–17
CAS

Markov sequences

Example 3

Multiply the matrices

$$\begin{bmatrix} 0.8 & 0.6 \\ 0.2 & 0.4 \end{bmatrix} \begin{bmatrix} 40 \\ 60 \end{bmatrix}$$

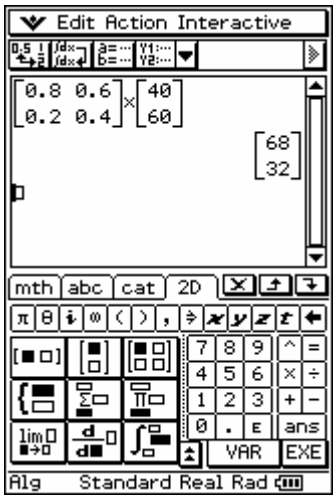
Answer: $\begin{bmatrix} 68 \\ 32 \end{bmatrix}$

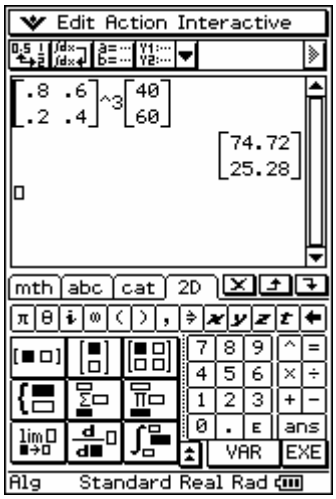
In the Main Menu, type the matrices, using the matrix format in 2D on the soft keyboard. Press EXE for answer.

Multiply the matrices

$$\begin{bmatrix} 0.8 & 0.6 \\ 0.2 & 0.4 \end{bmatrix}^3 \begin{bmatrix} 40 \\ 60 \end{bmatrix}$$

Answer: $\begin{bmatrix} 74.72 \\ 25.28 \end{bmatrix}$





Timeline Semester 2	Level 6 Year 10 Topic	VELS Learning focus	CAS implementation
Week 18	**Statistics** • histograms, bar graphs • mean and range • cumulative frequency • stemplots • boxplots • measures of spread • sampling	*Measurement, chance and data* • uni-variate, bi-variate data samples • display data • centrality, spread, association *Working mathematically* • generalisations by abstracting: words and symbols • test propositions, formal mathematical arguments and modify as required • develop mathematical models, assumptions and constraints • practical, theoretical and historical problem-solving contexts	The mean Example 1 Example 2 Boxplots Example 3 Bi-variate data Example 4

Week 18 CAS

The mean

Example 1

Find the Mean of the numbers 1,2,3,4,5.

Answer: 3

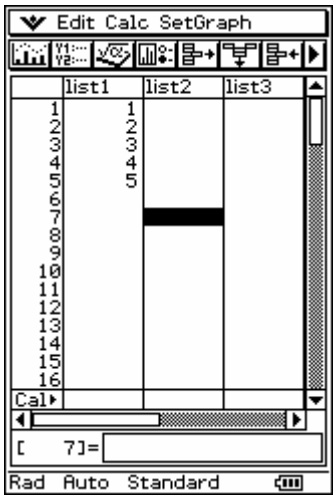
In the Statistics Menu, type the numbers 1,2,3,4,5 in list 1. Press Calc, One-Variable and EXE for the mean $\bar{x}$.

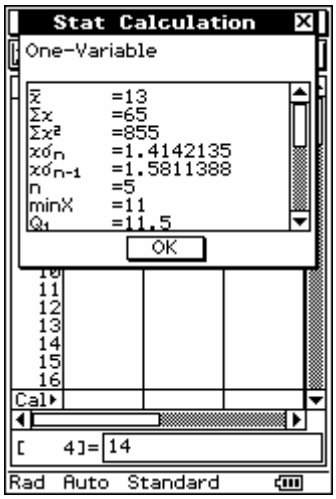
Example 2

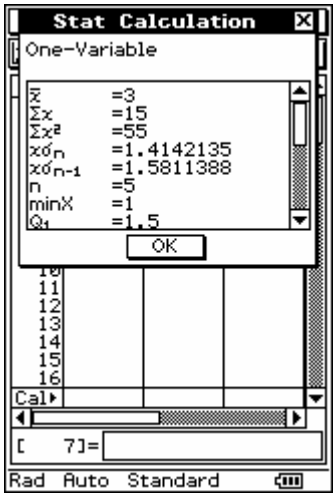
Find the Sum and minimum value of the list of numbers 11,12,13,14,15.

Answer: 65 and 11.

In the Statistics Menu, type the numbers 1,2,3,4,5 in list 1. Press Calc, One-Variable and EXE for the Sum $\sum x = 65$ and the minX=11.







