

Laboratorio di **Matematica e Geometria**

Smart Math: alcune idee di matematica realizzabili con gli smartphone

Lorenza Resta

Istituto superiore Liceo di Faenza

“Smartphone e tablet per l’insegnamento delle scienze”,

11-12 Settembre 2015, Città della Scienza, Napoli

Un' App molto utile



ios and Android:
Desmos (free)

<http://support.desmos.com/hc/en-us>



Introduzione a Desmos



A screenshot of the Desmos mobile app interface. The top status bar shows LTE, 92% battery, and 11:21. Below the status bar are icons for a wrench, a plus sign, and a minus sign. The main input area has a plus-minus icon, a settings gear, and a collapse icon. The input field contains a vertical cursor. An orange arrow points to the cursor. Below the input field is a calculator keypad with mathematical symbols like x, y, a^2, a^b, 7, 8, 9, ÷, funcs, (), <, >, 4, 5, 6, ×, ←, →, |a|, , ≤ ≥, 1, 2, 3, -, ×, A B C, √, π, 0, ., =, +, and a return key. The bottom navigation bar shows back, home, and recent apps icons.

A screenshot of the Desmos mobile app interface showing a graph of a parabola. The top status bar shows LTE, 92% battery, and 11:25. The graph area shows a coordinate plane with a red parabola opening upwards, with its vertex at (0, -4). The x-axis ranges from -10 to 10, and the y-axis ranges from -5 to 5. Below the graph are the same icons as in the previous screenshot. The input field now contains the equation $y = x^2 - 4$. An orange arrow points to the equation. Below the input field is the same calculator keypad as in the previous screenshot. The bottom navigation bar shows back, home, and recent apps icons.

Mentre si scrive la curva **cambia forma** man mano che si scrivono gli elementi.



Impostazioni



11:25 92%

1 Delete All Done

style: color:

2

powered by desmos

11:26 93%

1 Delete All Done

1 $y = x^2 - 4$

2 $y = x^2 - 4$

3

powered by desmos

11:27 93%

1 $y = x^2 - 4$

2 $y = x^2 - 4$

3

| x | $x^2 - 4$ |
|-----|-----------|
| -2 | 0 |
| -1 | -3 |
| 0 | -4 |
| 1 | -3 |

powered by desmos

Inserimenti



Folder: cartella

The screenshot shows the top status bar with signal strength, LTE, and 92% battery at 11:21. Below is a toolbar with a wrench icon, a plus sign, and a minus sign. A main menu bar contains a plus-minus icon, a settings gear, and a dropdown arrow. Below the menu is a list with two items, labeled 1 and 2. At the bottom is a large keyboard with mathematical symbols like x , y , a^2 , a^b , and standard numbers and operators.

The screenshot shows a coordinate plane with x-axis from -10 to 10 and y-axis from -5 to 5. The status bar shows 11:24. A menu is open over the graph, listing options: $f(x)$ expression, note, table, and folder. An orange arrow points from the 'Folder: cartella' text to this menu.

This screenshot shows a folder named 'Funzioni' containing two items: 'Funzione quadratiche' and two equations: $x = y^2 - 9y$ and $y = x^2 - 4$. An orange arrow points from the 'Folder: cartella' text to the folder icon.

This screenshot shows the same menu as in the previous screenshot, but with the 'image' option highlighted by a red circle. The entire menu area is enclosed in a red rectangular box. An orange arrow points from the 'image' option in this menu to the 'image' option in the menu shown in the previous screenshot.

Alcune funzioni utili.



$f(x) = x^2 - 4$

2

3

| | | | | | | | | | |
|-------|---|----------------|----------------|---|---|---|---|-------|---|
| x | y | a ² | a ^b | 7 | 8 | 9 | ÷ | funcs | |
| () | < | > | | 4 | 5 | 6 | × | ← | → |
| a | , | ≤ | ≥ | 1 | 2 | 3 | - | | ⊗ |
| A B C | √ | π | | 0 | . | = | + | | ↵ |

$f(x) = x$

2

3

| | | |
|------|---------|--------|
| trig | calc | misc |
| TRIG | INVERSE | HYPERB |
| sin | arcsin | sinh |
| cos | arccos | cosh |
| tan | arctan | tanh |
| csc | arccsc | csch |
| sec | arcsec | sech |
| cot | arccot | coth |

| | | | | | | | | | |
|-------|---|----------------|----------------|---|---|---|---|-------|---|
| x | y | a ² | a ^b | 7 | 8 | 9 | ÷ | funcs | |
| () | < | > | | 4 | 5 | 6 | × | ← | → |
| a | , | ≤ | ≥ | 1 | 2 | 3 | - | | ⊗ |
| A B C | √ | π | | 0 | . | = | + | | ↵ |

$f(x) = x$

2

3

| | | |
|------|-------|-------|
| trig | calc | misc |
| ceil | floor | round |
| abs | min | max |
| lcm | gcd | mod |
| nCr | nPr | a! |
| √ | ∛ | a |
| { } | | |

| | | | | | | | | | |
|-------|---|----------------|----------------|---|---|---|---|-------|---|
| x | y | a ² | a ^b | 7 | 8 | 9 | ÷ | funcs | |
| () | < | > | | 4 | 5 | 6 | × | ← | → |
| a | , | ≤ | ≥ | 1 | 2 | 3 | - | | ⊗ |
| A B C | √ | π | | 0 | . | = | + | | ↵ |

$f(x) = x$

2

3

| | | |
|------------------|------|------|
| trig | calc | misc |
| exp | ln | log |
| log _a | d/dx | Σ |
| Π | a! | e |

