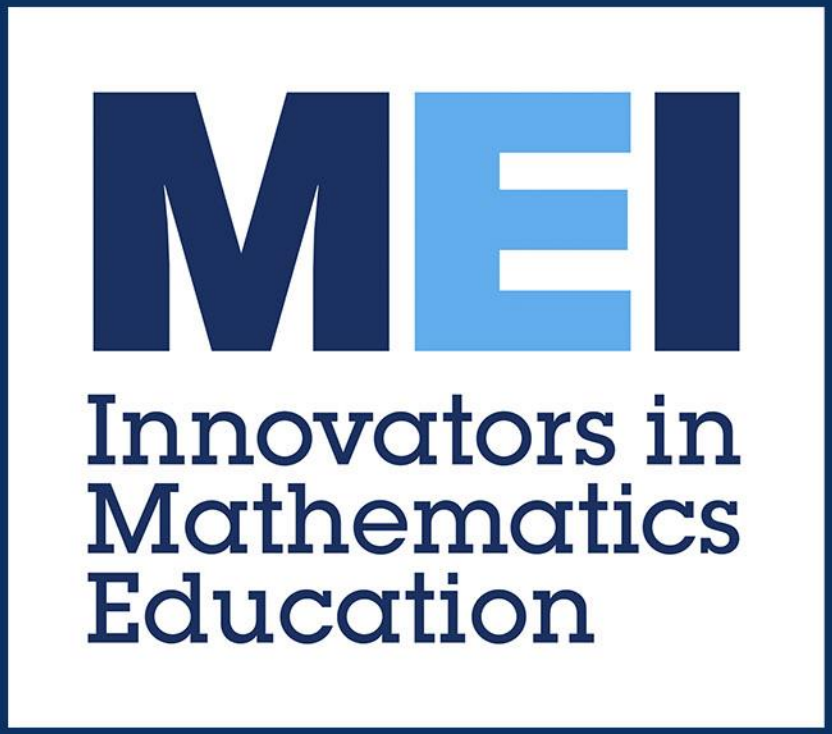

Mathematics in Education and Industry

Over 50 years at the forefront of Mathematics Education

CASIO

Teaching Statistics in the new A level using graphing technology

Cath Moore
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CASIO

Overarching themes and use of technology

Paragraph 8 of the Content Document states that –
8.The use of technology, in particular mathematical and statistical graphing tools and spreadsheets, must permeate the study of AS and A level mathematics.

Calculators used must include the following features:

- An iterative function
- The ability to compute summary statistics and access probabilities from standard statistical distributions

CALCULATOR HINTS FOR STATISTICS

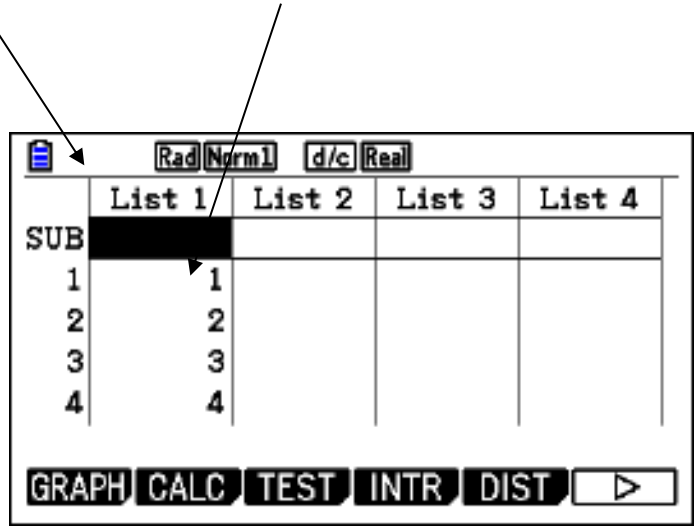
- *STAT MENU (2) on Casio CG10/20*

It is advised that mean and standard deviation are obtained directly from a calculator.

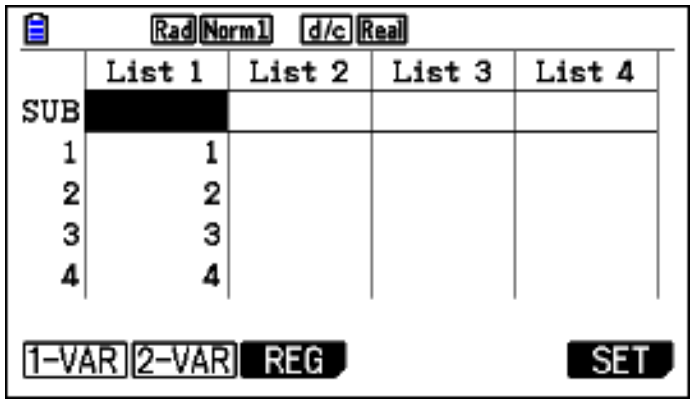
1. Numerical measures

(a) Mean and standard deviation, without frequencies

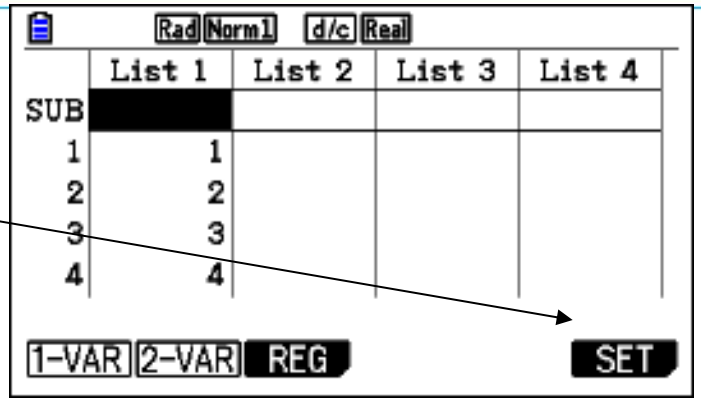
List 1: input *x* 1 2 3 4 5



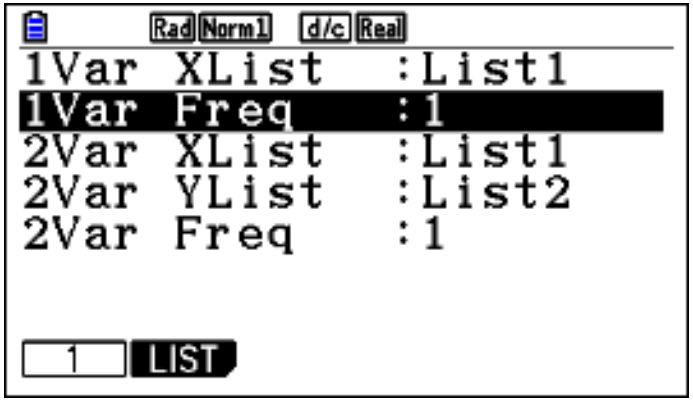
F2 (CALC)



