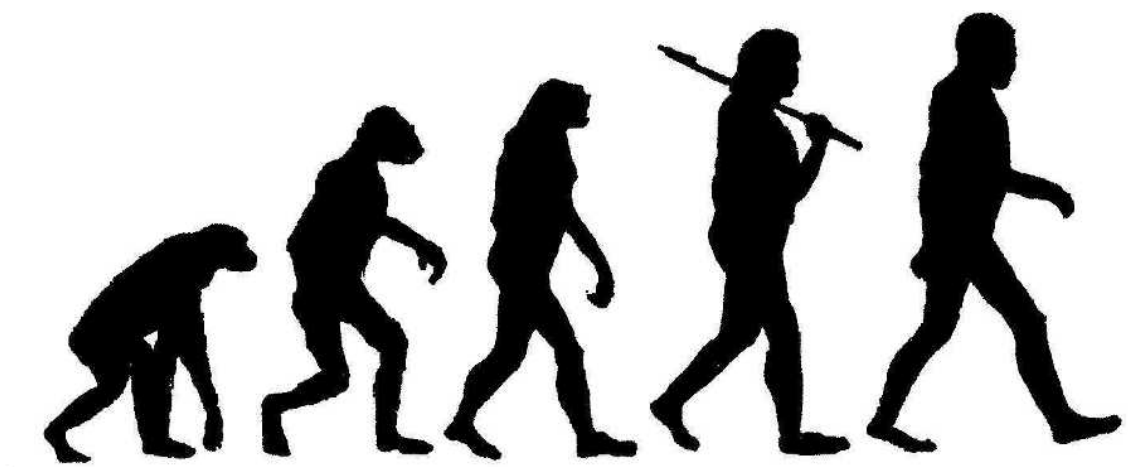
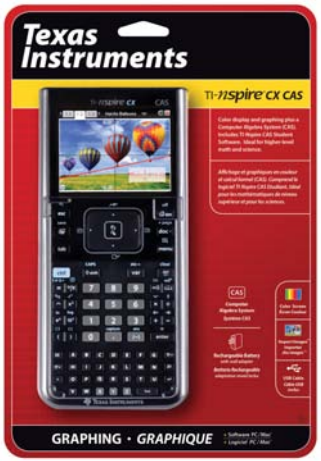
# $T^3$ Leuven, October 2016

# CAS from the Beginning





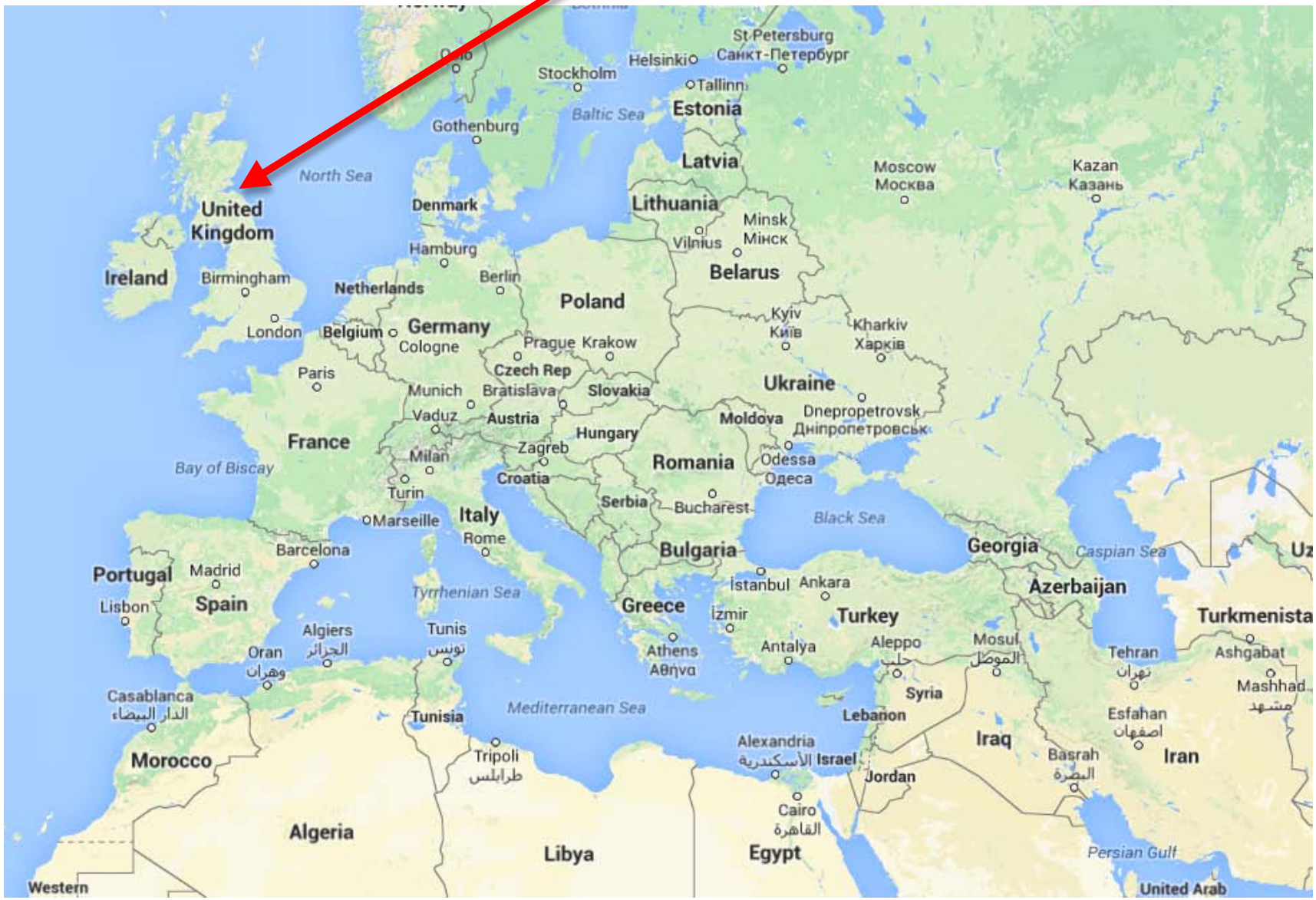


## Nevil Hopley

## $T^3$ National Trainer, Scotland & UK.
## Head of Mathematics Department.


www.calculatorsoftware.co.uk/nspire

# My Home


St Petersburg
Санкт-Петербург
Helsinki
Stockholm
Tallinn
Estonia
Baltic Sea
Gothenburg
Latvia
North Sea
Moscow
Москва
Kazan
Казань
United Kingdom
Denmark
Lithuania
Minsk
Минск
Vilnius
Hamburg
Belarus
Ireland
Birmingham
Netherlands
Berlin
Poland
London
Belgium
Germany
Cologne
Prague
Krakow
Kyiv
Київ
Kharkiv
Харків
Paris
Czech Rep
Munich
Bratislava
Slovakia
Ukraine
Vaduz
Austria
Moldova
Dnepropetrovsk
Дніпропетровськ
France
Hungary
Zagreb
Milan
Romania
Odessa
Одеса
Bay of Biscay
Croatia
Turin
Serbia
Bucharest
Black Sea
Marseille
Italy
Rome
Georgia
Caspian Sea
Barcelona
Bulgaria
Portugal
Madrid
İstanbul
Ankara
Azerbaijan
Spain
Tyrrhenian Sea
Greece
İzmir
Turkey
Lisbon
Algiers
الجزائر
Tunis
تونس
Athens
Αθήνα
Antalya
Aleppo
حلب
Mosul
الموصل
Tehran
تهران
Ashgabat
Oran
وهران
Syria
Mashhad
مشهد
Casablanca
الدار البيضاء
Tunisia
Mediterranean Sea
Lebanon
Esfahan
اصفهان
Alexandria
الأسكندرية
Israel
Iraq
Iran
Morocco
Tripoli
طرابلس
Jordan
Basrah
البصرة
Cairo
القاهرة
Algeria
Libya
Egypt
Persian Gulf
Western
United Arab

# This talk will have a....

**A Beginning**

Background information about me & CAS, and the remit of this talk.

**A Middle**

Activities, Documents, Functions & Programs covering 8 different maths topics for students aged 12-18 years.

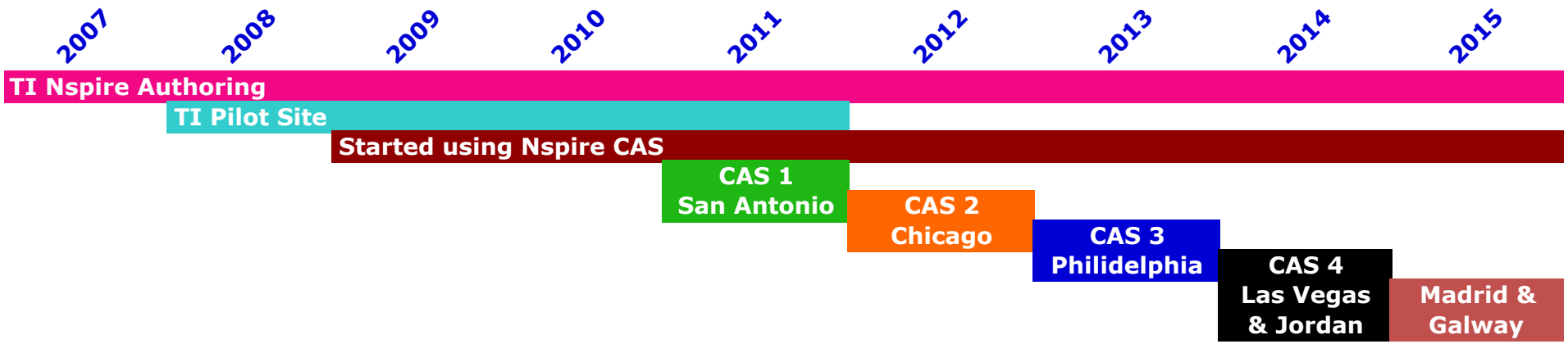
**An End**

In about 55 minutes!