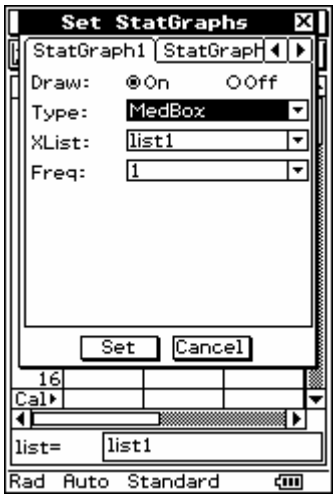
Week 18 CAS

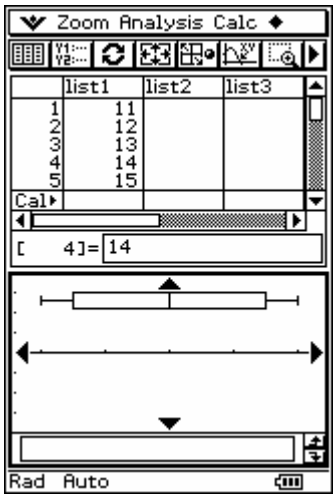
Boxplots

Example 3

Sketch a median boxplot for the numbers 11,12,13,14,15.

In the Statistics Menu, type the numbers 11,12,13,14,15 in list 1. Tap Set StatGraphs, MedBox using list 1.





Week 18
CAS

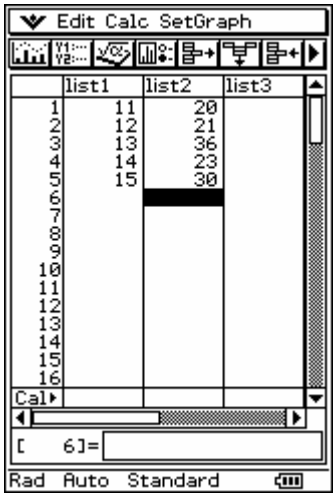
Bi-variate data

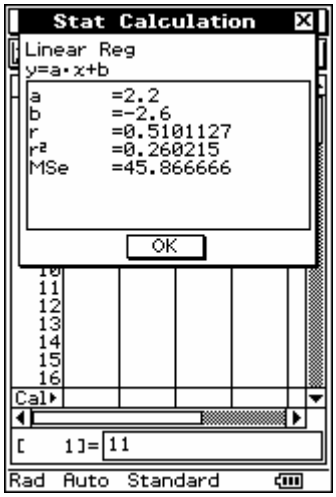
Example 4

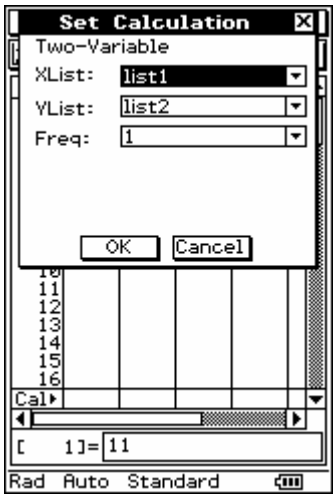
Find the linear regression for the numbers 11,12,13,14,15 and 20,21,36,23,30

Answer: $y = 2.2x - 2.6$

In the Statistics Menu, type the two lists of numbers in list 1 and list 2. Tap Calc, Two-Variable, list 1 and list 2, choosing Linear Reg.







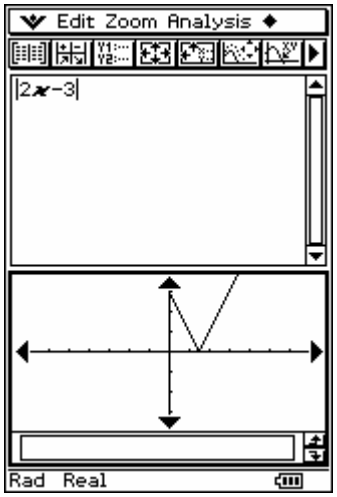
Timeline Semester 2	Level 6 Year 10 Topic	VELS Learning focus	CAS implementation
Extension	**Absolute value graphs** • plotting absolute value graphs • translation and dilation • sketching absolute value functions	*Structure* • functions: absolute value • transformations of these, graphs, and related algebraic properties • mental, by hand and technology-assisted and CAS methods	Absolute value graphs Example 1 Example 2

Extension **Absolute value graphs**

Example 1

Sketch the graph of the equation $y = |2x - 3|$

In the Main Menu, type the expression $|2x - 3|$, using the absolute value sign $| \, |$ in 2D on the soft keyboard. Tap the $Y1, Y2$ icon; black the equation and drag into the axes.



Example 2

Sketch the graph of the equation $y = |2x^2 - 3|$