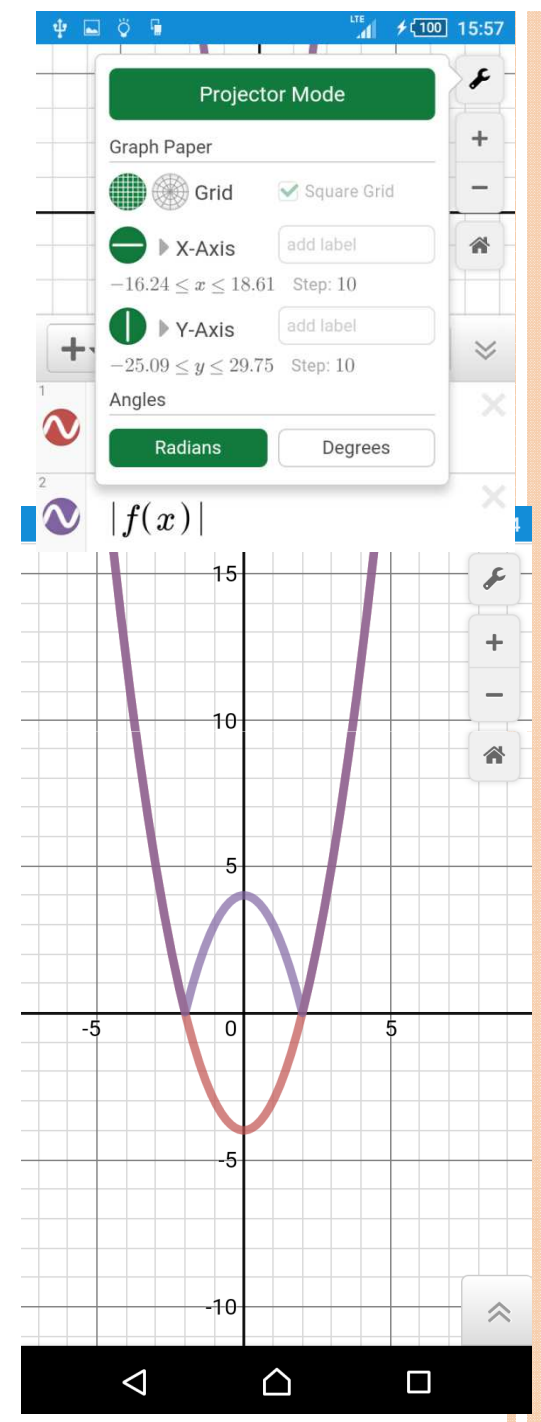
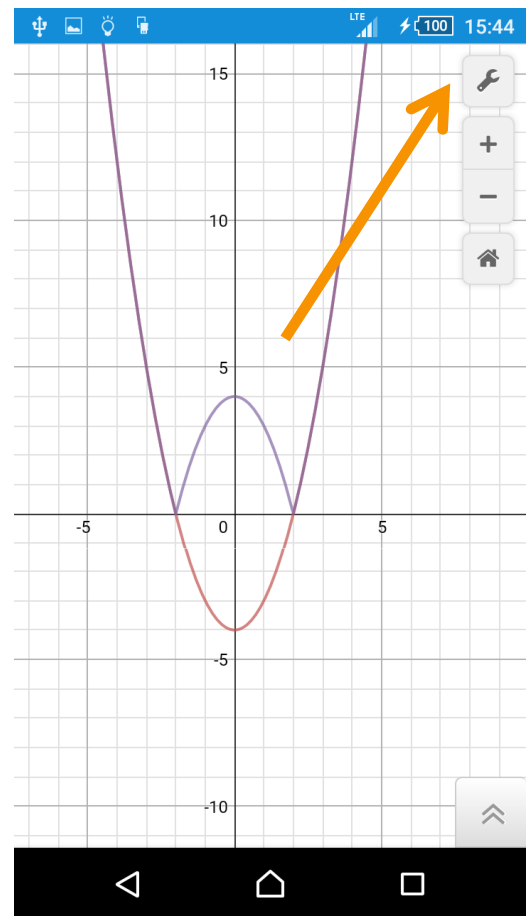
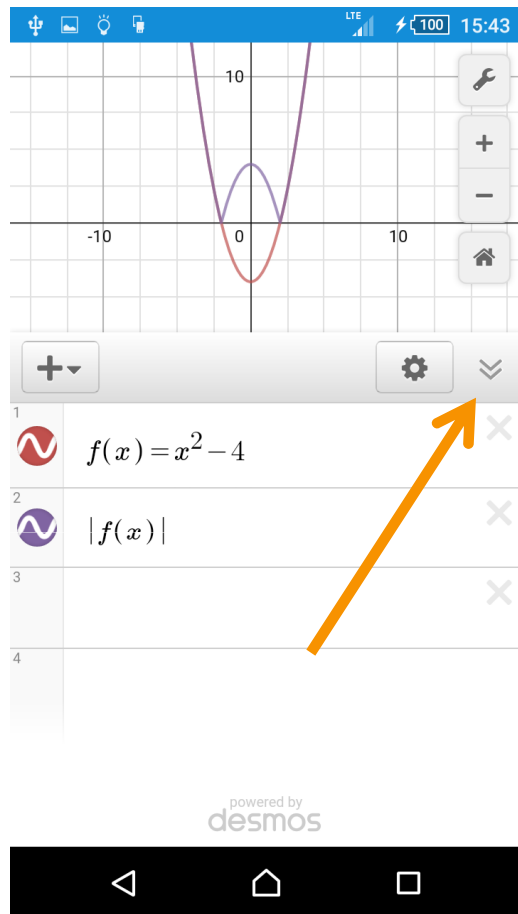
| | | | | | | | | | |
|-------|---|----------------|----------------|---|---|---|---|-------|---|
| x | y | a ² | a ^b | 7 | 8 | 9 | ÷ | funcs | |
| () | < | > | | 4 | 5 | 6 | × | ← | → |
| a | , | ≤ | ≥ | 1 | 2 | 3 | - | | ⊗ |
| A B C | √ | π | | 0 | . | = | + | | ↵ |



Smart Math

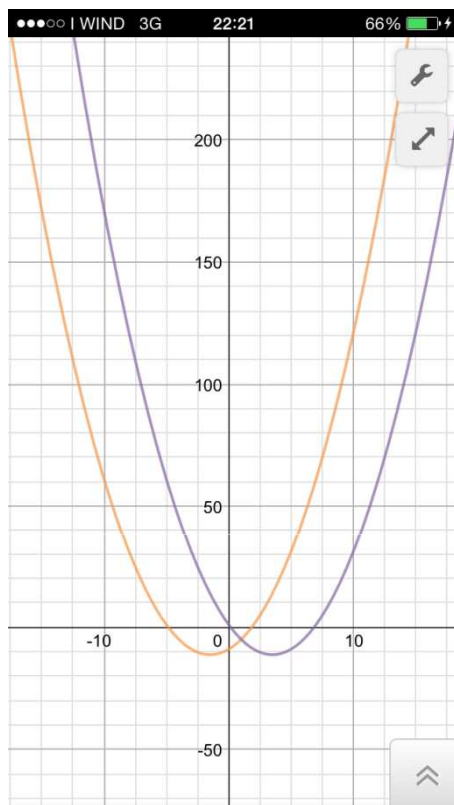
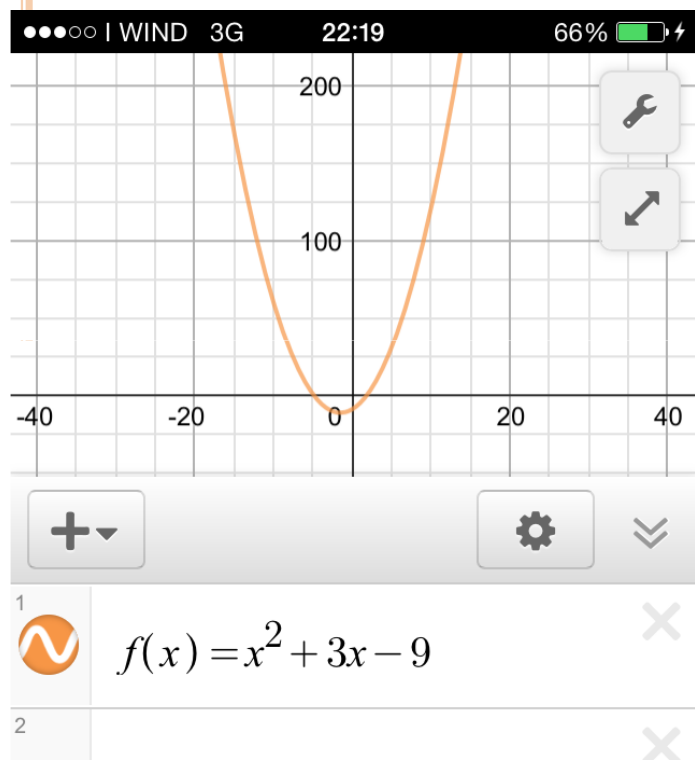