**And you can download all that you see today from**

**www.calculatorsoftware.co.uk/nspire**

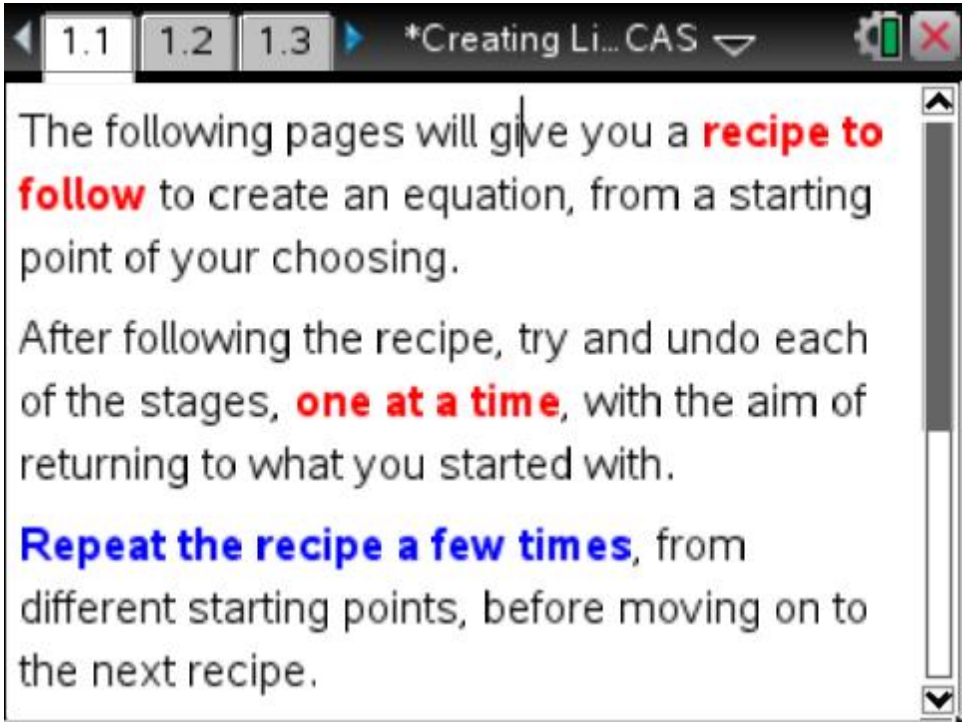
# My CAS Timeline

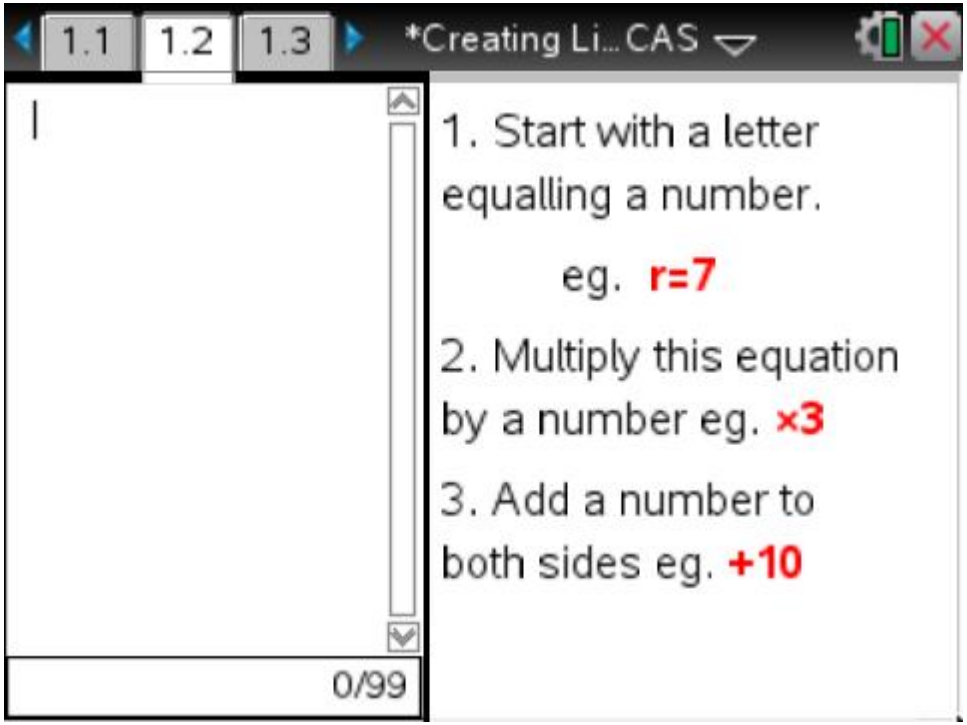



## CAS Talks at TI International & European Conferences

2011 My first 18 months of CAS usage
2012 Trigonometry and Rearranging Equations
2013 Linear Equations and Units
2014 Extending CAS with functions and programs
2015 CAS in Statistics ($T^3$ Europe, Madrid and USACAS$^9$, Cleveland, Ohio)

