

Graphical Times.

Volume 16, Issue 57, 2016.



Welcome to term 1, 2016! We hope that you had an enjoyable Summer break! We hope that you find this terms newsletter and activities informative along with the pricing for ‘Back to school’ and also for the remainder of the term , giving you and your students’ significant savings on the RRP. Our pricings are significantly better than our competitors. Please utilize the savings to maximize your profits to your school/faculty sales and savings that your students can make through purchasing through you from us.

What’s in here!

Included in this terms newsletter are calculator activities for the Classpad, graphic and scientific calculators:

- **Worksheet for the Classpad and similar models: What is the area of the largest rectangle ...**
- **Worksheet for the FX9750GII and similar models: Pythagorean triples**
- **Worksheet for the FX82AU+II and similar models: Moessner’s Theorem**
- **‘Back to School’ pricing valid until 29th February and Term 1 pricing valid until the end of Term 1, 2016.**

Workshop opportunities.

Workshop opportunities: If you would like to have a workshop for teachers and or students then please make contact with *Graphic Technologies*. A large number of schools are taking up this opportunity either singularly or as a cluster of schools (with both the graphic calculator and the ClassPad), to look at how the graphic calculator and CAS could impact on and be integrated into classroom practice. With NZQA having acknowledged that year 12 & 13 students without the use of a graphical calculator are being disadvantaged, a large number of schools have taking up the opportunity to up skilling teachers and students in using these mathematics/statistics hand-held and emulator technologies.



Program to support the use of the FX82AU+II and FX9750GII.

A reminder of the Casio Education NZ ‘Top Schools Program’ supporting schools using the FX82AUplus II scientific and FX9750GII graphic calculators. The goal of the programme is to have all senior students in New Zealand using a graphics calculator, so that no one is disadvantaged during NCEA examinations. Professional development courses are offered in conjunction with Graphic Technologies in supporting this initiative.

Please make sure that your schools stationery lists are updated for 2016.

Details of the program can be uploaded from: www.casio.edu.monacocorp.co.nz

Classpad update.

The ClassPad II [fx-CP400] features a much larger, backlit screen than the previous models, while keeping the same functionality. Major differences for this handheld are the 3D graphing and presentation applications have been replaced by E-Con EA200 for data logging. Connectivity is much easier, and the ClassPad II acts as a USB drive when plugged into a PC. **eActivities** are a great way to store procedures. These can be downloaded and sent to the handheld model using the USB cabling (SB-67). **Programs** can be written and downloaded to extend the functionality of the ClassPad II. eActivities, files and programmes can also be transferred from calculator to calculator using the SB-62 cabling. Visit: <http://www.classpad.com.au/index.html>

Mathematics and Statistics faculty circulation [Pass it on to . . .]

	→		→		→		→		→		→
	→		→		→		→		→		→

Graphic Technologies Specials for Term 1, 2016 and 'Back to School'.





Some pricing specials, valid until the end of February, 2016.

Product	Price per unit (excl GST)
FX9750GII graphic calculator (monochrome) RRP \$132.95	\$77.00
FX82AU plus II scientific calculator RRP \$33.95	\$17.00

Our pricings are significantly better than our competitors for these two popular calculators.

New Casio® products:

For more information on these new models specifications please click the URL links (or paste into your browser).

http://edu.casio.com/products/cwiz/fx991ex/ Class Wiz series FX991EX \$59.00 + GST		http://edu.casio.com/products/cwiz/fx570ex/ Class Wiz series FX570EX \$69.00 + GST	
http://edu.casio.com/products/cwiz/fx350ex/ Class Wiz series FX350EX \$39.00		http://edu.casio.com/products/cwiz/fx82ex/ Class Wiz series FX82EX \$37.00 + GST	

Worksheets downloaded off the web.

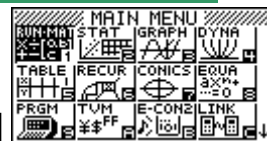
Visit Monaco Corporation and Graphic Technologies websites to view and download worksheets. There are links to other informative mathematics education websites too. For teachers we currently offer a large number of 'classroom ready' resources available and are designed primarily for the CASIO® FX82AU, FX82AU+ii, FX9750Gii, FX9750G, FX9750G+, CFX9850GB, CFX9850GB+, CFX9850GC+, FX9750GA, FX9750GA+ and FX9750Gii and the ClassPad300, 300+, 330A and 330A+ series. More have been added to the website since the last newsletter.

Please visit: www.casio.edu.monacocorp.co.nz and <http://graphic-technologies.co.nz>

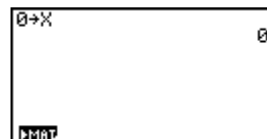
FX9750GII Activities – Solve and G-Solve (using d/dx and d²/dx²)

1. Solve feature in RUN/MAT mode:

Select [OPTN], then CALC [F4] then Solve [F1]. Notation: Solve(equation,variable)



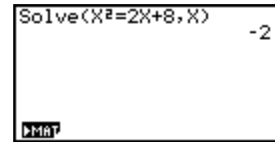
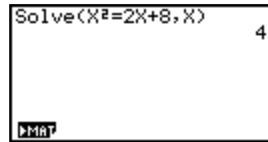
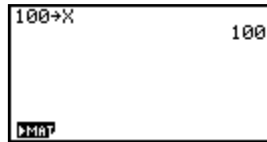
Firstly, assign a value to x . This gives the calculator a place to start the search for the solution. Generally this can be set to $x = 0$ by entering $0 \rightarrow X$ then press [EXE].