F6 SET

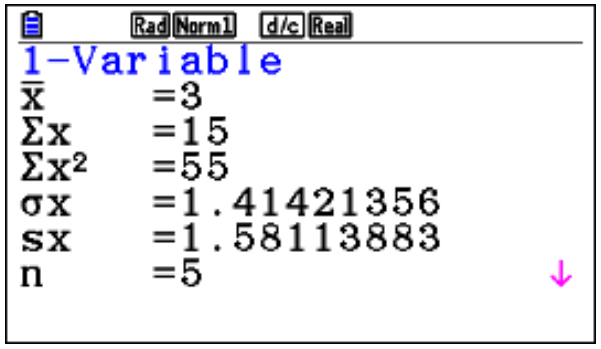


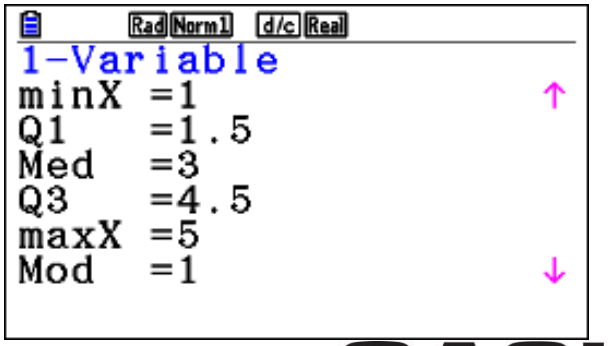
1 Var *X* List: List 1
F1 1 Var Freq : 1



EXIT

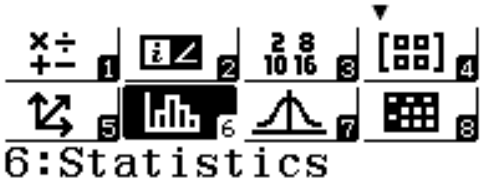
F1 (1 VAR)



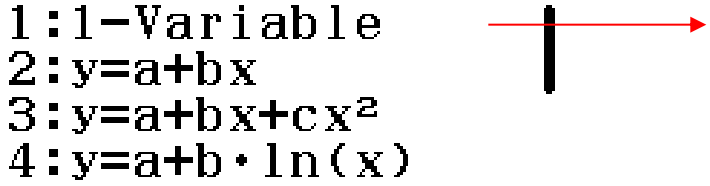


CASIO

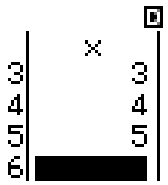
List 1: input *x* 1 2 3 4 5



Press 6

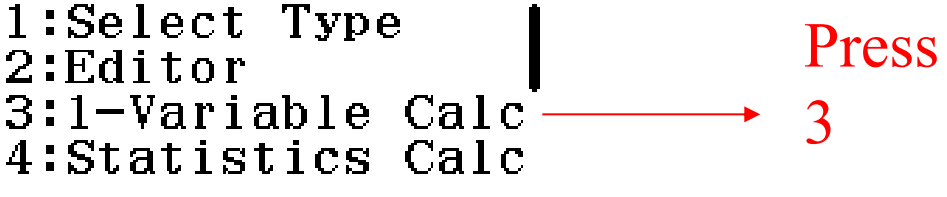


Press 1

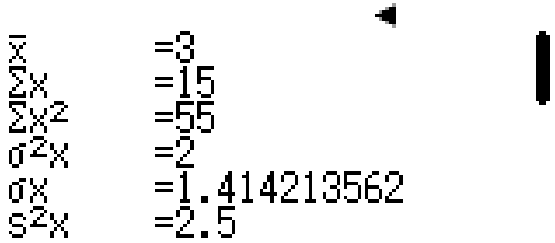


1 =
2 =
3 = etc

OPTN

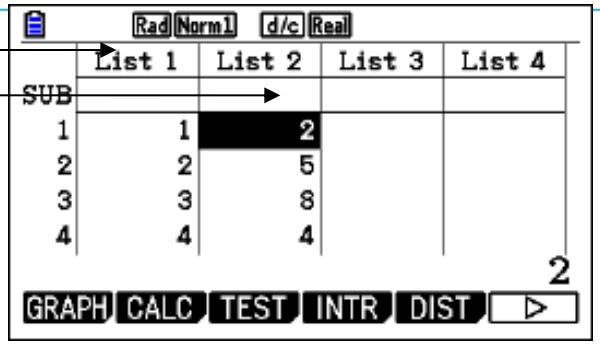


Press 3



CASIO

Frequencies given



List 1: input *x* 1 2 3 4 5

List 2: input frequencies 2 5 8 4 2

For grouped data, the mid values should be entered into List 1. This can be done by entering, for example,

(34.5 + 39.5)/2 directly into List 1.

F2 (CALC)

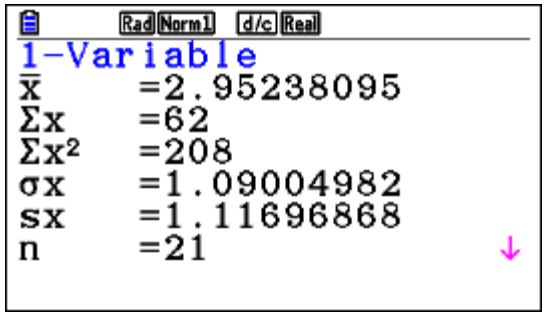
F6 SET

1 Var *X* List : List 1

1 Var Freq : List 2

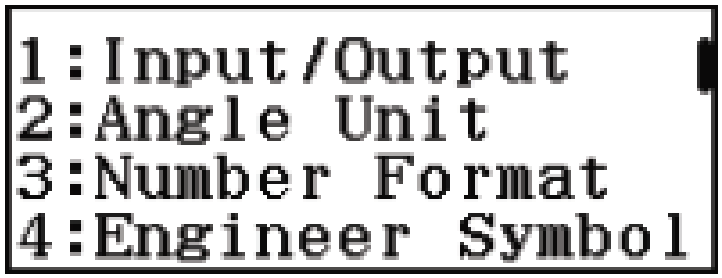
EXIT

F1 (1 VAR)