# Creating Linear Equations CAS.tns



# randomequation()

page 2.2 $ax \pm b = \pm d$

page 3.4 $Ax \pm b = ax \pm d$

page 4.1 $ax \pm b = Ax \pm d$

page 5.1 $ax \pm b = cx \pm d$

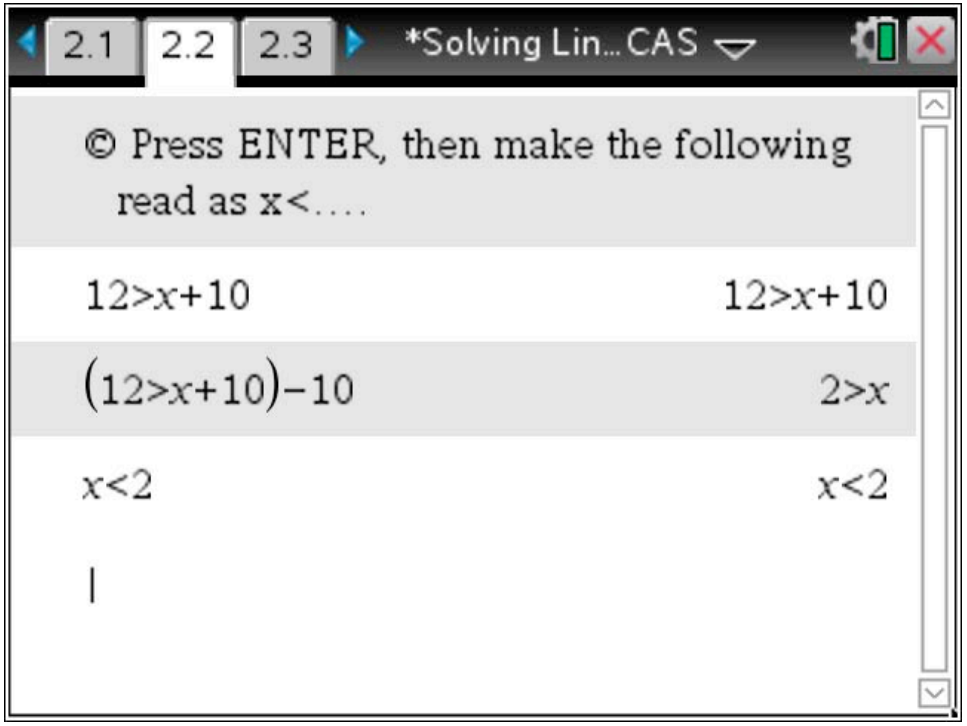
page 6.1 $ax \pm b = d - cx$

page 7.1 $b - ax = cx \pm d$

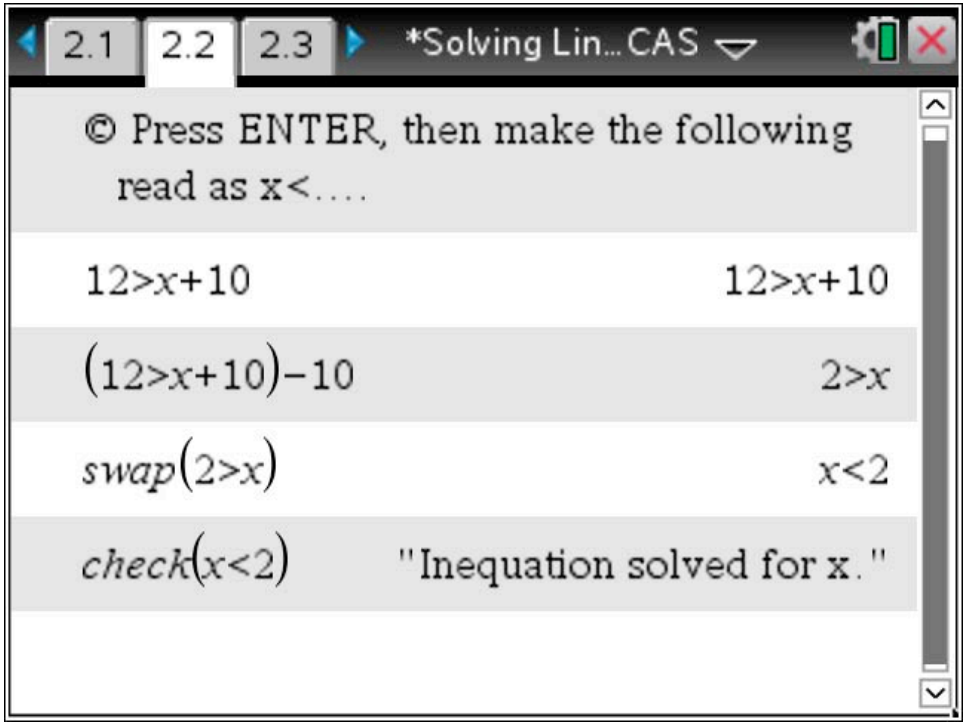
page 8.1 $b - ax = d - cx$

# Solving Linear Inequations CAS.tns

## The Issue




## Much Nicer!



# Metric Unit Conversion

| thousands | hundreds | tens | units | $\frac{1}{10}$ | $\frac{1}{100}$ | $\frac{1}{1000}$ |
|---|---|---|---|---|---|---|
| kilo- | hecto- | deca- | | deci- | centi- | milli- |
| 1000 | 100 | 10 | 1 | 0.1 | 0.01 | 0.001 |
| | | | | | | |
| | | | | | | |
| | | | | | | |

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|---|---|---|---|---|---|---|
| kilo- | hecto- | deca- | | deci- | centi- | milli- |
| 1000 | 100 | 10 | 1 | 0.1 | 0.01 | 0.001 |
| *km* | | | *metres* | | *cm* | *mm* |
| | | | | | | |
| | | | | | | |

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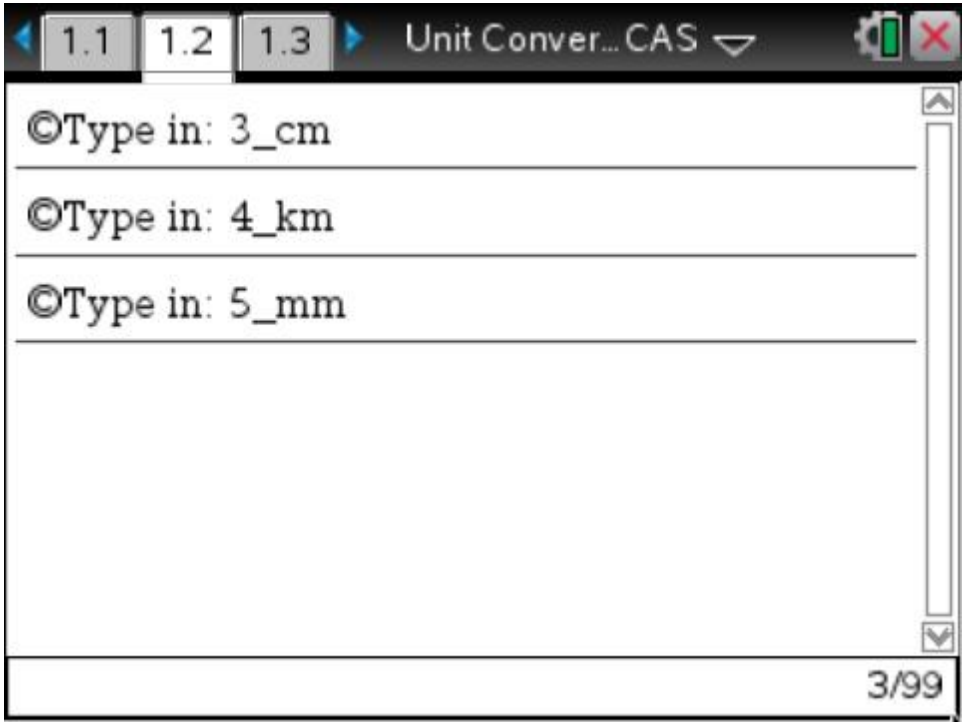
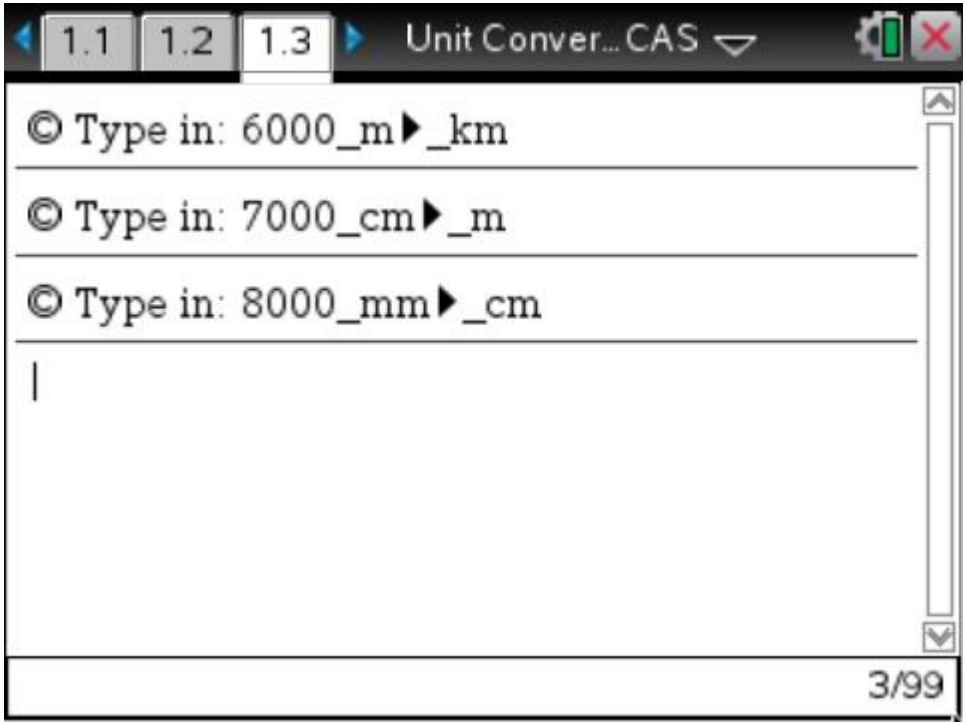
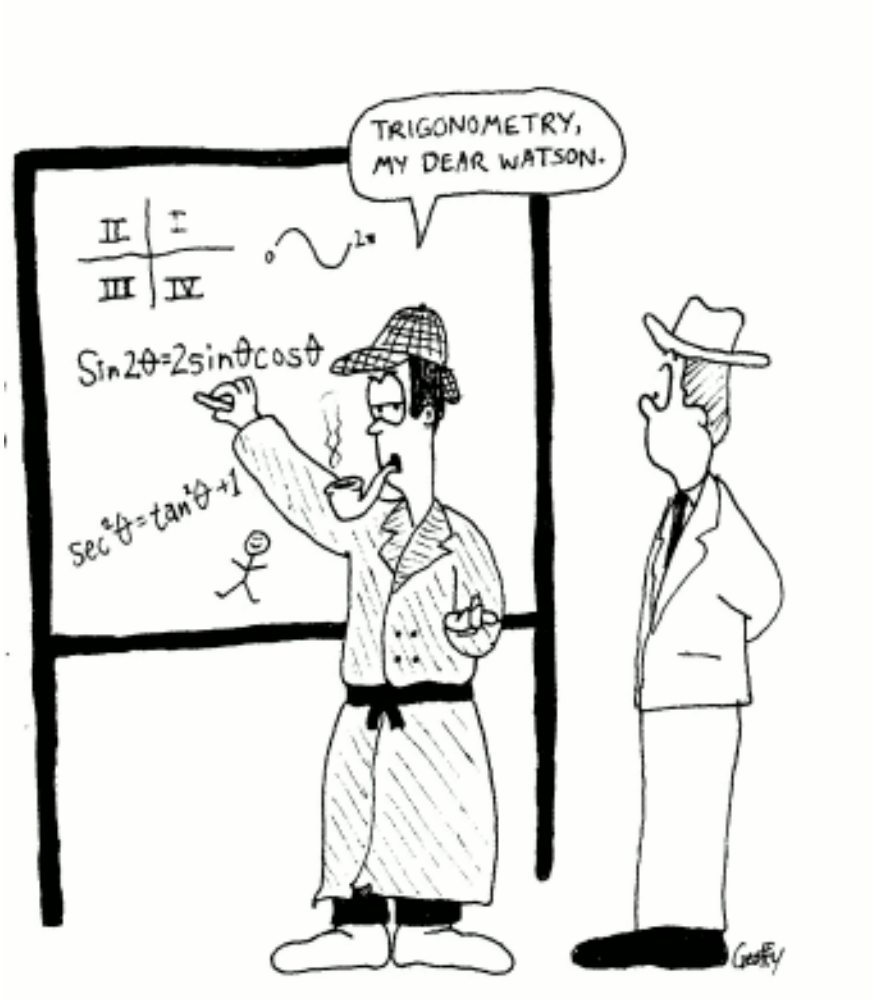
|---|---|---|---|---|---|---|
| kilo- | hecto- | deca- | | deci- | centi- | milli- |
| 1000 | 100 | 10 | 1 | 0.1 | 0.01 | 0.001 |
| km | | | metres | | cm | mm |
| | | | 0 | 0 | 3 | |
| 4 | 0 | 0 | 0 | 0 | 0 | 0 |