Visualizzazione utile.

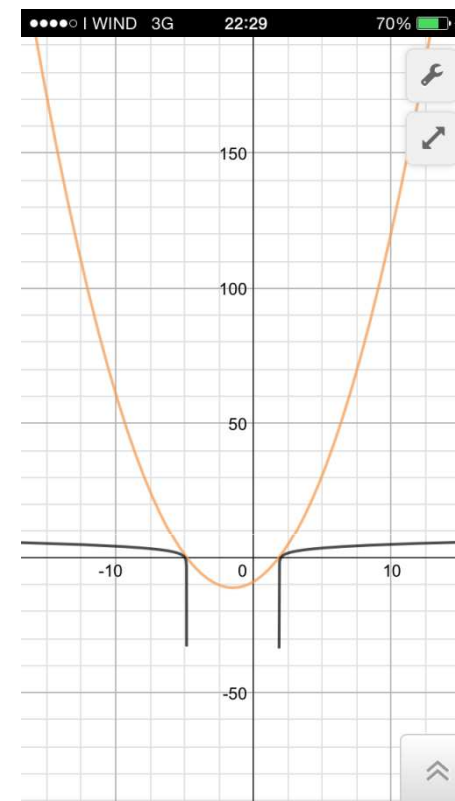




Smart Maths: “Manipolazione” di funzioni



$$y = f(x - 5)$$



$$y = \ln(f(x))$$



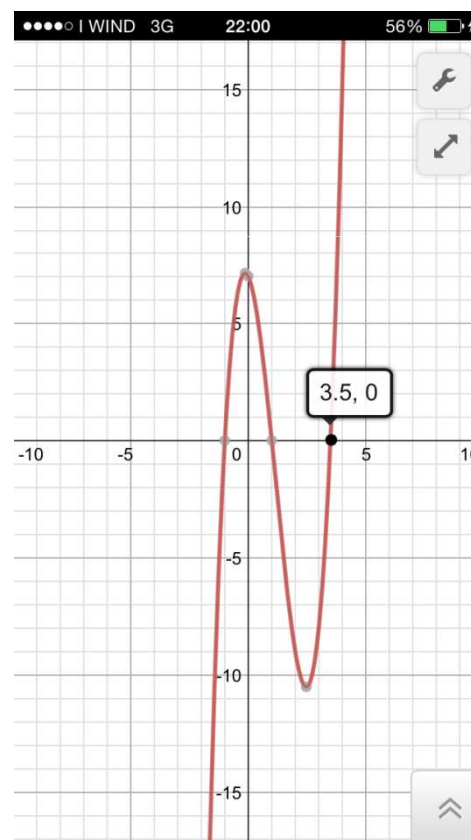
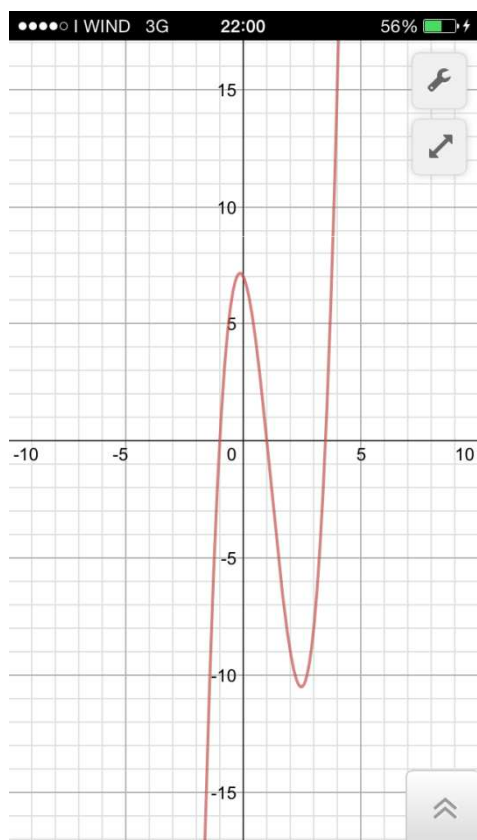
Smart Maths



$$2x^3 - 7x^2 - 2x + 7 = 0$$

$$2x^3 - 7x^2 - 2x + 7 > 0$$

Equazioni, disequazioni



Per le
soluzioni
approssimate
si può
utilizzare lo
zoom per
conoscere le
cifre decimali
necessarie..