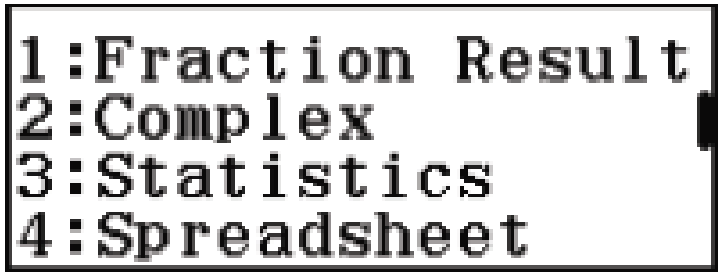


FREQUENCY TABLES

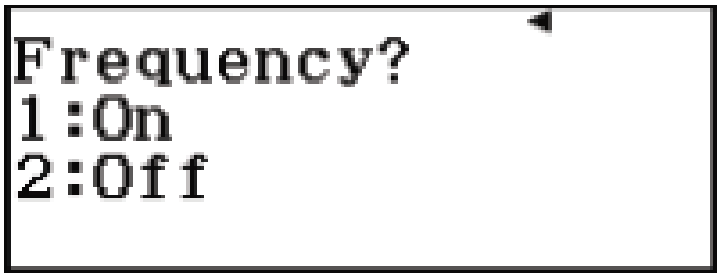
If the data comes from a frequency table, ClassWiz can be set up to input the data values in one column, and the frequencies in another.



To access the set-up menu, press SHIFT MENU (SET UP).



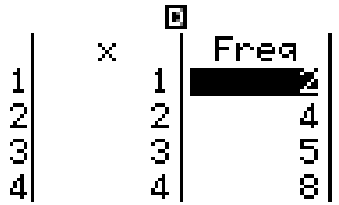
Press the down arrow (▼) to reach the second page and 3 to select the Statistics settings.



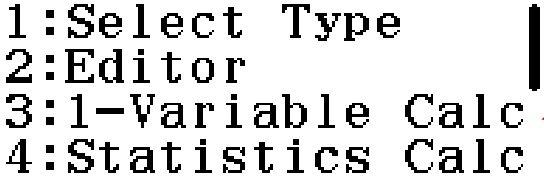
Press 1 to turn the Frequency option **On**.

List 1: input *x* 1 2 3 4 5

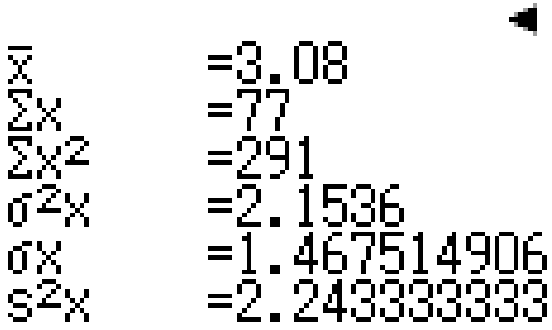
List 2: input frequencies 2 5 8 4 2



OPTN



Press 3



CASIO

(b) Mean and standard deviation with frequencies

A six-sided die was thrown a large number of times and the scores recorded as follows.

Score, x	Frequency, f
1	31
2	17
3	21
4	24
5	17
6	25

1. Find the mode.

2. Find the mean.

3. What is the median score?

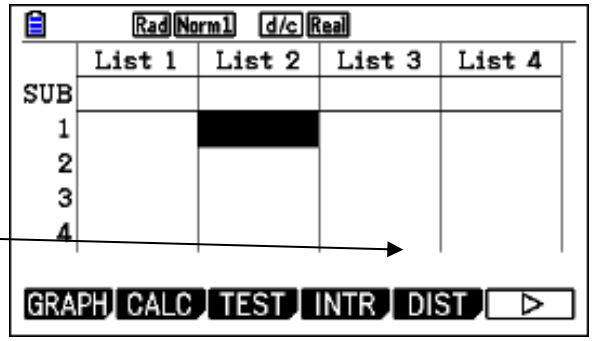
Calculators must be used to find probabilities.

2. Binomial Distribution

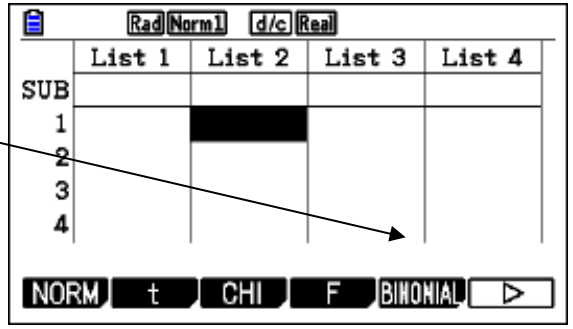
(a) Probabilities of type P($X = x$):

eg X~B(15, 0.2) P($X = 3$)

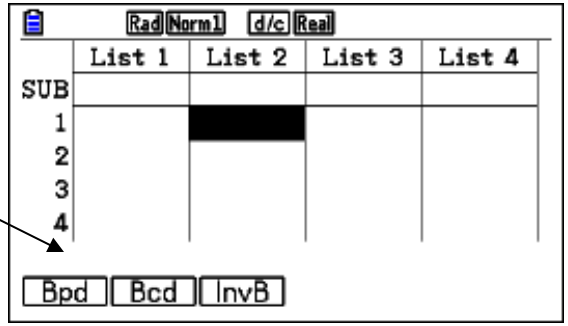
F5 DIST



F5 BINOMIAL



F1 Bpd

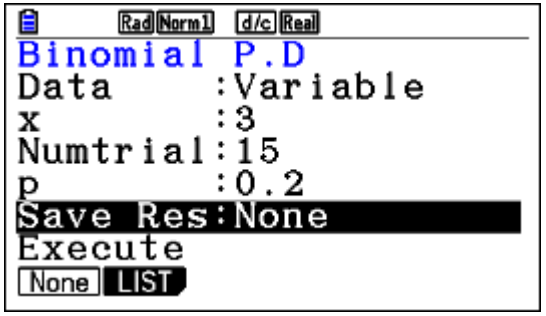


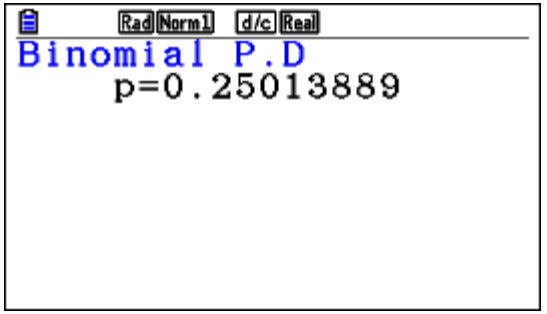
Data Variable

x 3 EXE

Numtrial 15 EXE

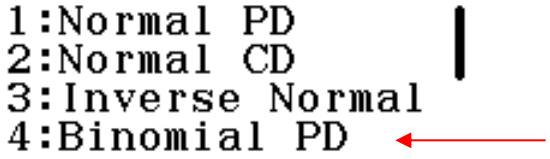
p 0.2 EXE





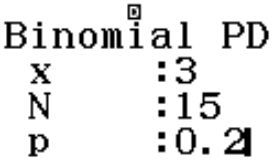
eg X~B(15, 0.2) P(*X* = 3)