[N.B. For polynomials with a degree > 1 , then some knowledge of maxima and minima is required. This is because there are 2 or more solutions and the selection of the starting point will 'zoom' into the 'zero' that is based on tangential and x-intercept iterations [Note: The FX9750Gii uses an enhanced Newton-Raphson iterative method].

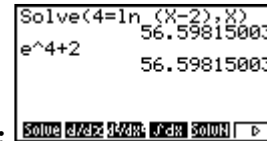
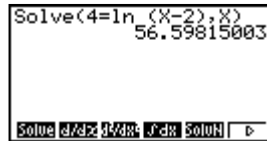
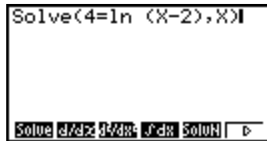
So for quadratic equations and variations use initial settings for x which are on either side of the minimum (or maximum point), e.g. both large negative **and** positive x -values.

Example 1: Solve($x^2=2x+8,x$)



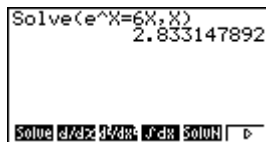
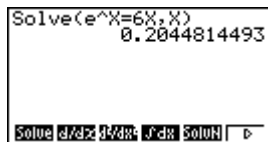
Check: $x^2 - 2x - 8 = 0 \rightarrow (x - 4)(x + 2) = 0 \rightarrow x = -4$ or 2

Example 2: Solve($4=\ln(x-2),x$)

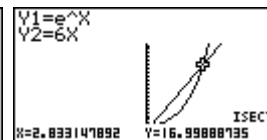
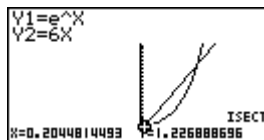
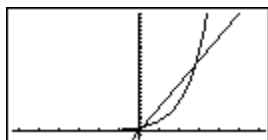


Checking the result:

Example 3: Solve($e^x=6x,x$)



Check: Cannot be solved algebraically so graphing and using G-Solve features.



2. **G-Solve features in GRAPH mode:**

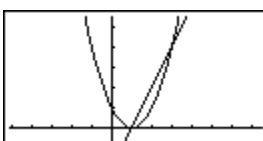
Y1 = expression

Y2 = d/dx(Y1,x)

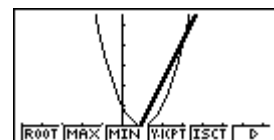
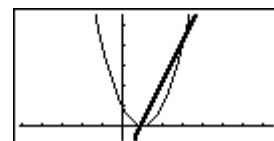
[Note: Could also have Y2 = d2/dx2(Y1,x)]

Then use the G-Solve features on Y2.

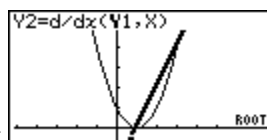
Example: Y1 = (x - 1)² and Y2 = d/dx(Y1,x)



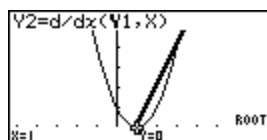
Or you can change the **STYLE** [F4] to distinguish between each graph drawn.



Pressing [SHIFT] gives: [TRACE] [ZOOM] [L] [MIN] [SHIFT] [GSLV] [G] [T] and [F5] gives the **G-Solve** features.



[F1]: **Root**



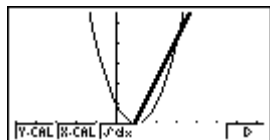
[F2]: **MAX**imum calculation

[F3]: **MIN**imum calculation



[F4]: Y-InterCePT calculation

[F5]: InterSeCTion calculation



[F6]: More choices

[F1]: Y-CALculation

[F2]: X-CALculation

[F3]: $\int dx$ calculation

Websites of interest.

http://www.casioeducation.com/resource/pdfs/activities/Arizona_High_School_AIMS_Exam.pdf

http://www.casioeducation.com/resource/pdfs/activities/Louisiana_Education_Assessment_Programs_Practice_Test-Grades%208%20-%202011.pdf

http://www.casioeducation.com/resource/pdfs/activities/Prairie_State_Achievement_Exam.pdf

http://www.casioeducation.com/resource/pdfs/activities/New_York_Regents_Exam.pdf

<http://www.casioeducation.com/products/activities/142EBF83-3E83-43FE-B29A-73B838EA0554>

Verify on the FX82AU+II

Select **Verify** to check whether solutions are either 'True' or 'False'.

Press [MODE] then [3],

```

1:COMP  2:STAT
3:VERIF

```

followed by [SHIFT] then [6].

```

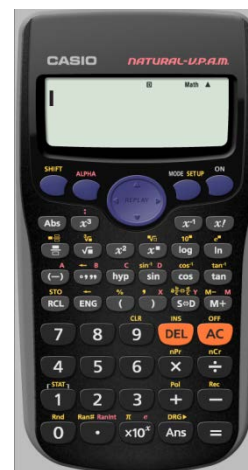
Math
TRUE/FALSE

```

```

1:=      2:≠
3:>      4:<
5:≥      6:≤

```



```

Math ▲
3=5
FALSE

```

Using [1]

```

Math ▲
3≠5
TRUE

```

Using [2]

```

Math ▲
3>5
FALSE

```

Using [3]

```

Math ▲
3<5
TRUE

```

Using [4]

```

Math ▲
3≥5
FALSE

```

Using [5]

```

Math ▲
3≤5
TRUE

```

Using [6]

A last word!