# Unit Conversion CAS.tns



# Issues with Elementary Trigonometry

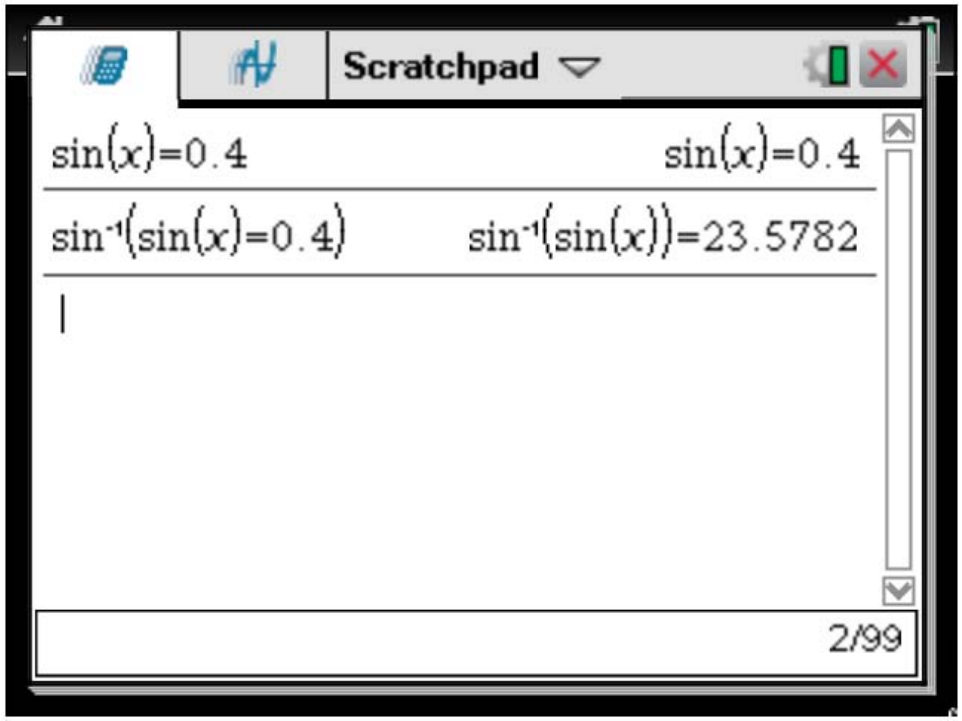


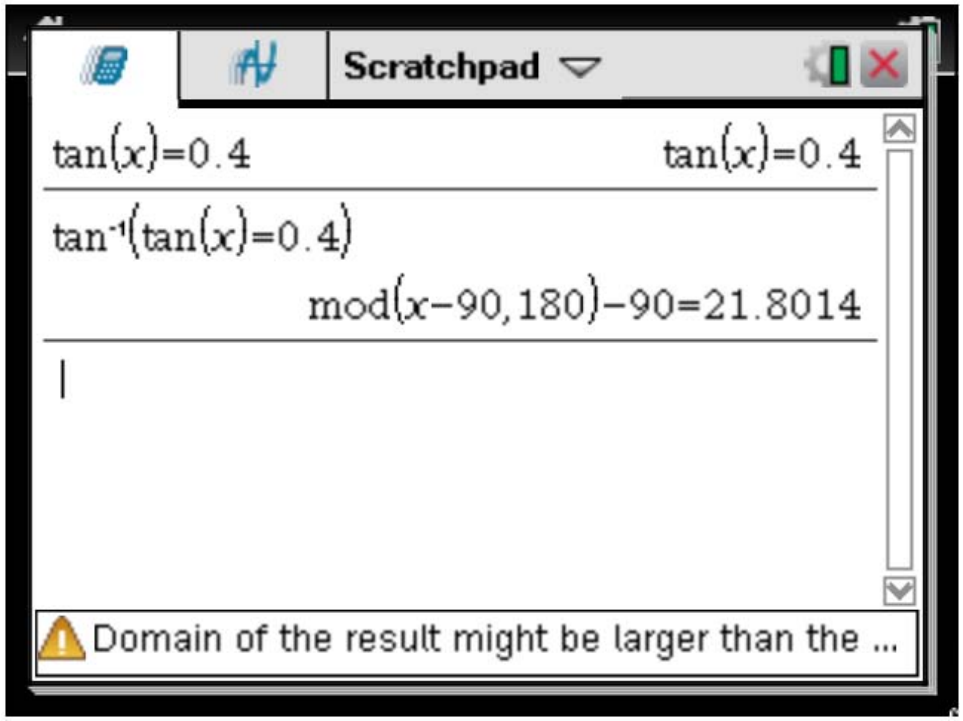

source: http://draperg.cis.byuh.edu/cartoons/jb/watson.html


and then try...

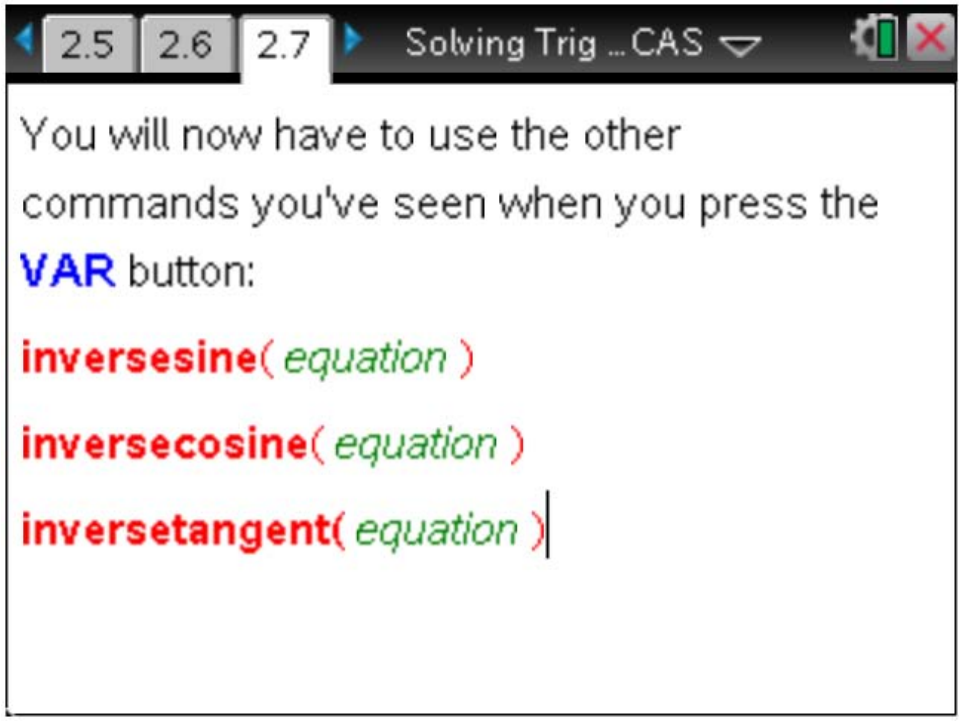

When does it ‘switch’ behaviour?

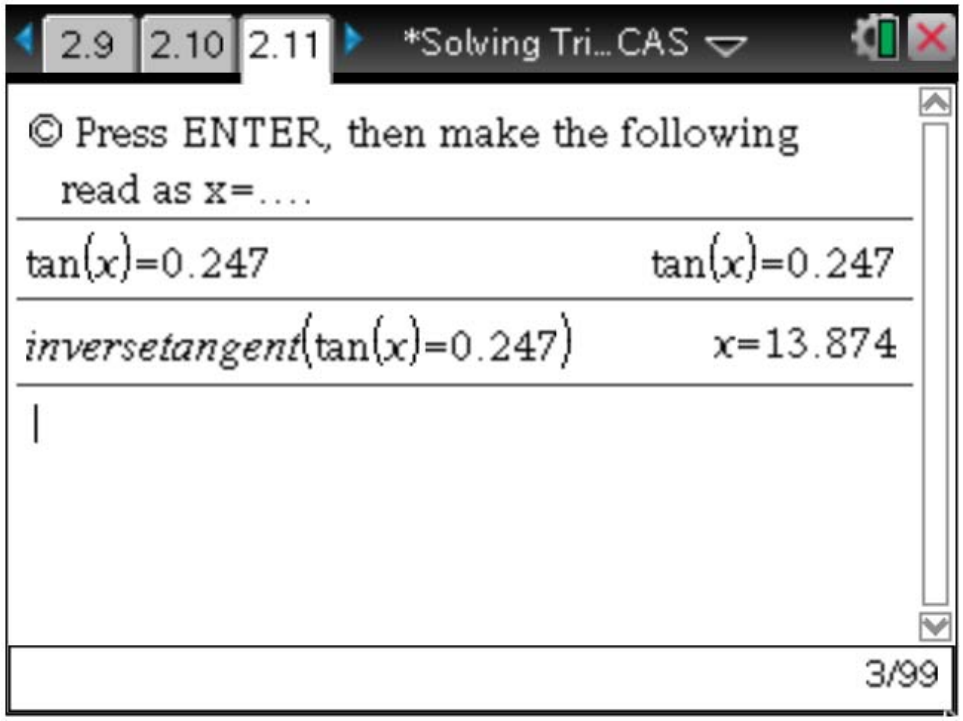
# Solving Simple Linear Trigonometric Equations