Press 7



Press 4 Binomial PD

Press 2 Variable



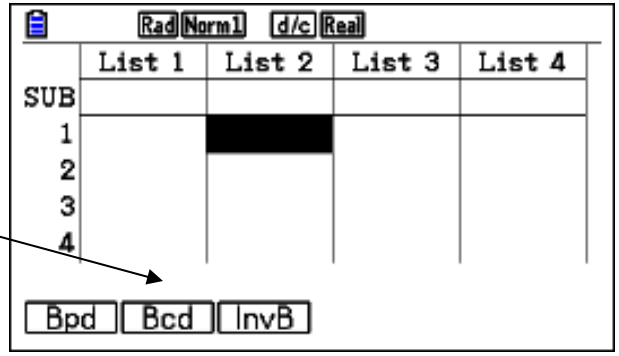
3 Press =
15 Press =
0.2 Press =
Press =

0.2501388953

(b) Probabilities of type P($X \leq x$):

eg X~B(15, 0.2) P($X \leq 3$)

F2 Bcd

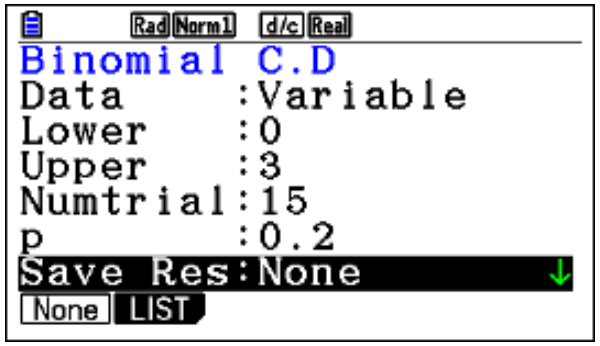


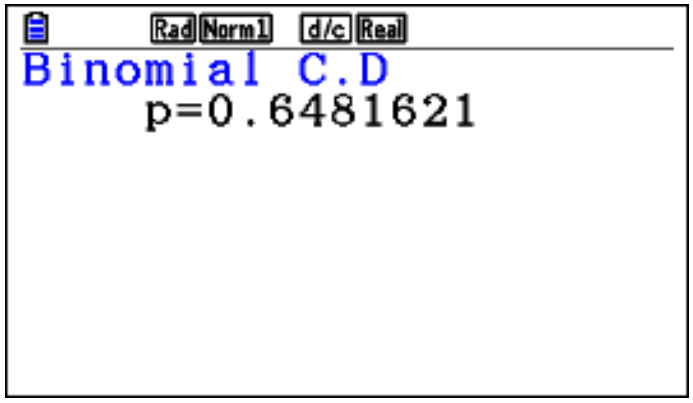
Upper 3 EXE

Numtrial 15 EXE

p 0.2 EXE

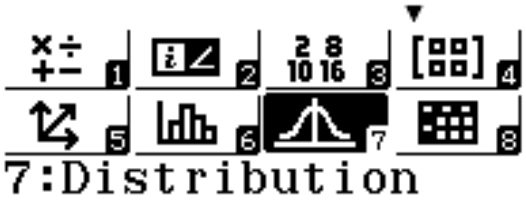
Execute F1 (calc)



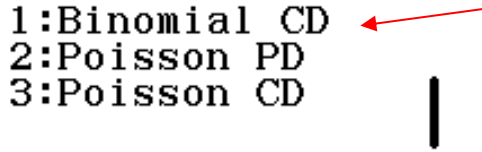


(b) Probabilities of type P($X \leq x$):

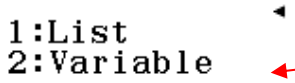
eg B(15, 0.2) P($X \leq 3$)



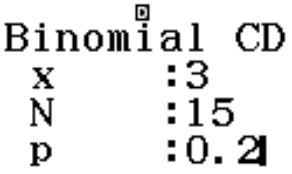
Press 7



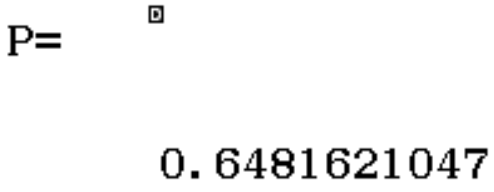
Use down arrow to navigate to more opts
Press 1 BinomialCD



Press 2 Variable



3 Press =
15 Press =
0.2 Press =
Press =



A hotel has 50 single rooms, 16 of which are on the ground floor. The hotel offers guests a choice of a full English breakfast, a continental breakfast or no breakfast. The probabilities of these choices being made are 0.45, 0.25 and 0.30 respectively. It may be assumed that the choice of breakfast is independent from guest to guest.

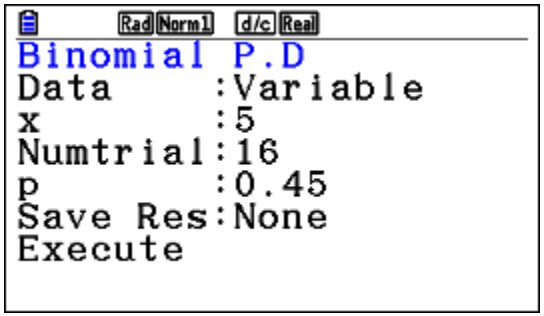
(a) On a particular morning there are 16 guests, each occupying a single room on the ground floor. Calculate the probability that exactly 5 of these guests require a full English breakfast.