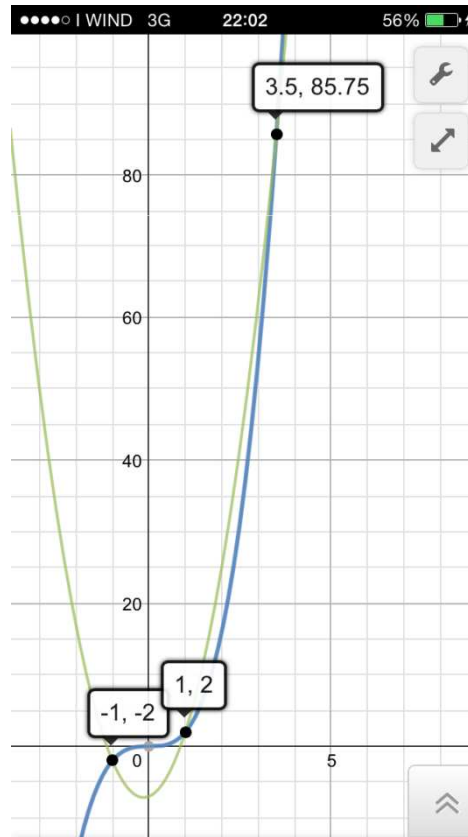
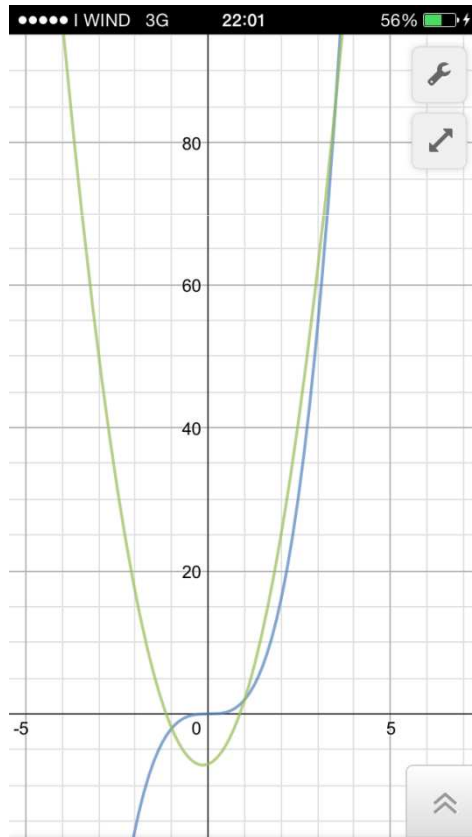


Smart Maths



Equazioni, disequazioni

$$2x^3 = 7x^2 + 2x - 7$$



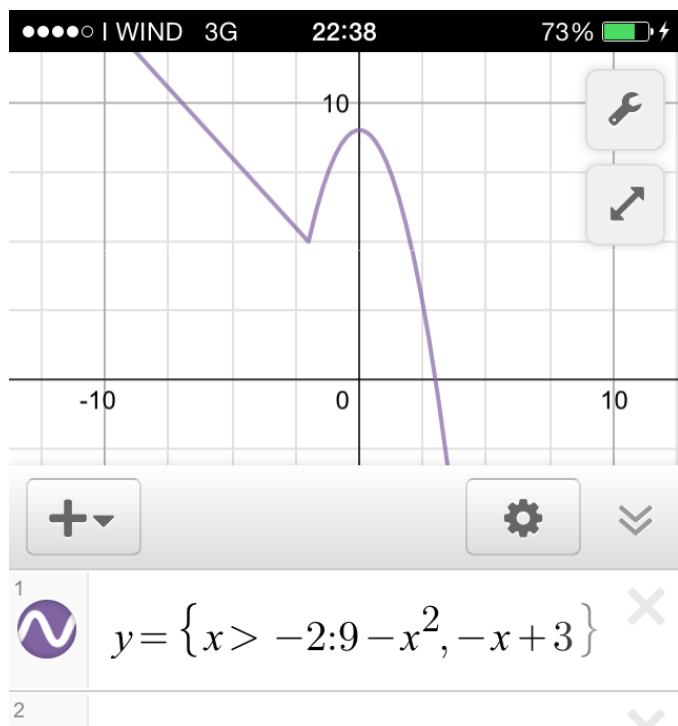


Smart Maths

E' possibile costruire anche **funzioni a tratti**.

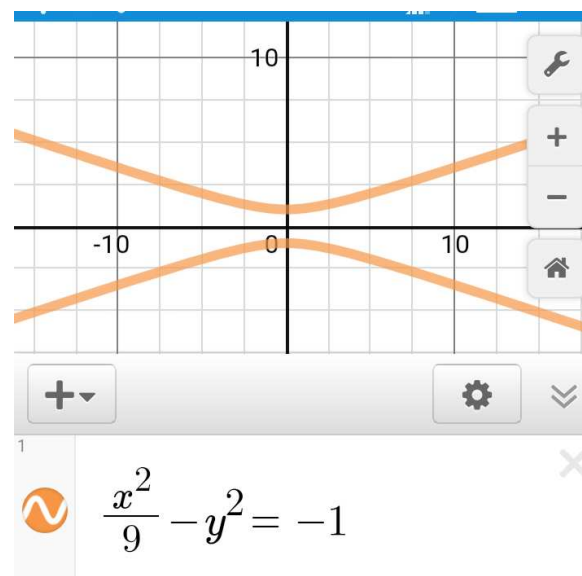
Funzioni condizionate

$$y = \{ \text{condizione: espressione}_1, \text{espressione}_2 \}$$



Attenzione al "livello" della scrittura!

$$\frac{x^2}{9} - y^2 = -1$$



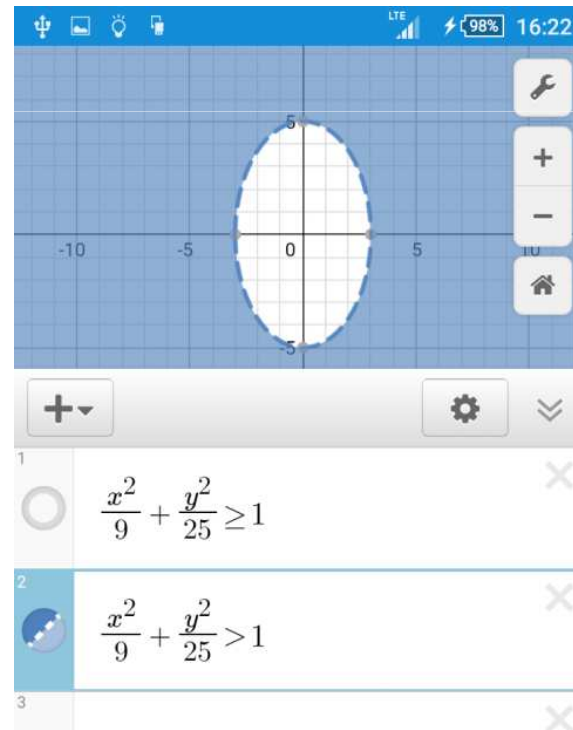
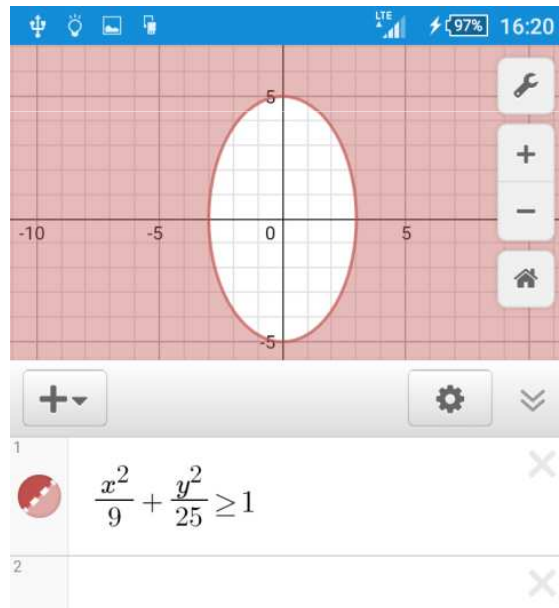
Curve in forma implicita