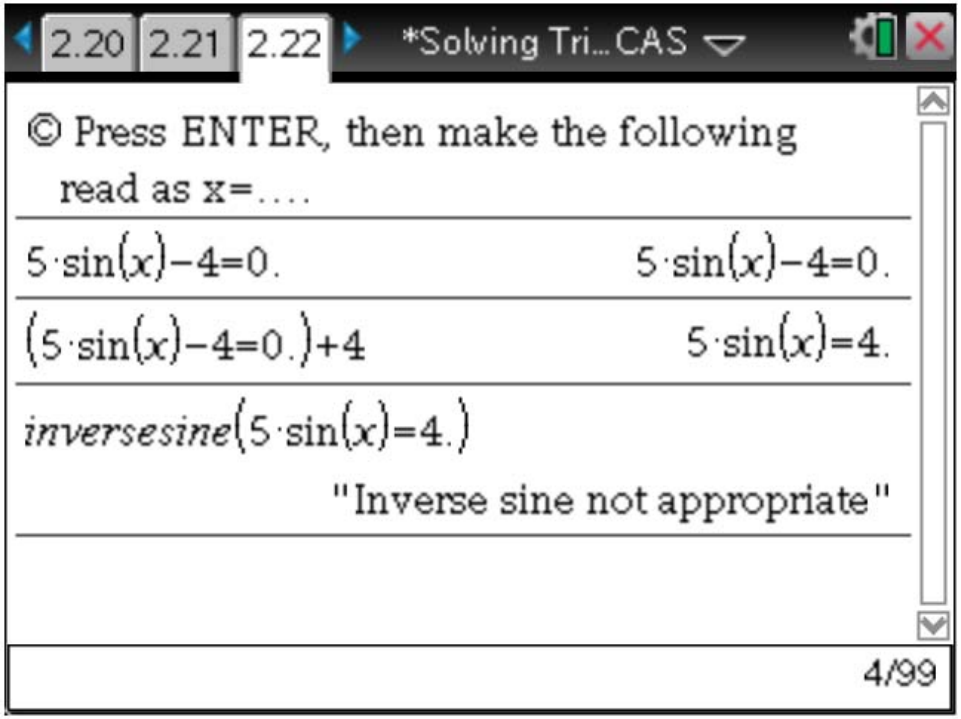
# Solving Trig Equations CAS.tns




**Further ... Quicker**

# Feedback Messages



# Rearranging the Cosine Rule

$$a^2 = b^2 + c^2 - 2bc.cos(A)$$

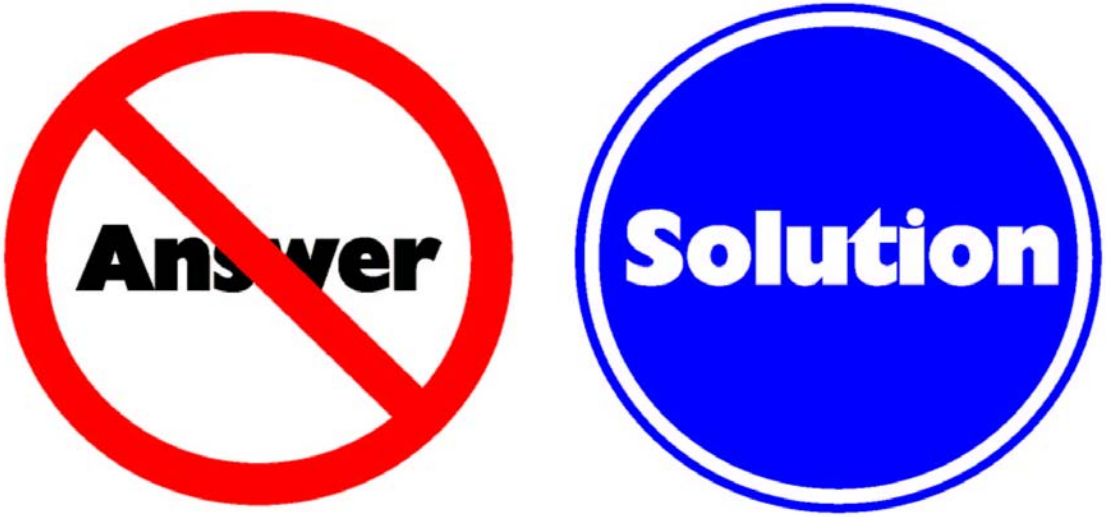
Matthew

Jon

Joanna

Elizabeth

# Follow Up to Rearranging the Cosine Rule




They did it by CAS.

They did it on paper.

I did it on the board.

Play spot the difference!

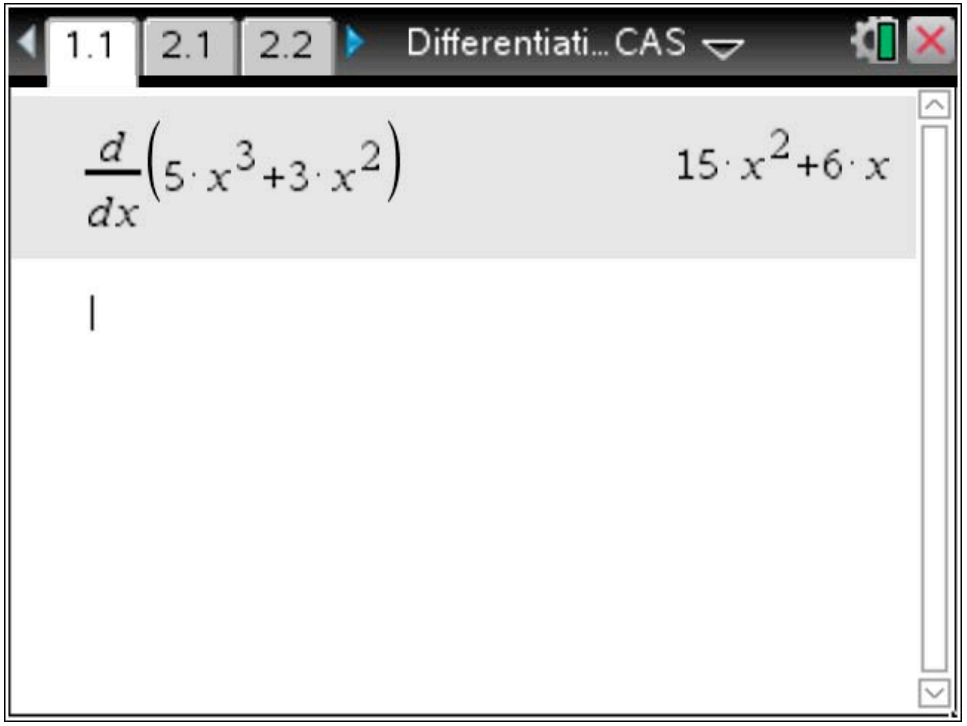
# Cosine Rule Rearranging Discussion

$$\cos(angl.a) = \frac{a^2 - b^2 - c^2}{-2bc} \qquad \cos(angl.a) = \frac{-(a^2 - b^2 - c^2)}{2bc} \qquad \cos(angl.a) = \frac{b^2 + c^2 - a^2}{2bc}$$

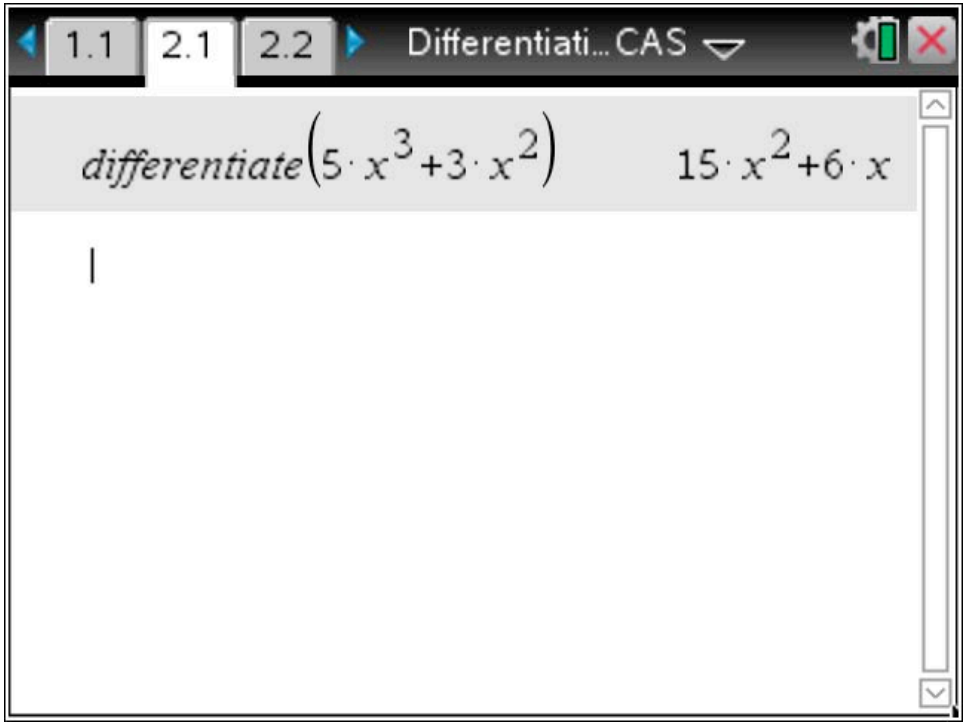
Dealing with that negative sign....