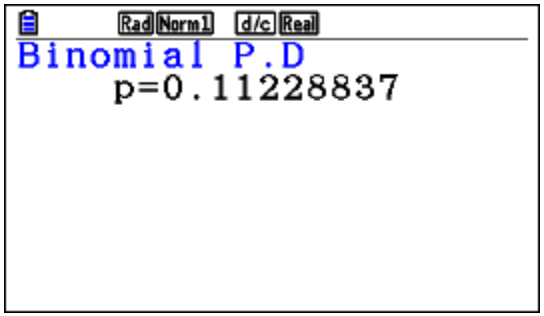
(b) On a particular morning when there are 50 guests, each occupying a single room, determine the probability that:

(i) at most 12 of these guests require a continental breakfast;

(ii) More than 10 but fewer than 20 of these guests require no breakfast.

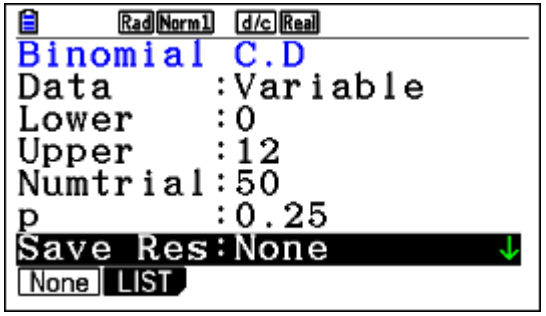
(a) On a particular morning there are 16 guests, each occupying a single room on the ground floor. Calculate the probability that exactly 5 of these guests require a full English breakfast. *(3 marks)*

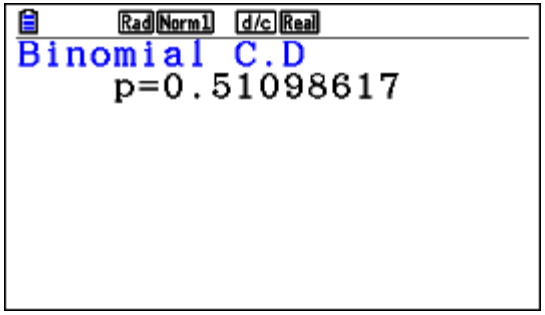




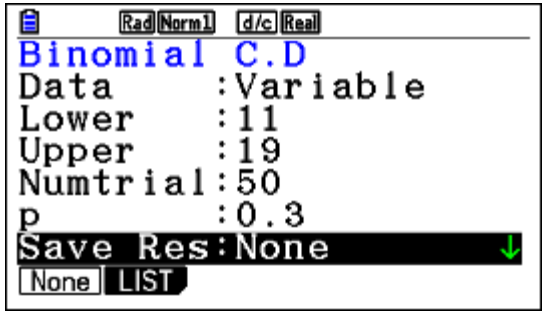
(b) On a particular morning when there are 50 guests, each occupying a single room, determine the probability that:

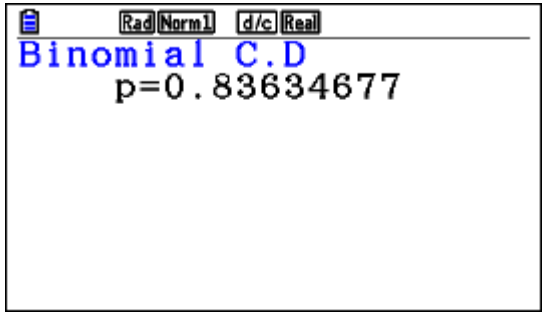
(i) at most 12 of these guests require a continental breakfast; *(2 marks)*





(ii) more than 10 but fewer than 20 of these guests require no breakfast. *(3 marks)*



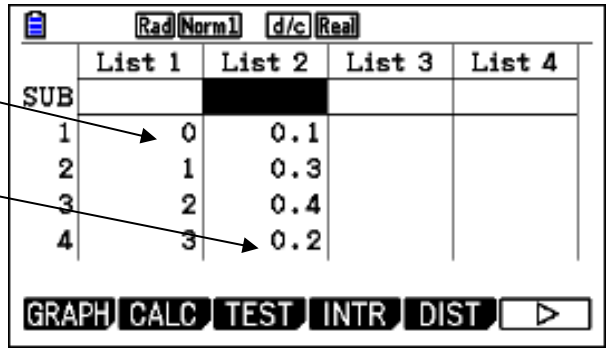


It is advised that students should be aware of the method involved as questions may involve being asked to **show** a result.

3.Discrete Probability Distributions: Expectation and variance

List 1: input *x* 0 1 2 3

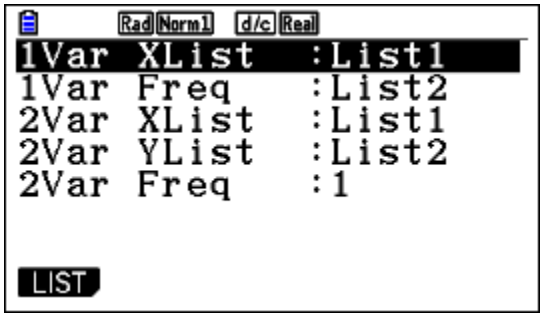
List 2: input probabilities 0.1 0.3 0.4 0.2