Well again, that's all I can fit onto the 4 pages! Enjoy term 1 and the upcoming summer break! Hope to see you at some workshops or hear from you via this newsletter or otherwise! If you would like to contribute or have suggestions as to what you would like to have discussed via this medium, please do not hesitate to contact us either by snail-mail, email, website, telephone, text or fax.

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Would you like to receive this mailout electronically?
Please email your request to: graph.tech@xtra.co.nz

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GRAPHIC TECHNOLOGIES

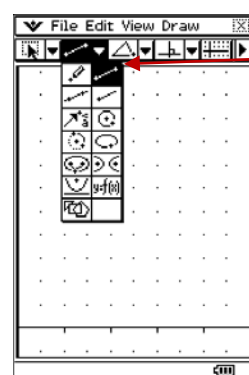
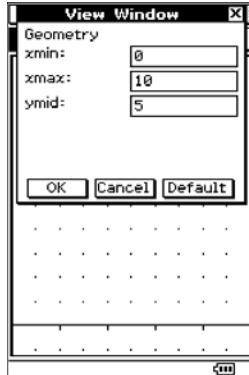
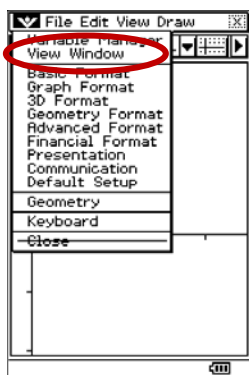
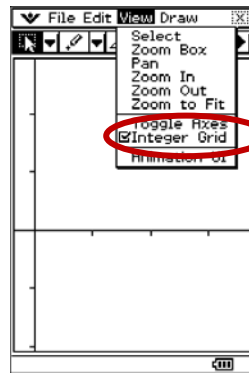
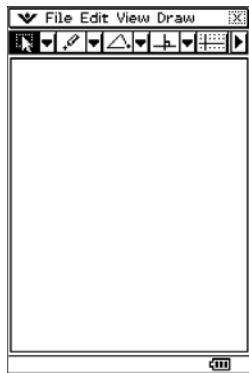
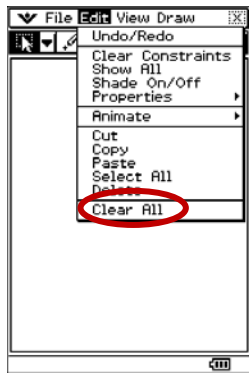
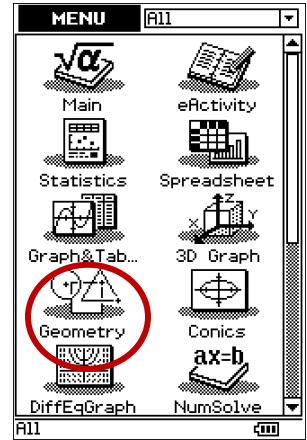
What is the area of the largest rectangle ...

This resource was written by Derek Smith with the support of CASIO New Zealand. It may be freely distributed but remains the intellectual property of the author and CASIO.

What is the maximum area of a rectangle that can be placed inside another with the vertices of the inner rectangle on the sides of the outer rectangle?

Let's start with a square as the outer rectangle and animate an inner rectangle, where the vertices of the inner rectangle travel along the sides of the outer square and use the animation to capture the lengths and areas of the inner rectangle as the vertices move.

Enter the **Geometry** icon from **Main** and clear any pictures, diagrams or text, to start with a clear working area. Tap with the stylus on **'Edit'** and then **'Clear All'** then follow the onscreen instructions. Select **'View'** then place a 'v' inside the box for **'Integer Grid'**. Adjust the screen so you can see the grid via **'View Window'** (see below) then tap **'OK'** to be displayed.

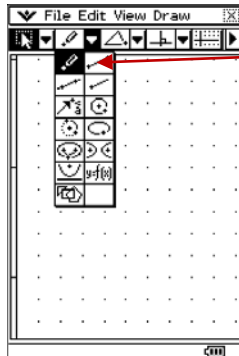
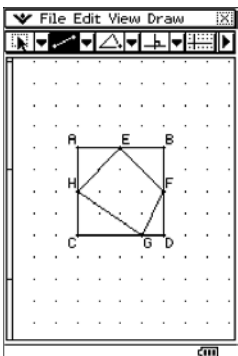
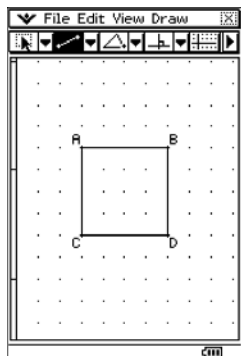


Line segment tool.

Create a square with sides of length 4 units. Create the line segment AB, then AC, then DB and DC, using the **'line segment tool'**.