# Differentiation CAS.tns

## The Issue

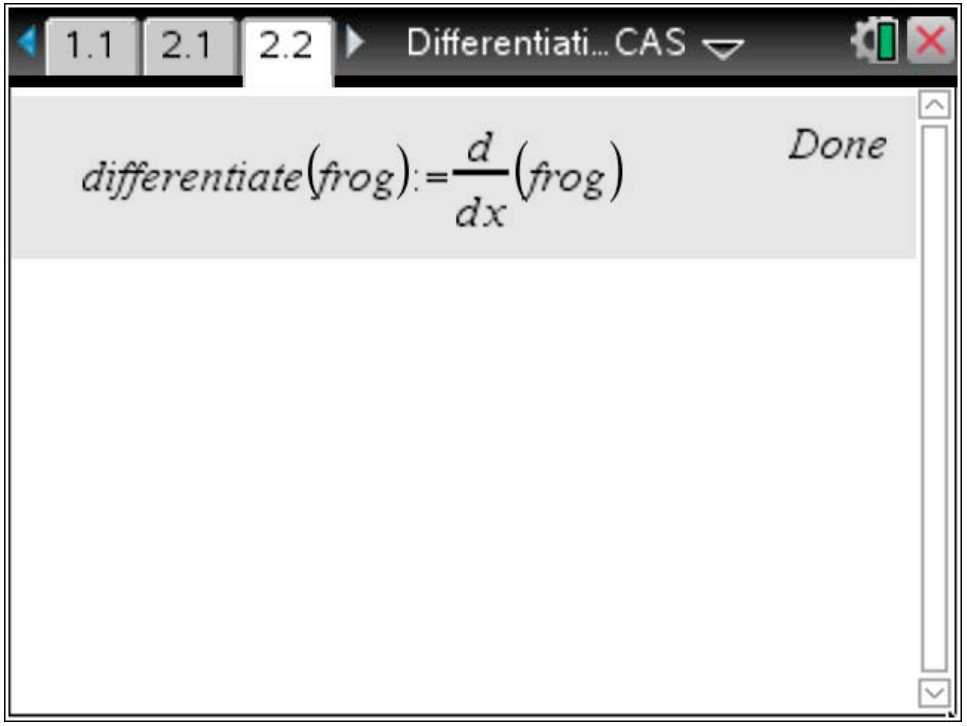



## Much Nicer!



# Differentiation CAS.tns

## The Function



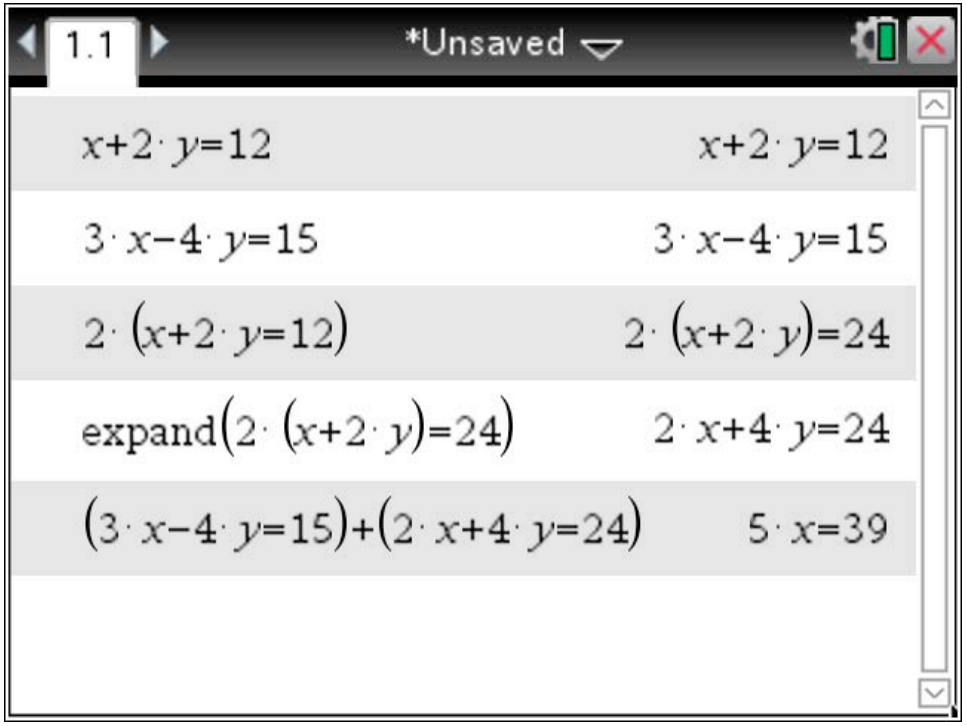

## Notes

'frog' is a dummy variable. It can be anything, but not a system command.

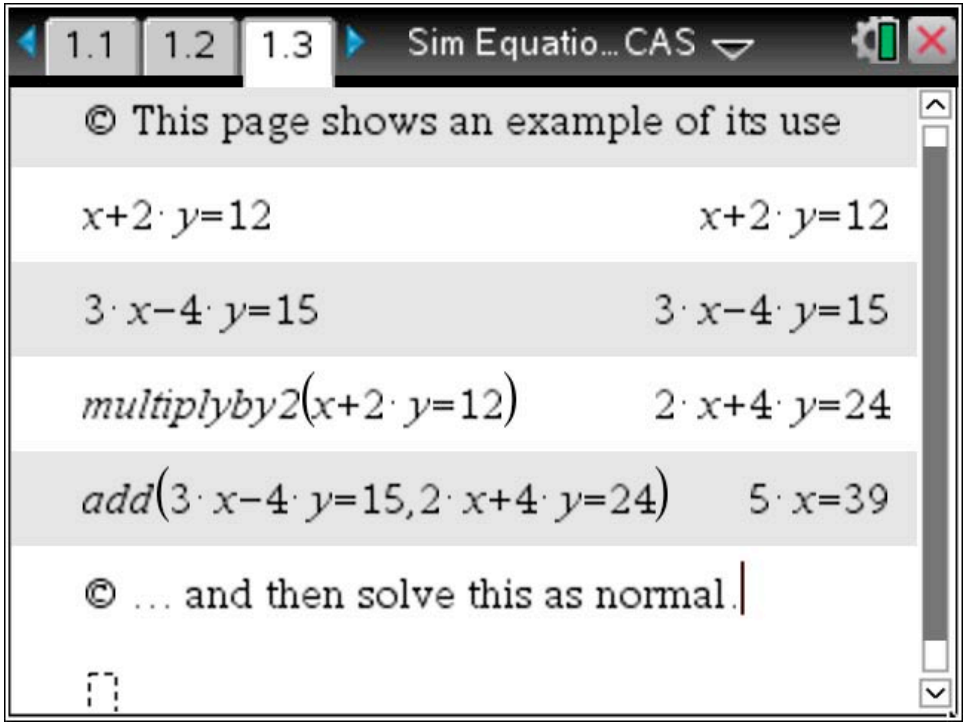
Limitation: no detection of the variable that's being differentiated with respect to. It's assumed to be $x$.