Smart Maths

$$\frac{(x)^2}{9} + \frac{(y+2)^2}{25} \geq 1$$

$$\frac{(x)^2}{9} + \frac{(y+2)^2}{25} > 1$$



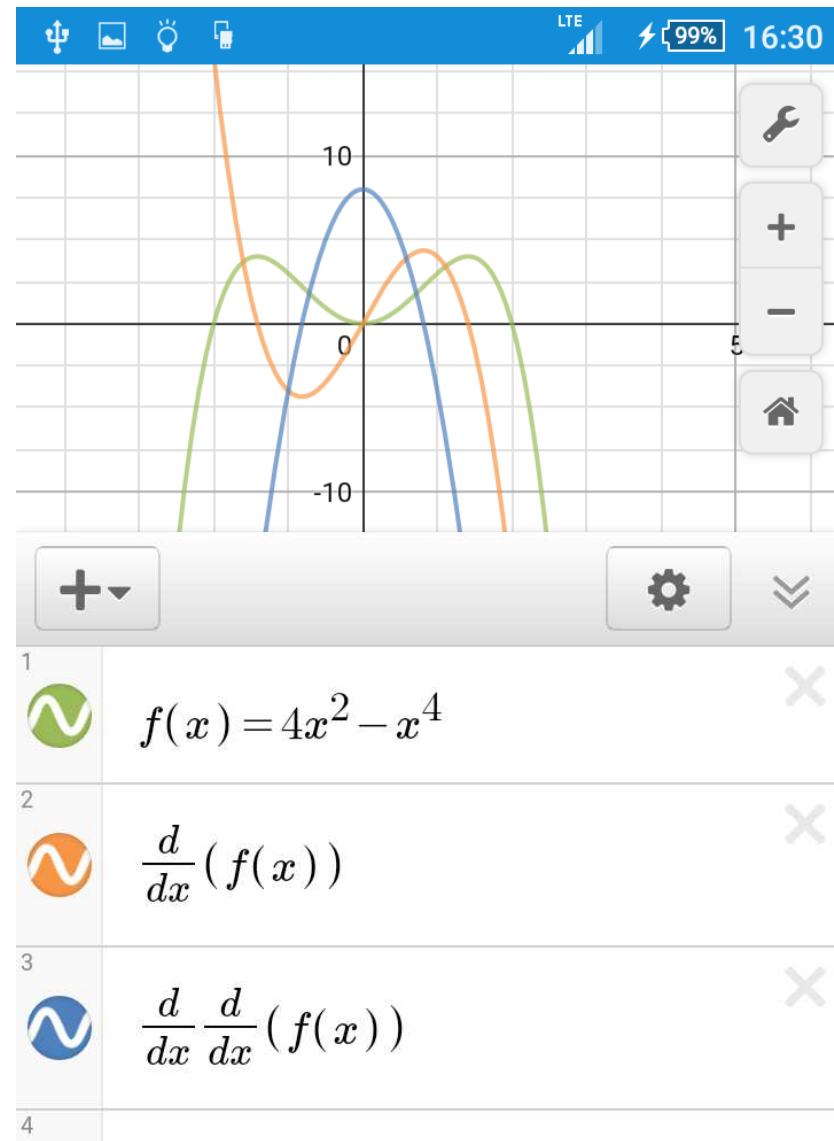
Smart Maths

Analisi: funzione e
sue **derivate**.

$$y = f(x) = 4x^2 - x^4$$

$$y = \frac{d}{dx} (4x^2 - x^4)$$

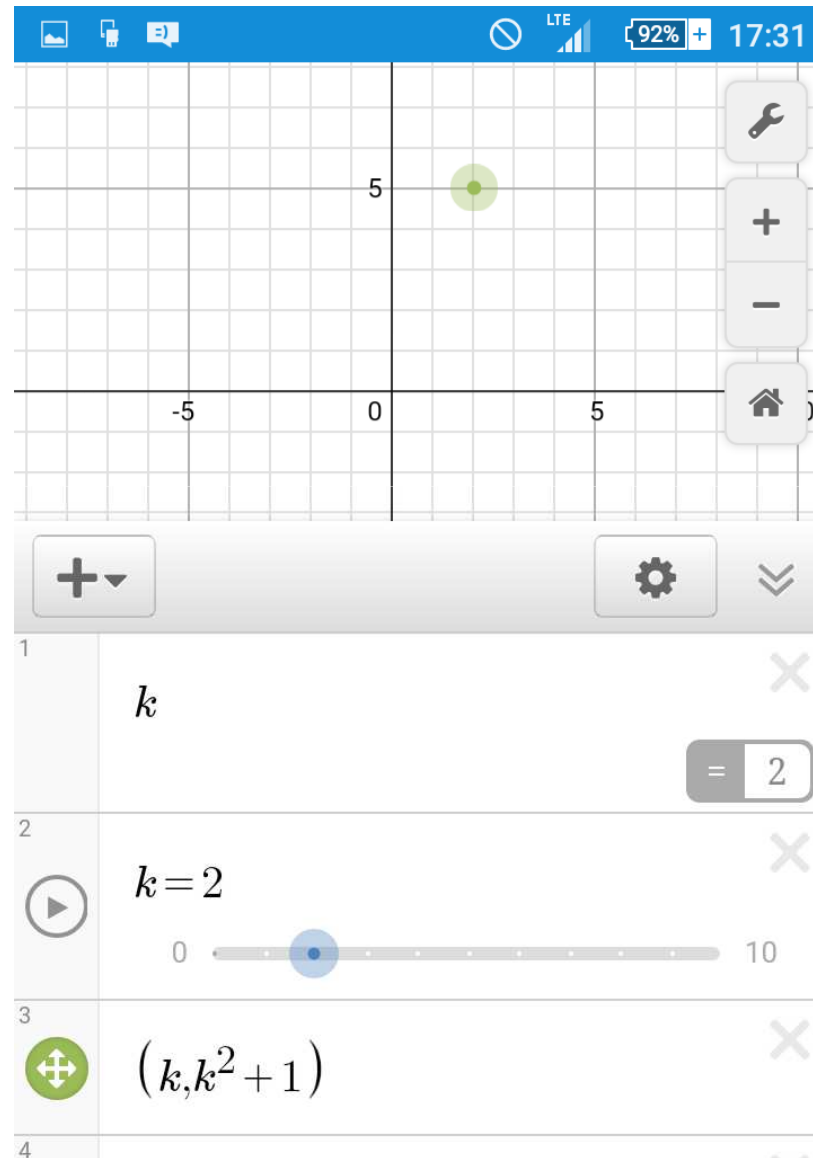
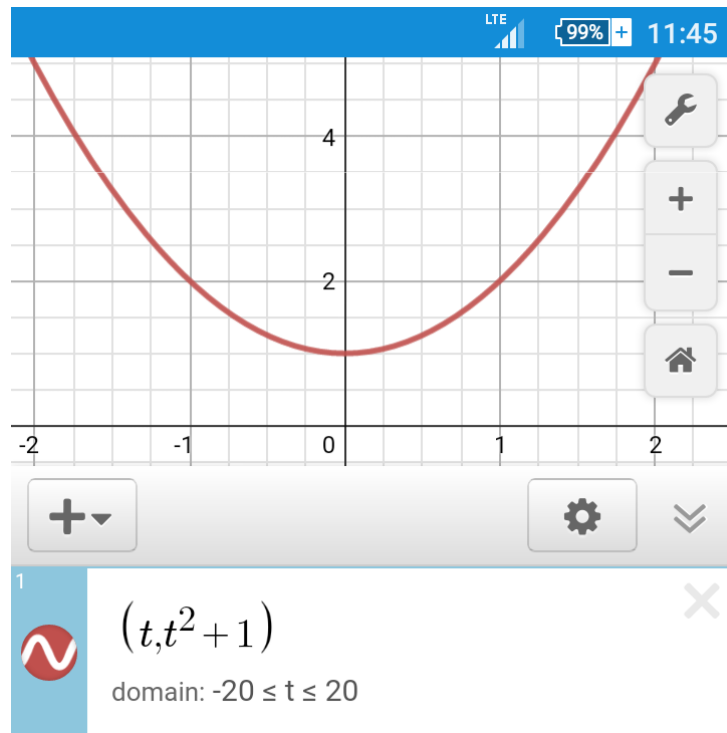
$$y = \frac{d^2}{dx^2} (4x^2 - x^4)$$