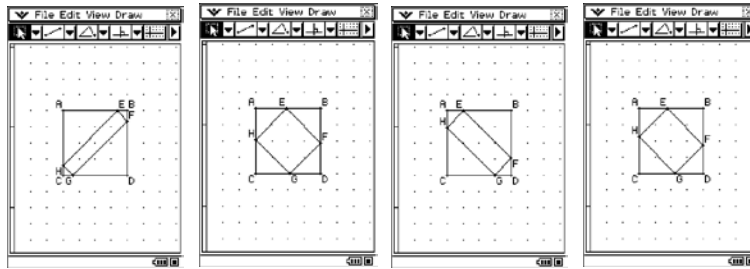
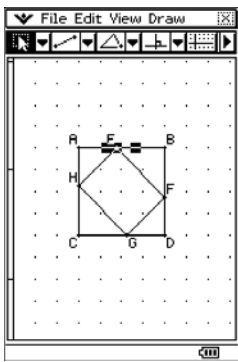
[Note: the order is important so that the animations of the inner rectangle move in the appropriate directions.]

Next, using the **'point'** tool, tap on each of the sides of the square $\square ABCD$ to create the points E, F, G and H. Now connect E, F, G and H with line segments to form a quadrilateral.



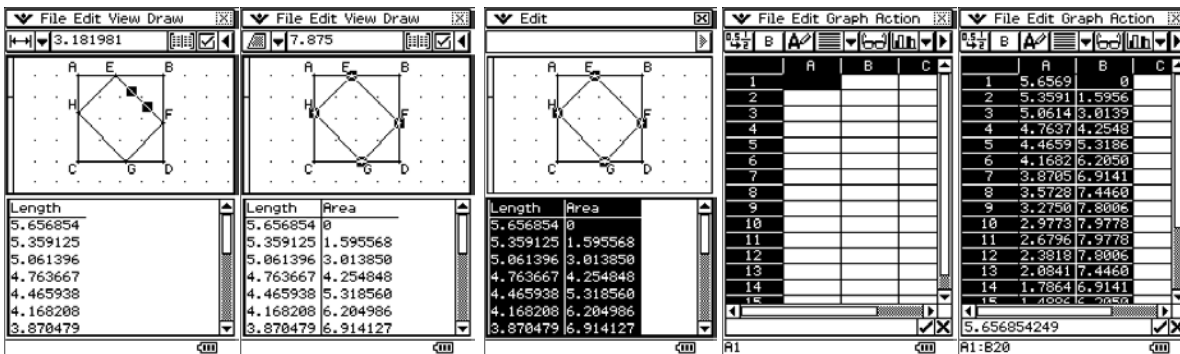
Point tool.

Now animate the points E, F, G and H with their respective sides of the outer square. You need to animate each point with its respective side one at a time. For example, tap on point E then the line AB, then **'Edit'** then **'Animate'** and lastly tap on **'Add Animation'**.

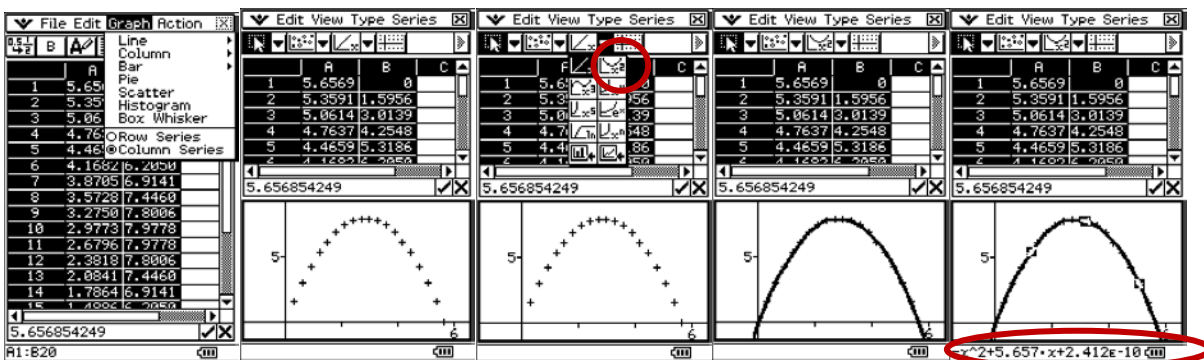


Repeat this process to animate the other 3 points and their respective sides of the outer square. Now animate by selecting 'Edit' then 'Go once'. See some screen captures are illustrated above.

Select a side (e.g. **EF**) and then tap on the icon to display the captured results of the lengths of **EF** during the animation process. Select the 4 vertices of the inner parallelogram (**E, F, G** and **H**) and then tap on the icon again to display the captured results of the areas produced in the animation process.



Select all of the data by highlighting the Length and Area columns, tap on 'Edit', then 'Copy' (See above). Tap on the **Main** icon (Bottom left area of the screen) and select the **Spreadsheet** icon, then 'Edit' then 'Paste' to transfer the animation data to the spreadsheet cells. Now, create a scattergraph for Length versus Area.



Select 'Graph' then 'Scatter'. Select the mathematical model. Mathematical model equation displayed.

Questions:

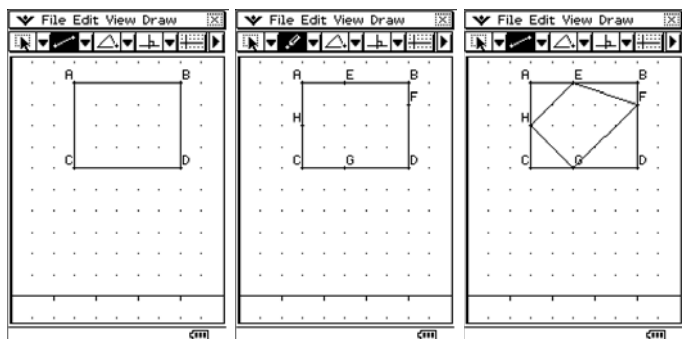
1. What is the length of the side **EF** (or **EH**), where the maximum area for the inner rectangle occurs?
2. How do you know that the inner rectangle is a rectangle?
3. What is the relationship of the side **EF** (or **EH**) to the diagonal of the outer square?