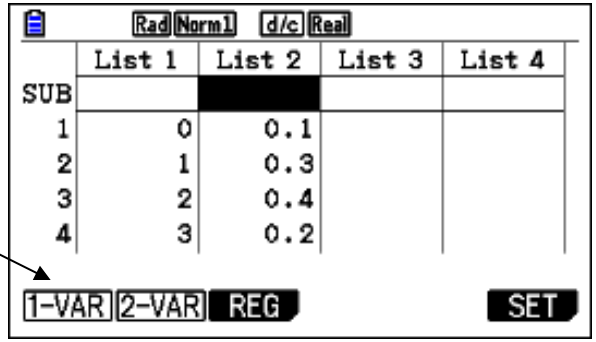
CALC F2

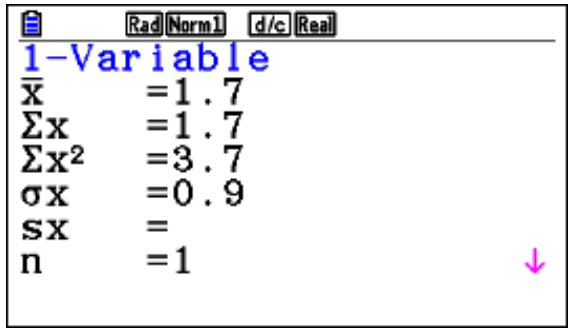
SET

EXIT



1 VAR



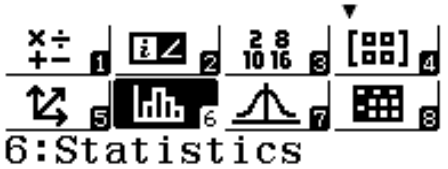


$\overline{X}$ = E(*X*) $\sum x$ = E(*X*) $\sum x^2$ =E(*X*²) σ given

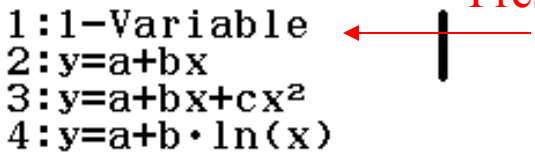
Check n = 1

List 1: input *x* 0 1 2 3

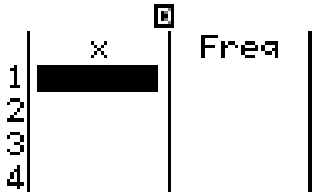
List 2: input probabilities 0.1 0.3 0.4 0.2



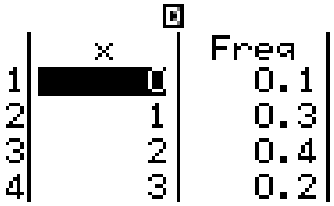
Press =

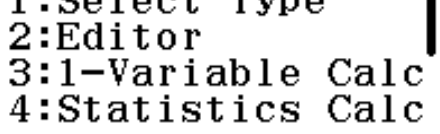


Press 1 1-Variable

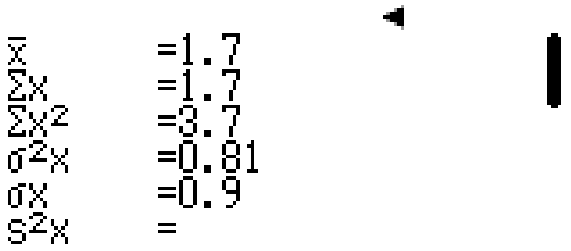


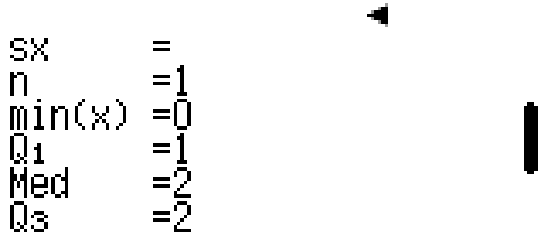
Enter data





Press OPTN
Press 3
1-Variable





Example

For the following probability distribution,

x	**0**	**1**	**2**	**3**	**4**	**5**
P ($X = x$)	0.08	0.30	0.34	0.15	0.10	0.03

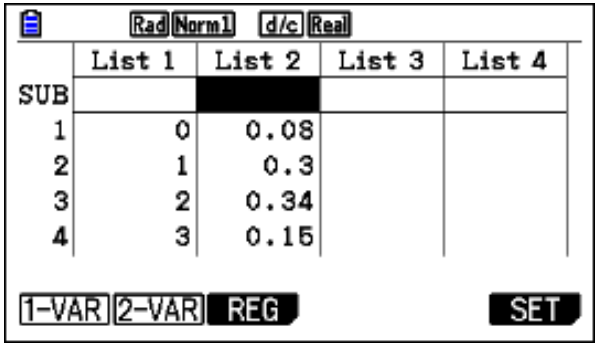
calculate

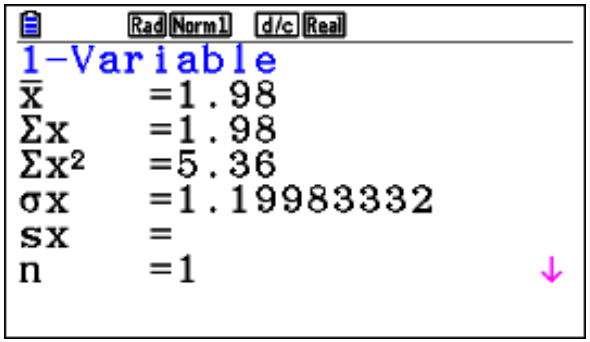
(a) E(X)

(b) E(X^2)

(c) the variance of X

(d) the standard deviation of X





(a) E(X) =1.98

(b) E(X^2) = 5.36

(c) Var = 5.36 – 1.98^2 = 1.44

(d) sd = 1.20

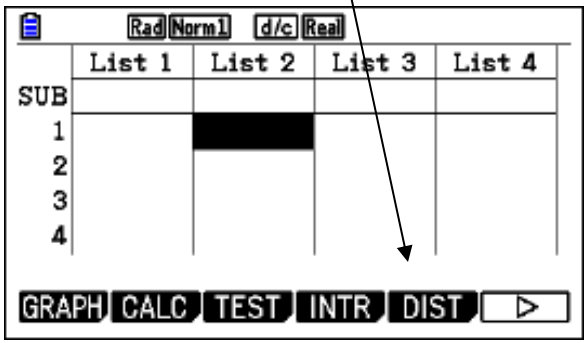
It is advised that *z* values and methods are shown and the calculator is used for checking results.

4. Normal Distribution: Calculation of probabilities

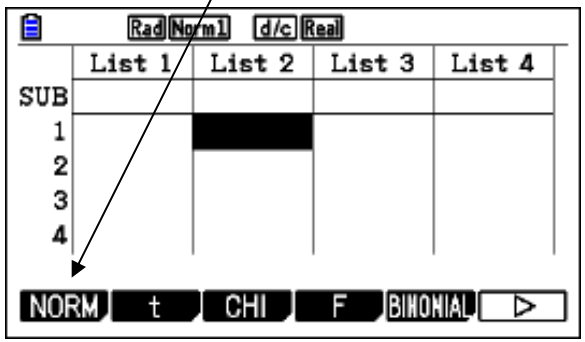
(a) Probabilities of types $P(X \le x)$, $P(X < x)$, $P(X > x)$ and $P(X \ge x)$ can be found directly