# Sim Equations Toolkit CAS.tns

## The Issue

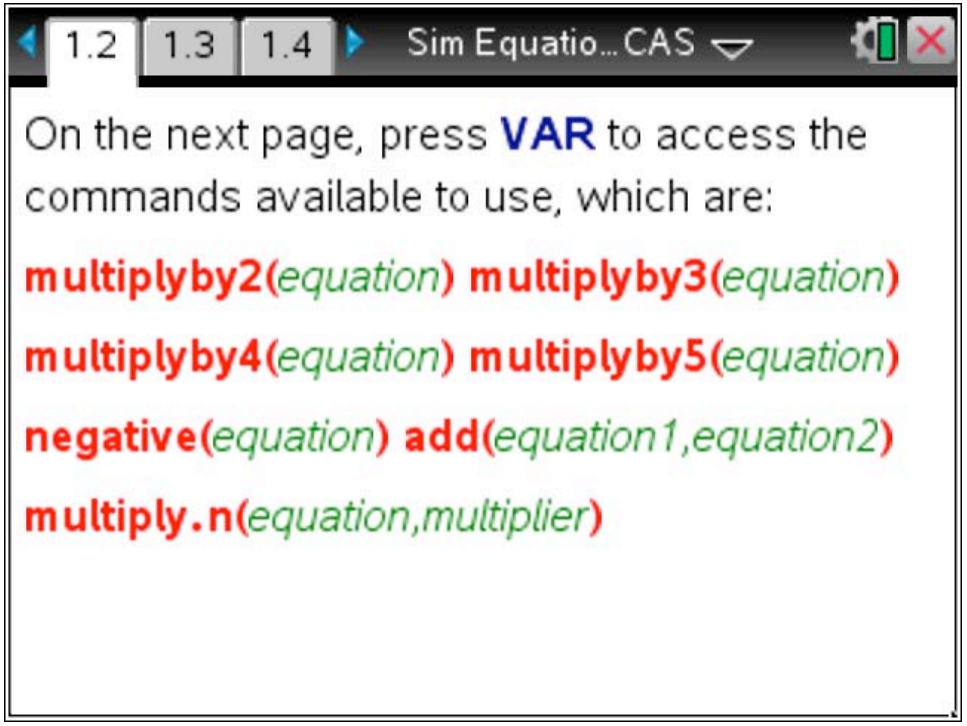



## Much Nicer!



# Sim Equations Toolkit CAS.tns

## The Functions



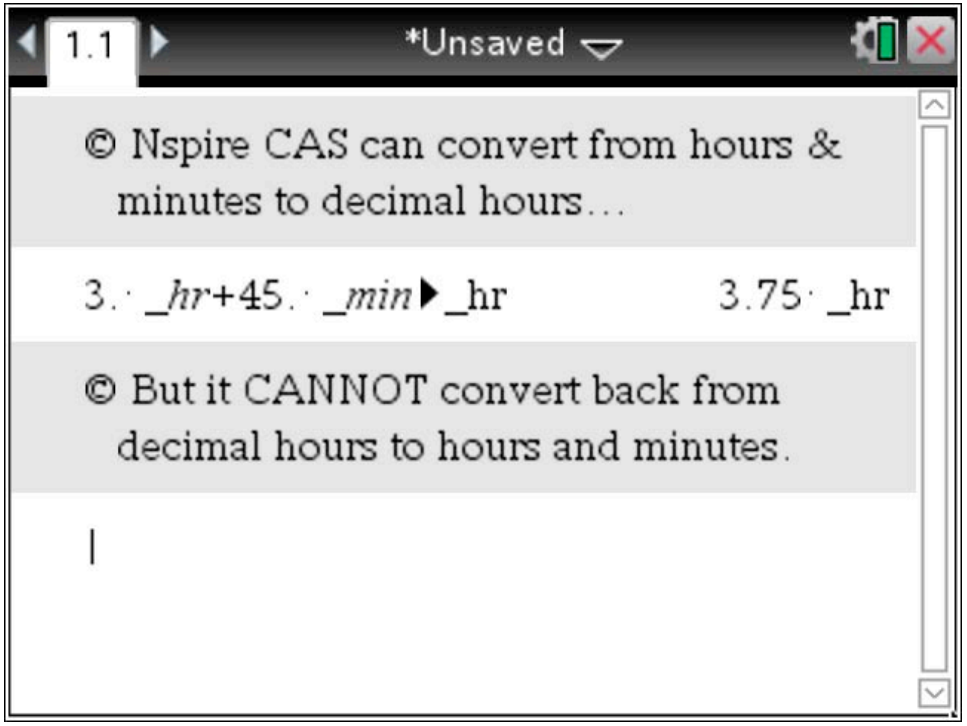

## Notes

Go to pages 1.7 and 1.8 to view the underlying functions.

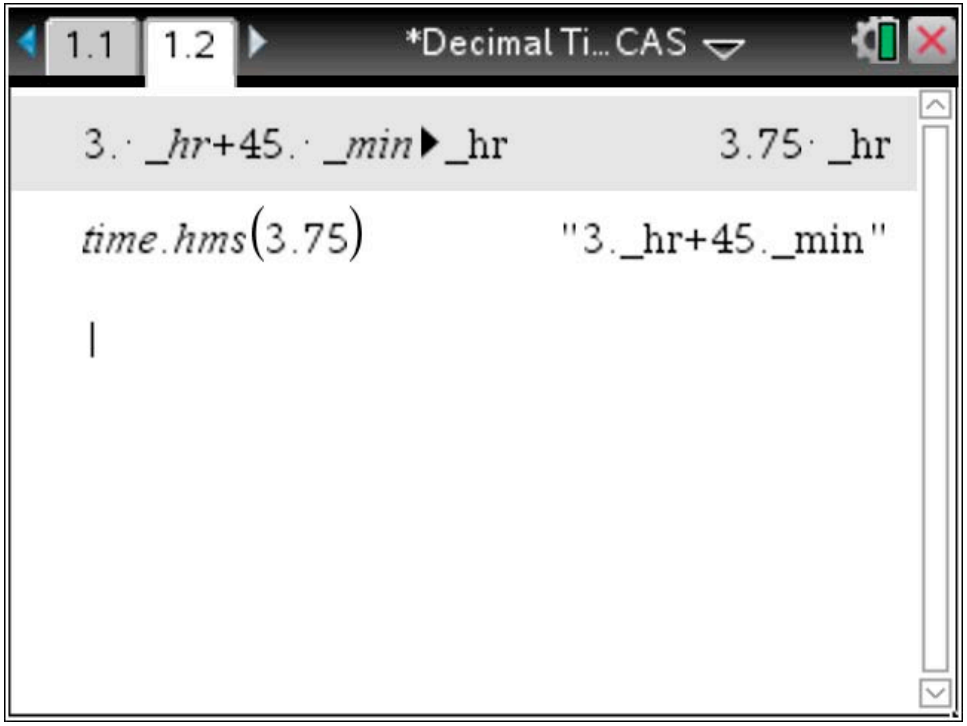
Ungroup each of these pages by pressing **CTRL** then **6**

# Decimal Time CAS.tns

## The Issue




## Much Nicer!



# Decimal Time CAS.tns

## The Function

## Notes

time.hms 0/6

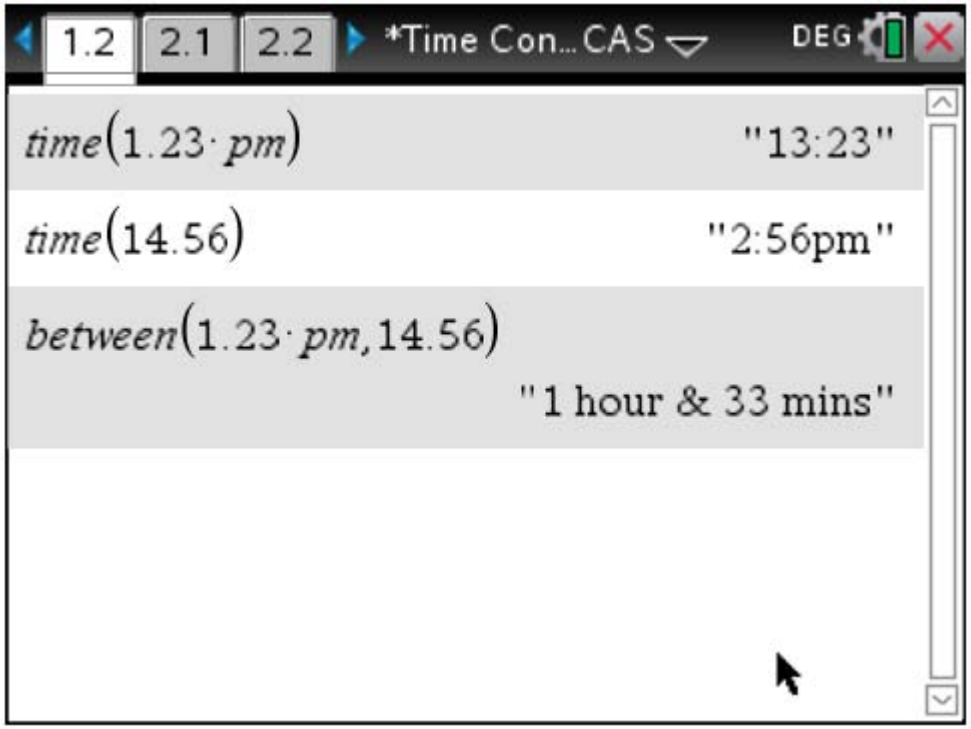
```
Define time.hms(time)=
Func
Local h,m,s,t
h:=iPart(time)
t:=60· fPart(time)
m:=iPart(60· fPart(time))
s:=  0,                          m=t
     round(60·(t−m),2),          m≠t
Return  string(h)&"_hr+"&string(m)&"_min",                    s=0
        string(h)&"_hr+"&string(m)&"_min+"&string(s)&"_s",    s>0
EndFunc
```

Piecewise functions are used instead of lots of ‘if’ statements

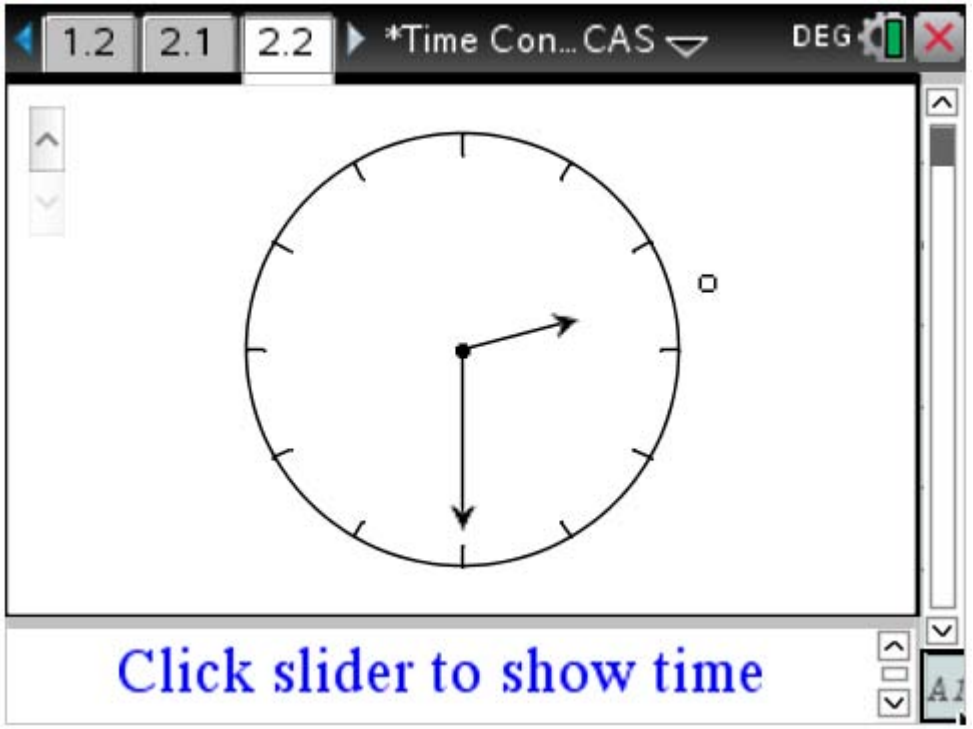
Text strings were needed at the end to prevent auto evaluation of the answer back to the original form!