Variation:

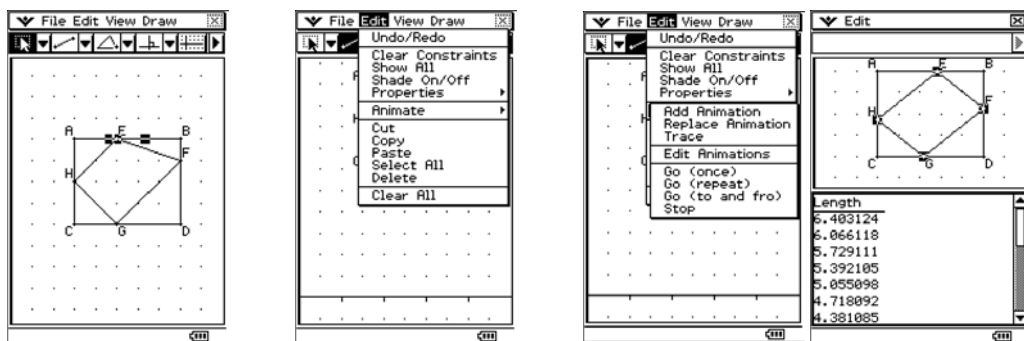
What if the outer rectangle is NOT a square?

[Note: This will make the inner 4-sided figure is a parallelogram.] How do you know this?

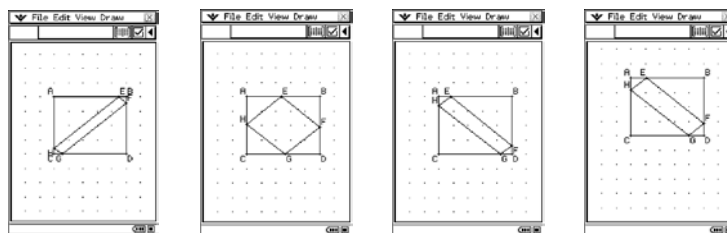
The example illustrated for this variation is a rectangle ABCD with sides of lengths 5 mu by 4 mu respectively. The construction is repeating the tapping process illustrated in the square example. Can you generalize for a $m \times n$ rectangle?





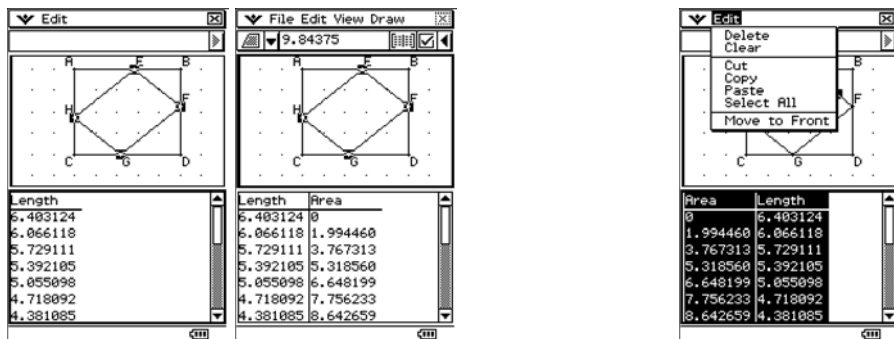
Now animate the points **E, F, G** and **H** with their respective sides of the outer square. You need to animate each point with its respective side one at a time. Tap on the point **E** then the line **AB**, then **'Edit'** then **'Animate'** and lastly **'Add Animation'**.



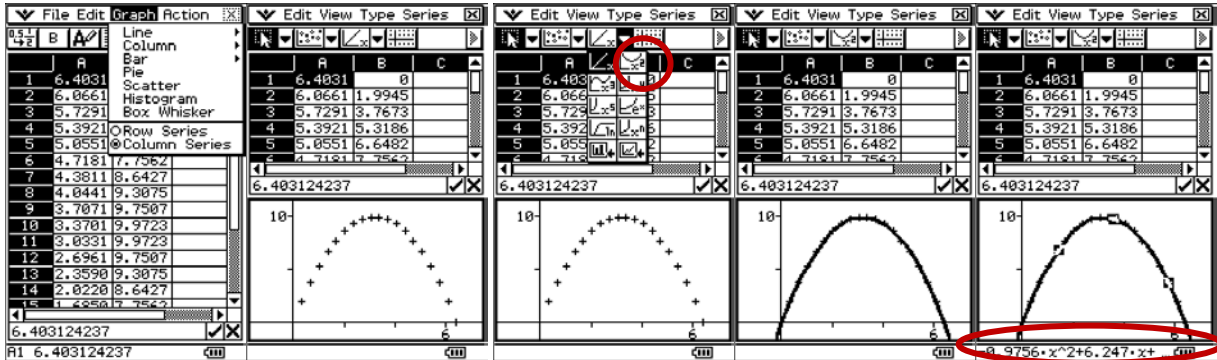
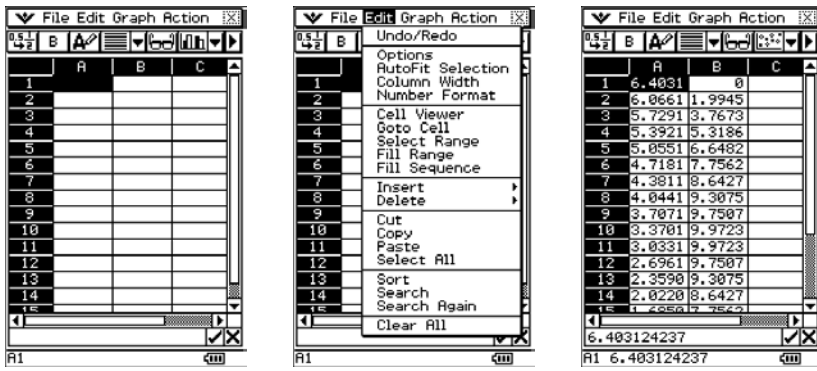
Repeat this for the other 3 points and lines. Now animate by selecting **'Edit'** then **'Go once'**. Some screen captures are illustrated below.