eg $X \sim N(135, 15^2)$ $P(X \le 127)$ or $P(X < 127)$

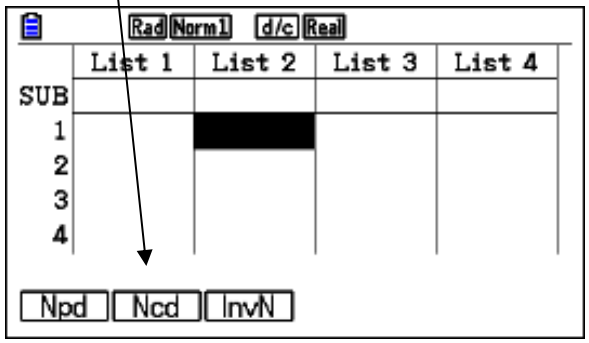
F5 DIST



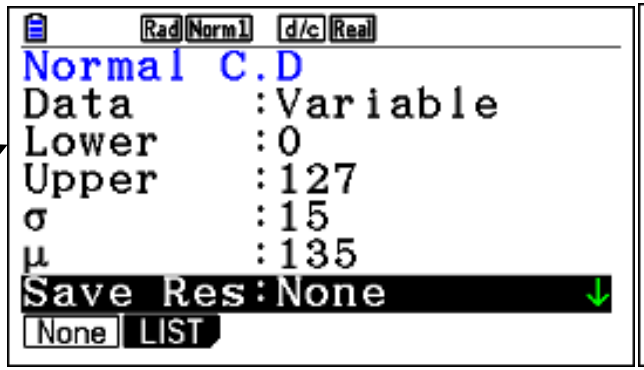
F1 Norm

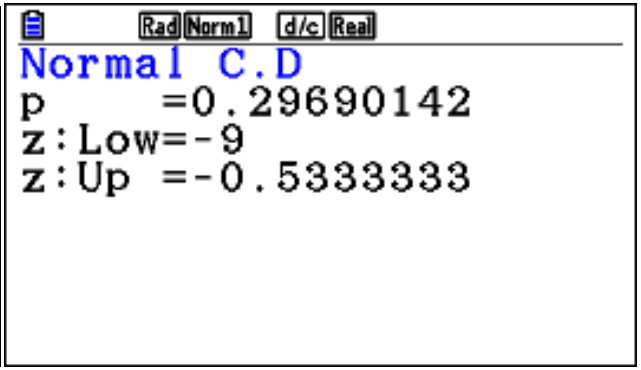


F2 Ncd



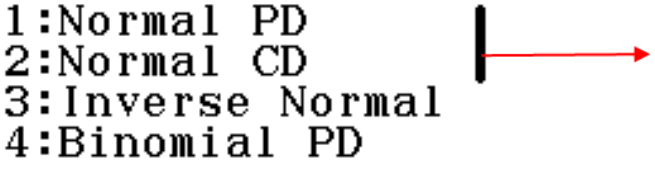
Select a suitable Lower value



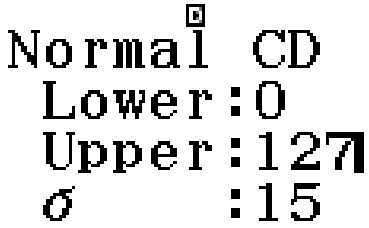


eg $X \sim N(135, 15^2)$ $P(X \leq 127)$ or $P(X < 127)$

Press 7



Press 2



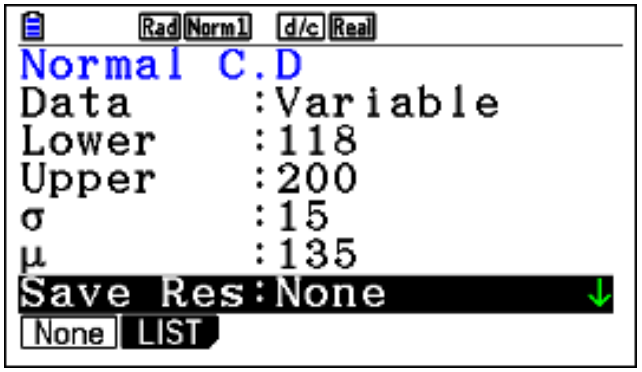
Enter data then =

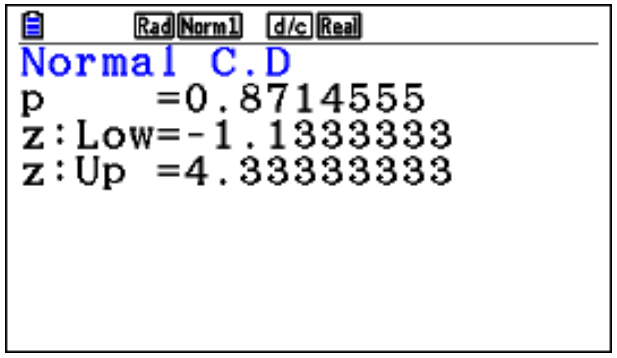
P=

0.2969014278

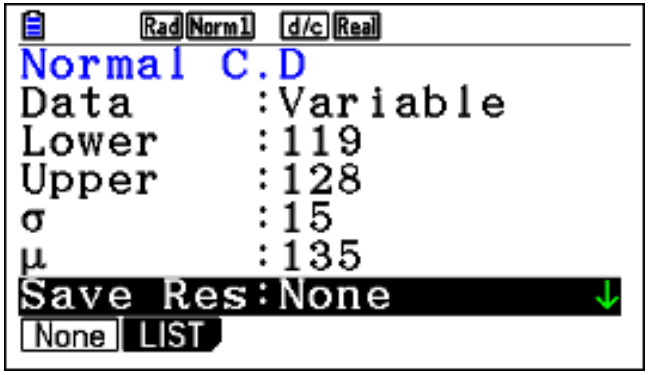
eg $X \sim N(135, 15^2)$ $P(X \geq 118)$ or $P(X > 118)$