Smart Maths

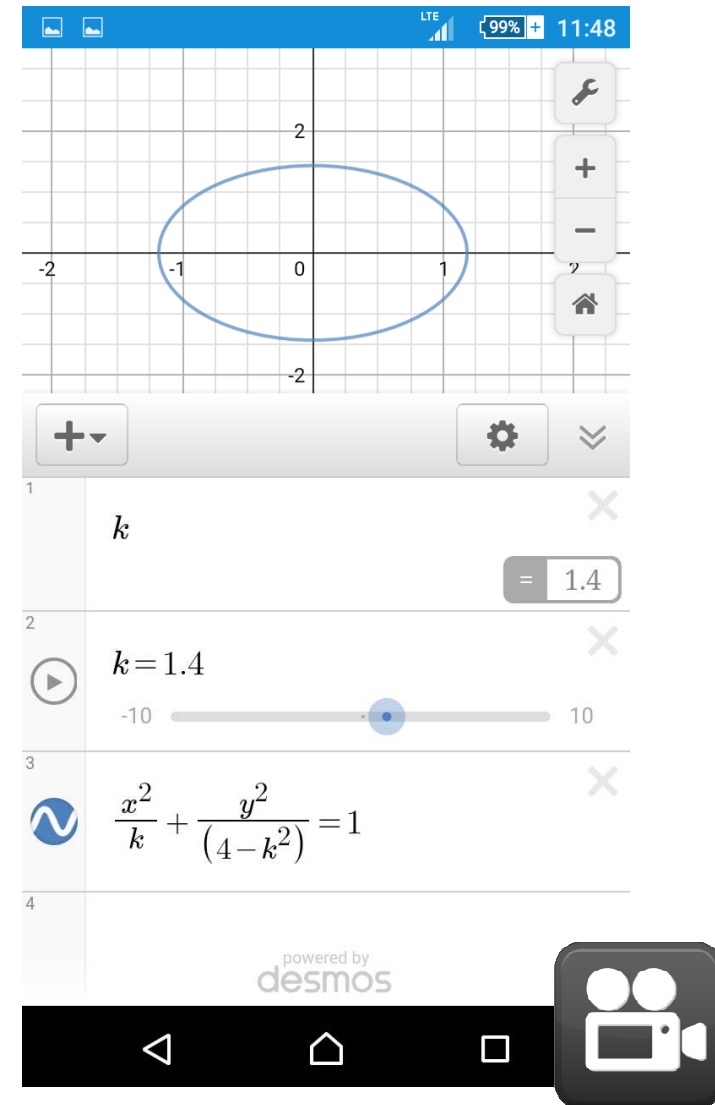
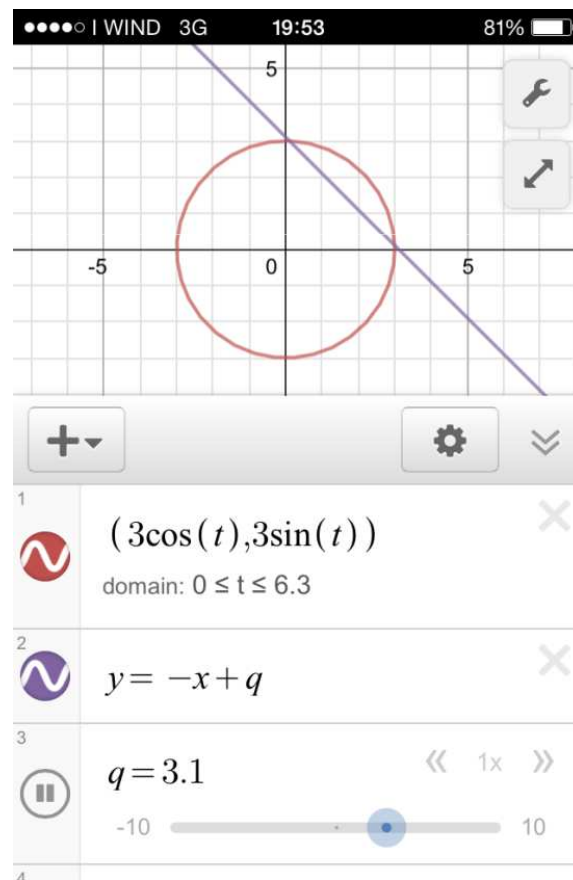
Oggetti
parametrici.