Select a side (e.g. EF) and then tap on the  icon to display the captured results of the lengths for the animation. Also select the 4 vertices of the inner parallelogram (E, F, G and H) and then tap on  icon again to display the captured results of the areas for the animation.



Select all of the data by highlighting the area and Length Columns, tap on **'Edit'** then **'Copy'** (See above). Tap on the **Main** icon (Bottom left area of the screen) and select the **Spreadsheet** icon, then **'Edit'** then **'Paste'** to transfer the animation data to the spreadsheet cells. Now, create a scattergraph for Length versus Area.



Select 'Graph' then 'Scatter'.

Select the mathematical model.

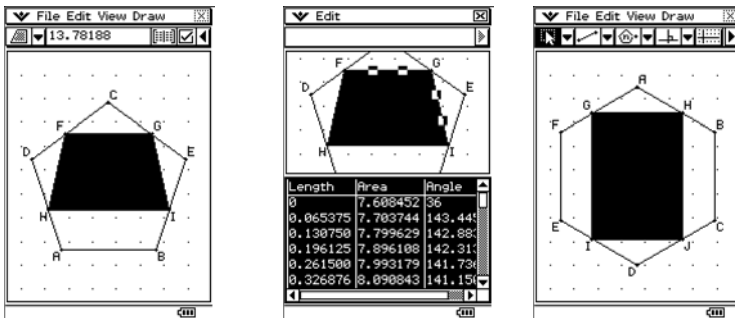
Mathematical model equation displayed.

Questions:

1. What is the length of the side **EF** (or **EH**), where the maximum area for the inner parallelogram occurs?
2. How do you know that the inner rectangle is a rectangle?
3. What is the relationship of the side **EF** (or **EH**) to the diagonal of the outer square?

Other variations:

Fit the largest quadrilateral inside a series of regular polygons with sides $n > 4$, ...explore!



Questions:

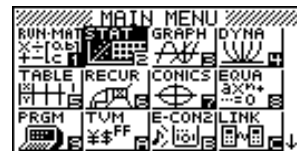
1. What quadrilateral shapes is inside from the different polygons used as the outer?
2. What is the length of the sides of the quadrilateral inside the regular polygon, where the maximum area for the inner rectangle occurs?
3. How do you know that the inner rectangle is a quadrilateral?
4. What is the length of the inner quadrilaterals side relationship to the diagonal of the outer polygon?

For further tips, more helpful information and software support visit our websites:
www.casio.edu.monacocorp.co.nz or <http://graphic-technologies.co.nz>

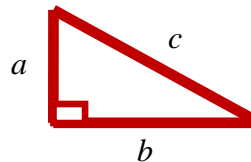
Pythagorean triples.

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Select the **STAT** icon from the **Main Menu** by using the arrow keys to highlight the **STAT** icon followed by **[EXE]** or by pressing the **[2]** key.



Below is an example of a list of some Pythagorean triples, whole numbers that obey the rule: $a^2 + b^2 = c^2$ for a right-angled triangle.

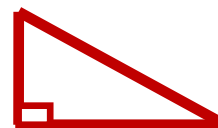


Pythagorean Triples

(3, 4, 5)	(5, 12, 13)	(7, 24, 25)	(8, 15, 17)
(9, 40, 41)	(11, 60, 61)	(12, 35, 37)	(13, 84, 85)
(16, 63, 65)	(20, 21, 29)	(28, 45, 53)	(33, 56, 65)
(36, 77, 85)	(39, 80, 89)	(48, 55, 73)	(65, 72, 97)

Questions:

- What Pythagorean triples can be generated, such that a right angled triangle has the sides: $n^2 + 1$, $n^2 - 1$ and $2n$ respectively?
Which sides of the right angled triangle will $n^2 + 1$, $n^2 - 1$ and $2n$ be placed? How do you know?



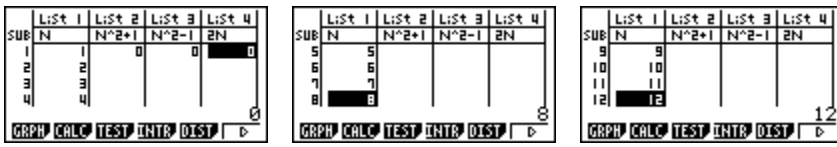
- Complete the table below:

$n =$	$n^2 + 1$	$n^2 - 1$	$2n$
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
...