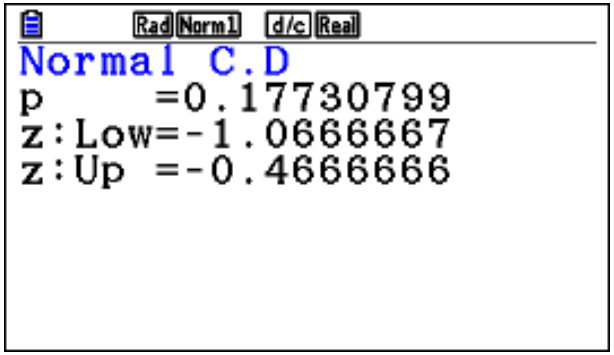
Select a suitable Upper value



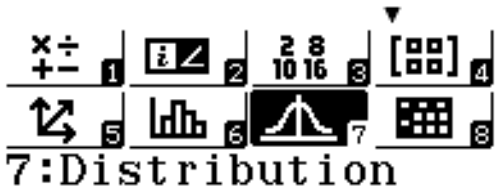


eg $X \sim N(135, 15^2)$ $P(119 < X < 128)$





eg $X \sim N(135, 15^2)$ $P(X \geq 118)$ or $P(X > 118)$



Press 7

1:Normal PD
2:Normal CD
3:Inverse Normal
4:Binomial PD

Press 2

Normal CD
Lower:118
Upper:200
σ :15

Normal CD
Upper:200
σ :15
μ :135

Enter data then =

P=

0.8714555072

eg $X \sim N(135, 15^2)$ $P(119 < X < 128)$

Normal CD
Lower:119
Upper:128
σ :15

Normal CD
Upper:128
σ :15
μ :135

P=

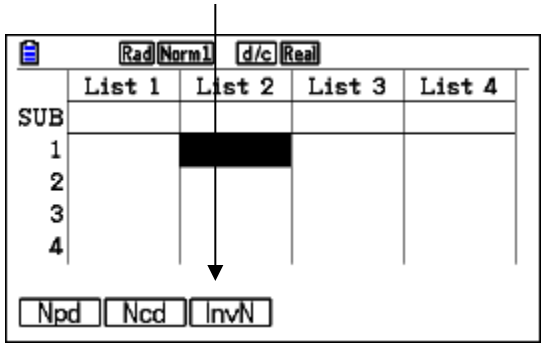
0.1773079985

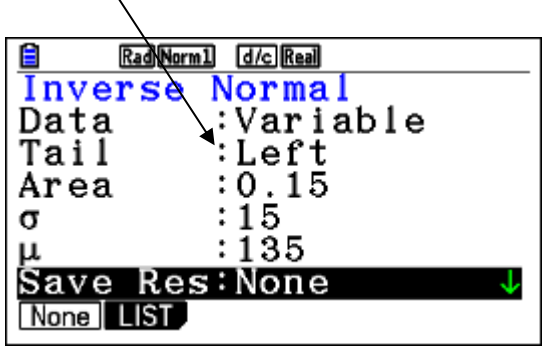
(b) Problems involving inverse normal probabilities:

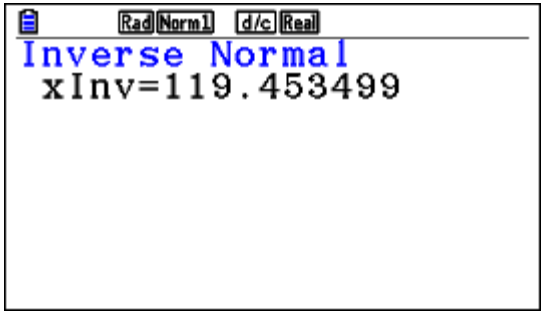
eg $X \sim N(135, 15^2)$ Find value of x such that $P(X < x) = 0.15$

F5 DIST F1 NORM

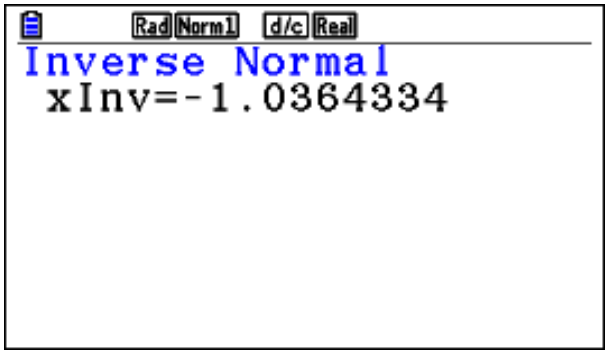
F3 InvN Area Left







z scores corresponding to area can also be obtained (InvNormal tables)



eg $X \sim N(135, 15^2)$

Find value of x such that $P(X < x) = 0.15$

Press 7

1:Normal PD
2:Normal CD
3:Inverse Normal
4:Binomial PD

Press 3

Inverse Normal
Area :0.15
σ :15
μ :135

Enter data then =

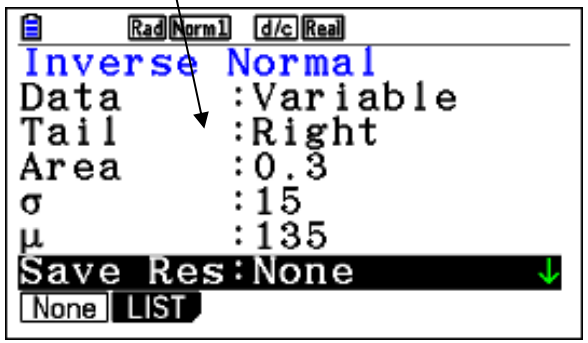
xInv=

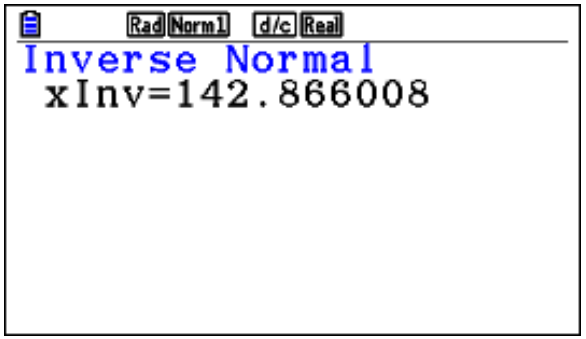
119.4535129

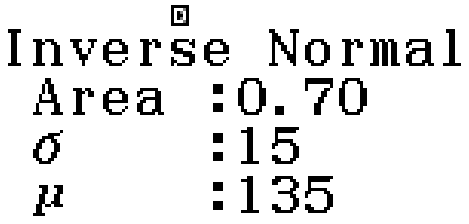
Note: area is always to the left

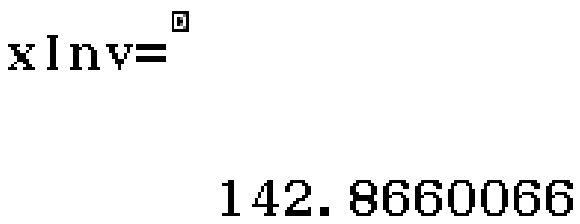
eg $X \sim N(135, 15^2)$ Find value of x such that $P(X > x) = 0.30$

Area right this time









Area to left is 0.70

About MEI

- Registered charity committed to improving mathematics education
- Independent UK curriculum development body
- We offer continuing professional development courses, provide specialist tuition for students and work with industry to enhance mathematical skills in the workplace
- We also pioneer the development of innovative teaching and learning resources