Smart Maths

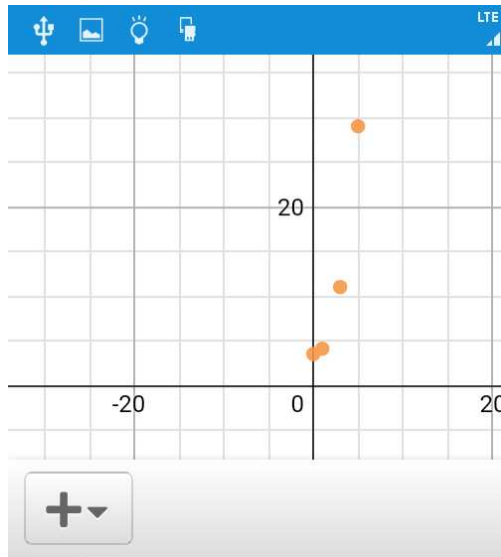
Oggetti
parametrici.



**Smarth
Math
Alcune altre
possibilità...**

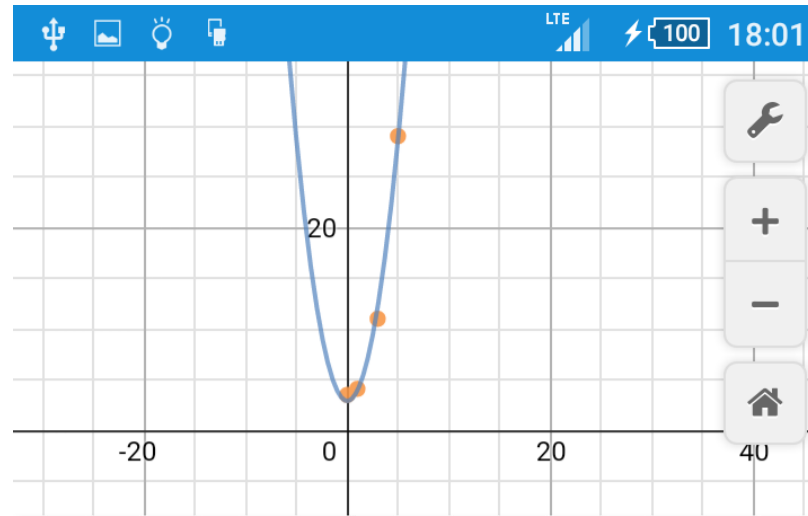


Smart Maths



1

| x_1 | y_1 |
|-------|-------|
| 0 | 3.5 |
| 1 | 4.1 |
| 3 | 11 |
| 5 | 29 |



+ ▾



2

$$y_1 \sim ax_1^2 + c$$



STATISTICS
 $R^2 = 0.996$

RESIDUALS
 e_1 plot

PARAMETERS
 $a = 1.03$

$c = 2.91$

3

Delete All



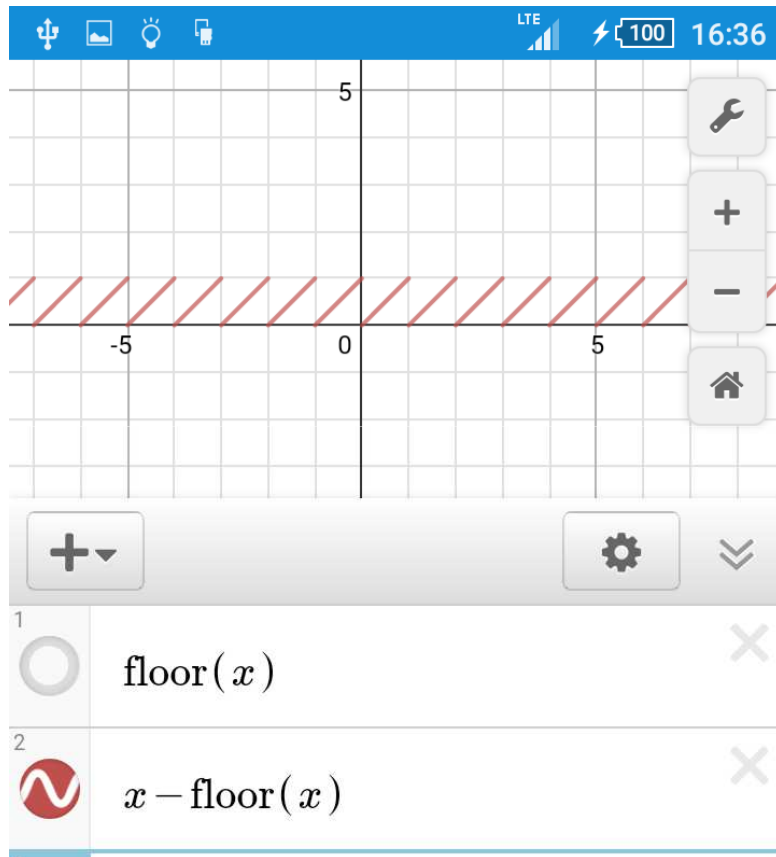
Done

1

| x_1 | y_1 |
|-------|-------|
| 0 | 3.5 |
| 1 | 4.1 |
| 3 | 11 |
| 5 | 29 |

2

Smart Maths



Un esempio di **funzione periodica non goniometrica**:

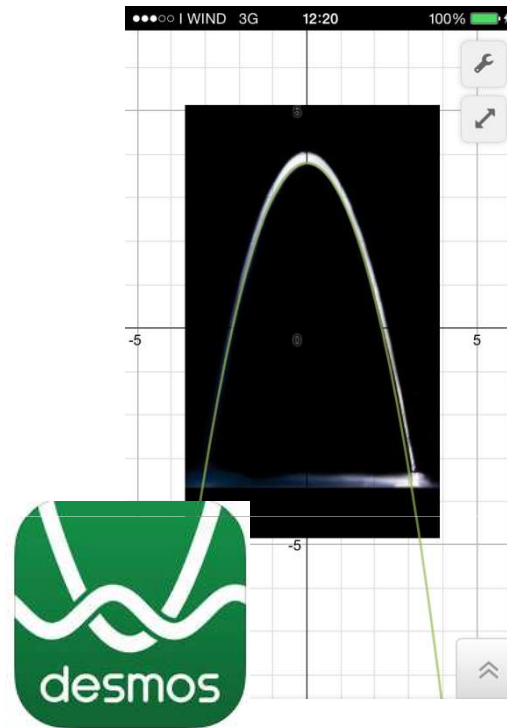
$$y = x - [x]$$

$$y = x - \text{floor}(x)$$



Smart Maths

Modellizzazione della realtà:
curve geometriche

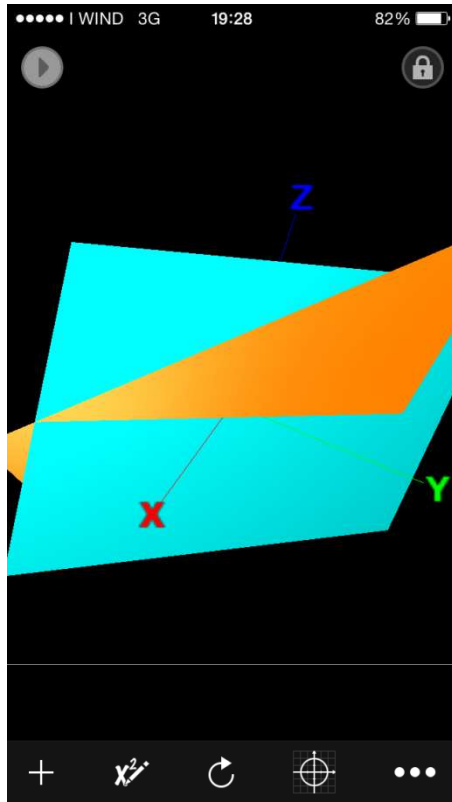


A screenshot of the Desmos calculator interface. It shows a list of items on the left and their corresponding settings on the right. The items are numbered 1 through 7. Item 1 is 'image.jpg' with center (0.14, 0.15) and size 7.5 x 10. Item 2 is the equation $y = ax^2 + bx + c$. Item 3 is a slider for 'a = -0.8' ranging from -10 to 10. Item 4 is a slider for 'c = 3.8' ranging from -10 to 10. Item 5 is a slider for 'b = 0' ranging from -10 to 10. Item 6 is the resulting equation $y = -0.785x^2 + 3.8$. Item 7 is empty. There are icons for zooming, settings, and a list at the top.

Modellizzazione della realtà:
trigonometria

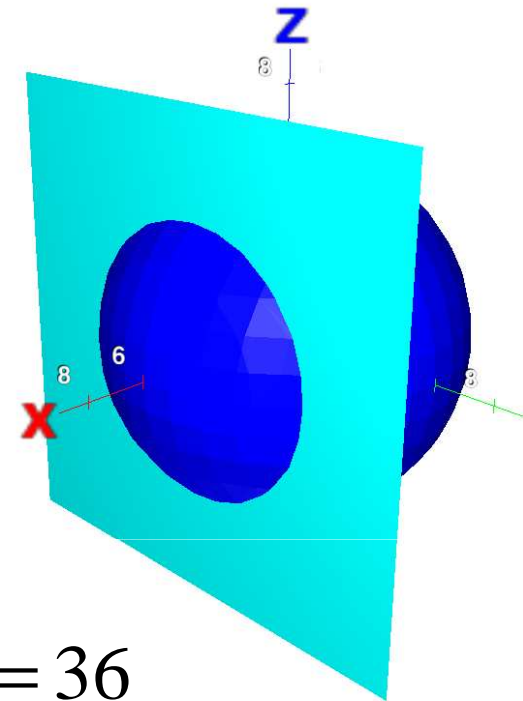


Smart Maths



$$z = x + y - 2$$

$$y = 2 - x$$



$$x^2 + y^2 + z^2 = 36$$

$$x = n$$



ios: **Quick Graph**

(Verde: free

Gialla: 1,99 euro)



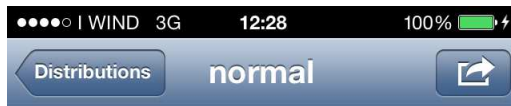


Smart Maths

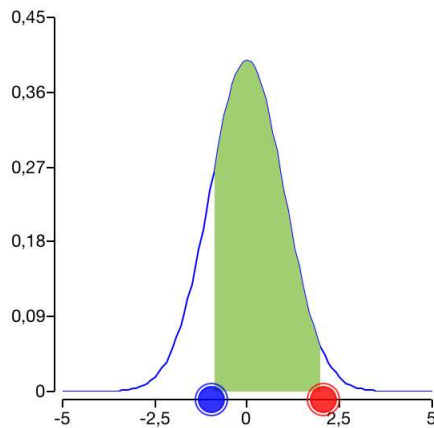
ios: LearnStatistic (free)



Android: MathPac (free)



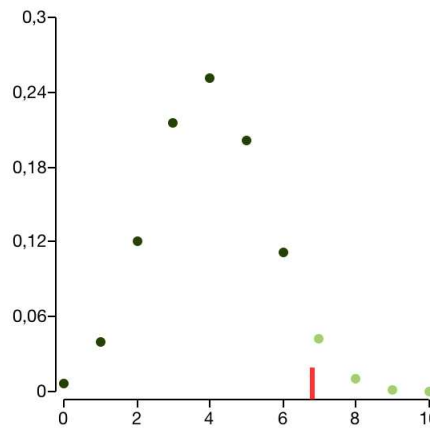
$$P(-0,945 \leq X \leq 2,073) = 0,809$$



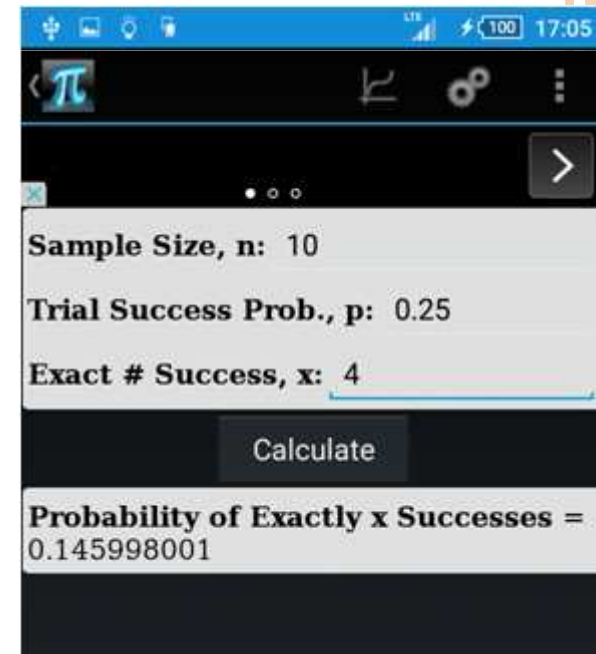
PDF CDF Options Notes



$$P(X \leq 6,829) = 0,945$$



PDF CDF Options Notes



Grazie a tutti per l'attenzione!



lresta@racine.ra.it