These Pythagorean triples can be calculated via the **STAT** icon.

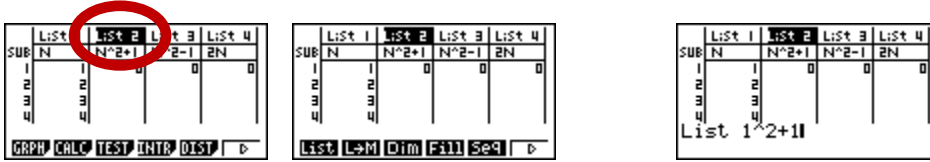
Firstly, give each of the List spaces 1, 2, 3 and 4 a header (**SUB** title), using the **[ALPHA]** keys and then enter in the **N** values, into **List 1**, the numbers 1 ~ 12.





Now, populate List spaces 2, 3 and 4 by entering in the instructions, when the 'Cursor' is highlighting the respective **List** area (see circled area below).

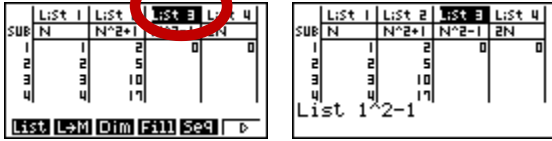
For **List 2**:



[OPTN] then [F1] for List.

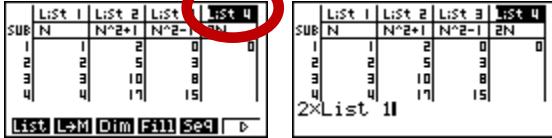
[F1] for List to appear on the screen. Then [1], [^], [2], [+], [1] and press [EXE] to populate the List 2 space.

For **List 3**:



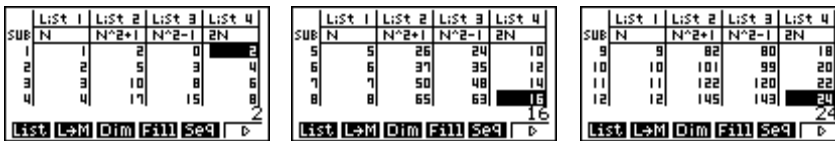
Then press [EXE] to populate the list 3 space.

For **List 4**:



Then press [EXE] to populate the list 4 space.

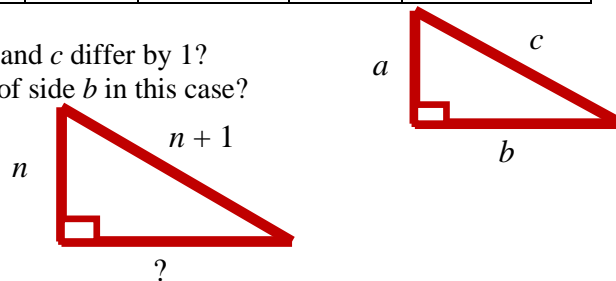
The completed set of 12 Pythagorean triples, for $1 \leq n \leq 12$.



Set		Set		Set		Set	
N =		N =		N =		N =	
1	2, 0, 2	4	17, 15, 8	7	50, 48, 14	10	101, 99, 20
2	5, 4, 3	5	26, 24, 10	8	65, 63, 16	11	122, 120, 22
3	10, 8, 6	6	37, 35, 12	9	82, 80, 18	12	145, 143, 24

Questions:

- Can you generate Pythagorean triples where a and c differ by 1?
That is, $a = n$ and $c = n + 1$. What is the value of side b in this case?



- Can you generate Pythagorean triples where a and c differ by 2?
- Can you generate Pythagorean triples where a and c differ by 3?
- Now generalise, can you generate Pythagorean triples, where a and c differ by m ? [Note: $m < n$.]

Moessner's Theorem.

This resource was written by Derek Smith with the support of CASIO New Zealand. It may be freely distributed but remains the intellectual property of the author and CASIO.

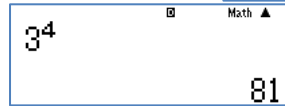
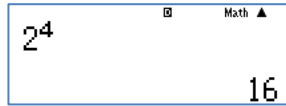
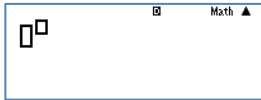
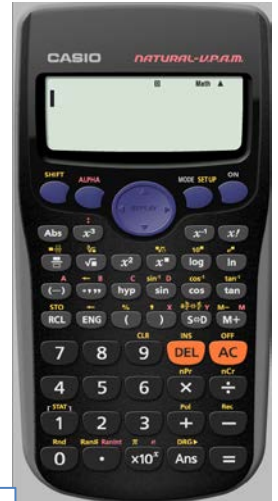
Moessner's Theorem describes a procedure for generating a n integer sequences that lead unexpectedly to the sequence of n th powers $1^n, 2^n, 3^n, \dots$ for $n > 1$. To generate the first sequence, write down the positive integers $1, 2, 3, \dots$, then cross out every n^{th} element. For the second sequence, compute the prefix sums of the first sequence, ignoring the crossed-out elements, then cross out every $(n - 1)^{\text{th}}$ element. For the third sequence, compute the prefix sums of the second sequence, then cross out every $(n - 2)^{\text{th}}$ element, and so on until you have only one number for each 'n-group' that you started with.