# Time Conversion+Clock Face CAS.tns

**Helpful?**

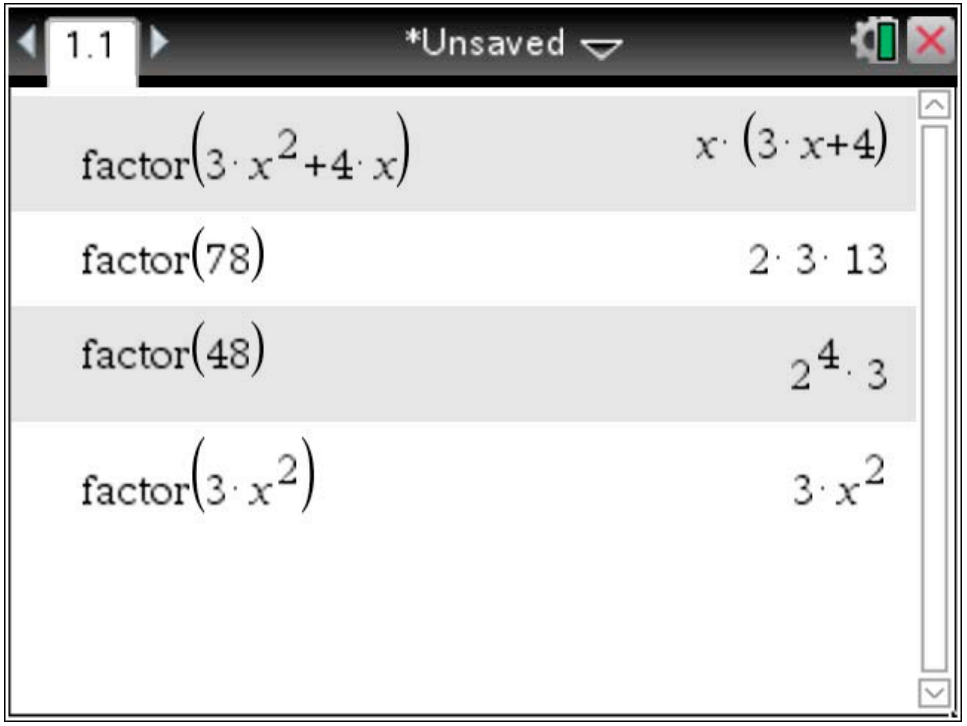



**Helpful?**

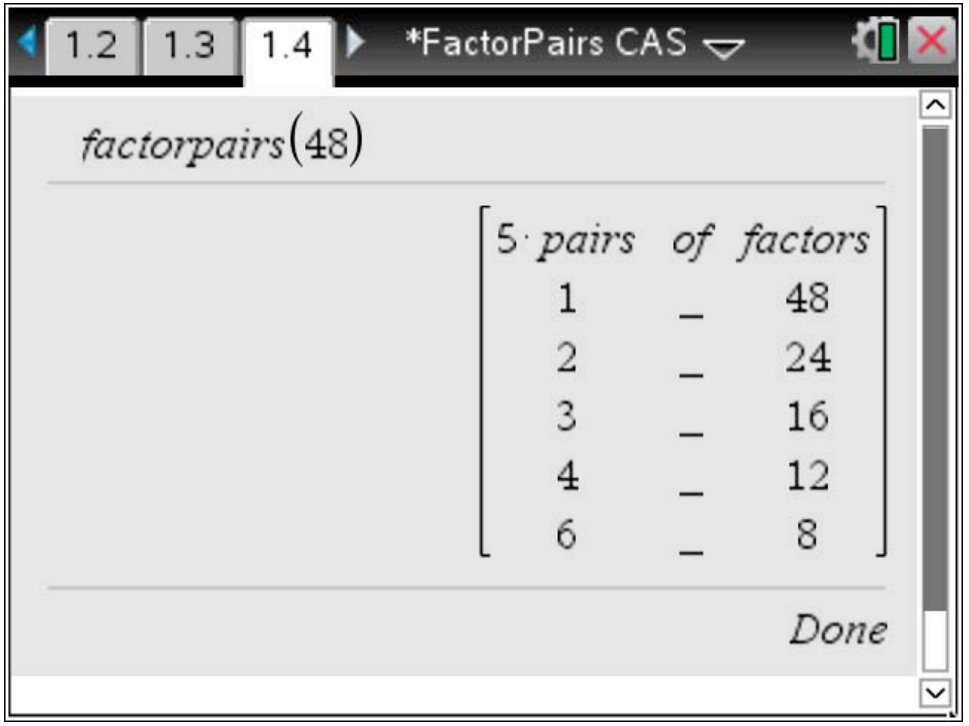


# FactorPairs CAS.tns

## The Issue




## More Helpful

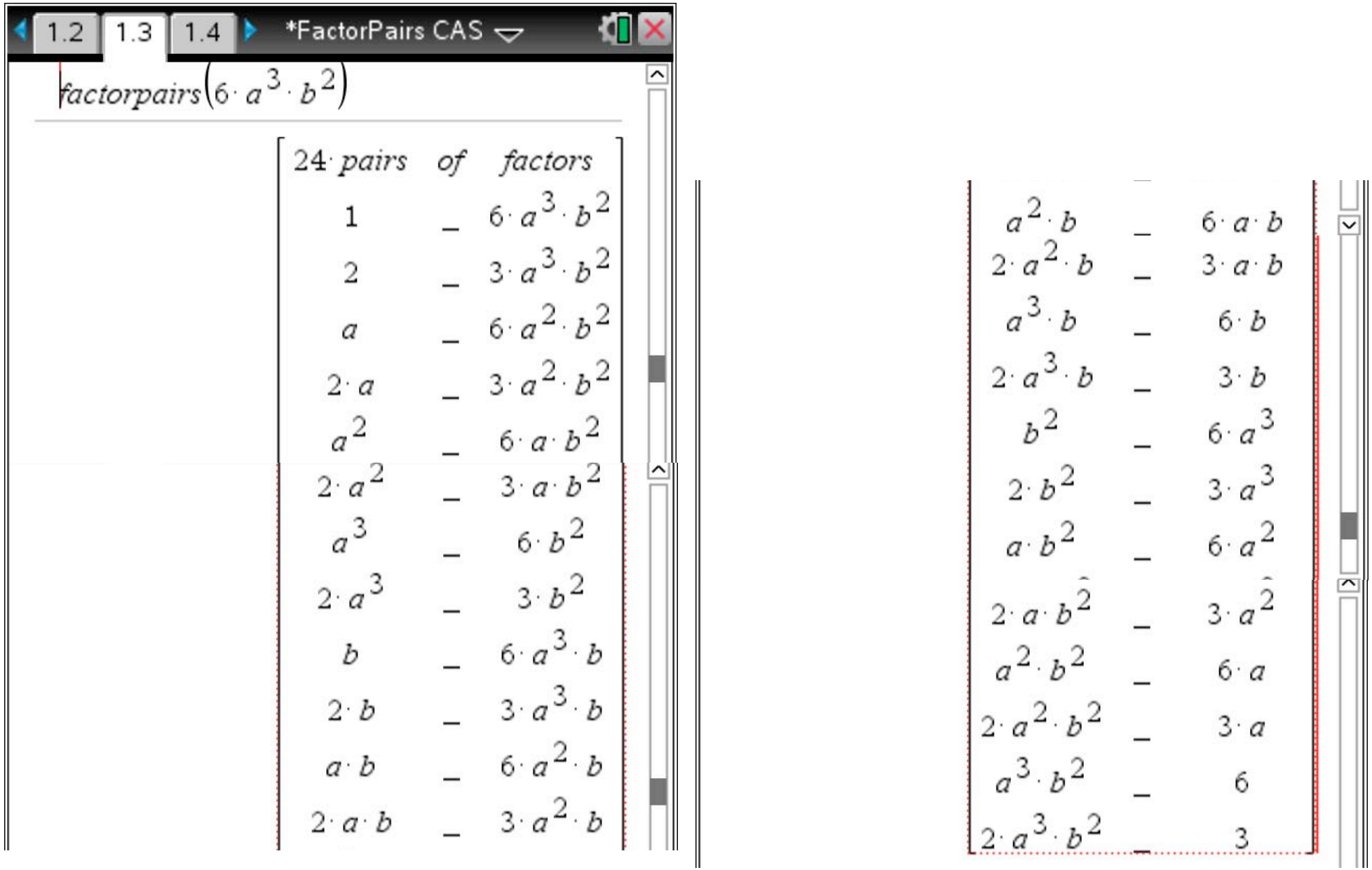



**Teach...**

**Primes & Times Tables Backwards & Basics of Factorising & many, many other things!**

# FactorPairs CAS.tns

## See the algorithm in action …



## Want Copies of Everything?

## www.CalculatorSoftware.co.uk/nspire

**Thank you for coming to my talk.**


**Nevil Hopley**

$T^3$ National Trainer, Scotland & UK.

Head of Mathematics Department

CAS user on Handhelds and TI-Nspire iPad App

TI-Basic and Lua Programmer

Mountain Unicycler