For example, for $n = 4$:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	3	6		11	17	24		33	43	54		67	81	96		113	131	150		171	193	216	
1	4		15	32		65	108		175	256		369	500		671	864							
1		16		81		256		625		1296													

Moessner's theorem says that the final sequence is $1^n, 2^n, 3^n, \dots$

Checking: $1 = 1^4, 16 = 2^4, 81 = 3^4, 256 = 4^4, 625 = 5^4, 1296 = 6^4$



Try for $n = 3$

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Try for $n = 5$

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Try for $n = 6$

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

Questions:

- What happens when $n = 1$?
- What is the value of n so that the 3^{rd} and 4^{th} number in the last sequence generated are 729 and 6 561 respectively?
- In the construction of Moessner's Theorem, the initial step size n is constant.
 - What would happen if you increase it at each step? Repeat the construction starting with a step size of one and increasing the step size by one each time. Thus, in the first sequence, we cross out 1, 3, 6, 10, ... What sequence of numbers are generated now?
 - What would happen if you increased n as an arithmetic sequence? Thus, in the first sequence, we cross out 1, 3, 5, 7, ... What sequence of numbers are generated now?

Hint: $a \times 1^{n-1}, (a + d) \times 2^{n-1}, (a + 2d) \times 3^{n-1}, \dots$
 Hint: Factorials. $3! = 3 \times 2 \times 1 = 6$

Graphic Technologies School Price List for 'Back to School' 2016 pricing.

Valid until 29th February, 2016.



NOTE:

- No Courier or Postal charges are made to schools for bulk orders of \$100.00 and over
- A \$5.00 postage and packaging charge for orders less than \$100.00.

Product	# of Units	Price per unit (excl GST)	Quantity required
FX9750GII graphic calculator (monochrome) RRP \$132.95	NA	\$77.00	
FX82AU+II plus II scientific calculator RRP \$33.95	NA	\$17.00	
FX-CG20 GRAPHIC CALCULATOR	NA	\$210.00	
Class Wiz series FX570EX New	NA	\$59.00	
Class Wiz series FX991EX New	NA	\$69.00	
Class Wiz series FX82EX New	NA	\$37.00	
Class Wiz series FX350EX New	NA	\$39.00	
FX991ES plus scientific calculator	NA	\$60.00	
FX991ES plus emulator software single licence	NA	\$60.00	
FX100 scientific calculator	NA	\$50.00	
FC100V financial calculator	NA	\$90.00	
FA9860A emulator software single licence [FX9750GII]	NA	\$190.00	
FA9860B emulator software school licence [FX9750GII]	NA	\$770.00	
FX82AU+II emulator software single licence	NA	\$60.00	
ClassPad II [fx-CP400]	NA	\$230.00	
ClassPad330 individual user PC licence	NA	\$170.00	
ClassPad330 school user PC licence	NA	\$680.00	
EA-200 Data Logger	NA	\$350.00	
EA-2 Motion Sensor	NA	\$350.00	
EA-200 Data Logger and EA- 2 Motion Sensor combined	NA	\$600.00	
SB-62 Cable (Calculator to calculator link)	NA	\$30.00	
FA-124USB cable [high-speed data communication between PC and the FX9750GII]	NA	\$20.00	
AAA Batteries Card of 4 (Minimum 12 cards (48) an order)	NA	\$5.00	
AA Batteries Card of 4 (Minimum 12 cards (48) an order)	NA	\$5.00	
Back up battery CR2032 [for graphic calculator]	NA	\$2.50	
Wall Clock [Digital Day Date Month Thermometer]	NA	\$110.00	

School: _____

Address: _____

Phone: _____ **Fax:** _____

Contact: _____ **Order Number:** _____

Graphic Technologies School Price List for Term 1, 2016 pricing.

**Valid from 1st March, 2016 until the end of
term 1, 2016.**



NOTE:

- No Courier or Postal charges are made to schools for bulk orders of \$100.00 and over
- A \$5.00 postage and packaging charge for orders less than \$100.00.

Product	Price per unit (excl GST)	Quantity required
FX9750GII graphic calculator (monochrome) RRP \$132.95	\$82.00	
FX82AU plus II scientific calculator RRP \$33.95	\$23.00	
FX-CG20 GRAPHIC CALCULATOR New model	\$210.00	
Class Wiz series FX570EX New	\$59.00	
Class Wiz series FX991EX New	\$69.00	
Class Wiz series FX82EX New	\$37.00	
Class Wiz series FX350EX New	\$39.00	
FX991ES plus scientific calculator	\$60.00	
FX991ES plus emulator software single licence	\$50.00	
FX100 scientific calculator	\$50.00	
FC100V financial calculator	\$90.00	
FA9860A emulator software single licence [FX9750GII]	\$190.00	
FA9860B emulator software school licence [FX9750GII]	\$770.00	
FX82A+II emulator software single licence	\$50.00	
ClassPad II [fx-CP400]	\$230.00	
ClassPad330 individual user PC licence	\$170.00	
ClassPad330 school user PC licence	\$680.00	
EA-200 Data Logger	\$350.00	
EA-2 Motion Sensor	\$350.00	
EA-200 Data Logger and EA- 2 Motion Sensor combined	\$600.00	
SB-62 Cable (Calculator to calculator link)	\$30.00	
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Wall Clock [Digital Day Date Month Thermometer]	\$110.00	

School: _____

Address: _____

Phone: _____ **Fax:** _____

Contact: _____ **Order Number:** _____

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