Chapter 14 / **Example 7**

Calculating with the binomial distribution

Use of a table or graph when the number of trials is unknown.

A box contains a large number of carnations, $\frac{1}{4}$ of which are red. The rest are white.

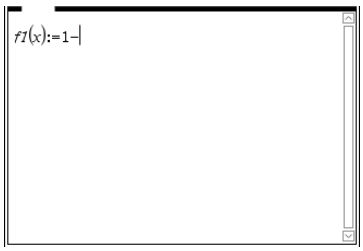
Carnations are picked at random from the box. How many carnations must be picked so that the probability that there is at least one red carnation among them is greater than 0.95?

Open a new document and add a Calculator page.

Type f 1 (x)

Press ctrl (:=)

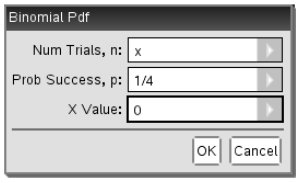
1 −



Press menu 5:Probability | 5:Distributions | A:Binomial Pdf…

Enter X as the number of trials, $\frac{1}{4}$ as the probability of success (type 1 ÷ 4) and 0 as the X value.

Press enter or click OK with the touchpad.



Press ctrl doc (+page) and add a Lists & Spreadsheet page.

Press ctrl T to change from a spreadsheet to a table.

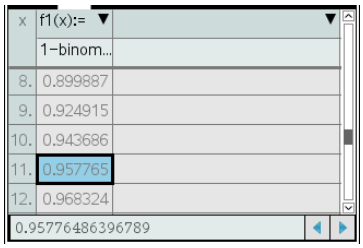
Press enter.

Scroll down the table using ▼.

When $n = 10$, $\mathrm{P}(X \geq 1) = 0.94368$

When $n = 11$, $\mathrm{P}(X \geq 1) = 0.95776$

Hence at least 11 carnations must be picked out of the box to ensure that the probability that there is at least one red carnation among them is greater than 0.95.



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To solve the problem graphically, you need to solve the equation $1-(0.75)^n = 0.95$.

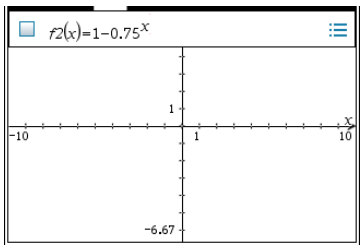
Press ctrl doc (+page) and add a Graphs page.

The entry line is displayed at the top of the work area.

The default graph type is function, so '*f2*(*x*)=' is displayed.

The default axes are $-10 \le x \le 10$ and $-6.67 \le y \le 6.67$.

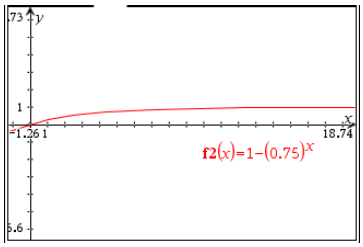
Type $1-(0.75)^x$ and press enter.



The GDC displays the first straight-line graph $f2(x) = 1-(0.75)^x$

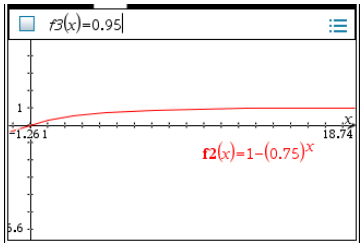
Click and hold the touchpad somewhere on the white area of the screen. You should see the cursor change to ✋. Drag the axes. This is called panning.

When you have a better view of the curve, click the touchpad again (or press esc).



Press tab to display the entry line again. This time '*f3*(*x*)=' is displayed.

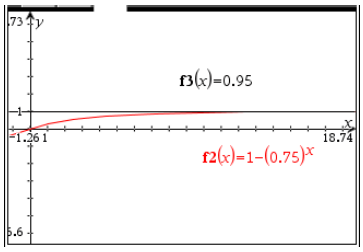
Type 0.95 and press enter.



The GDC now displays both straight-line graphs:

$f2(x) = 1-(0.75)^x$

$f3(x) = 0.95$

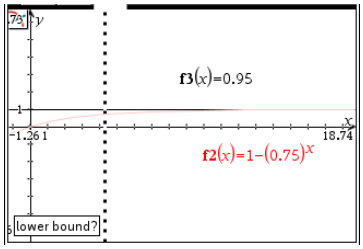


Press menu 6:Analyse Graph | 4:Intersection

To find the intersection you need to give the lower and upper bounds of the region that includes the intersection.

The GDC shows a line and asks you to set the lower bound. Move the line using the touchpad and choose a position to the left of the intersection.

Click the touchpad.



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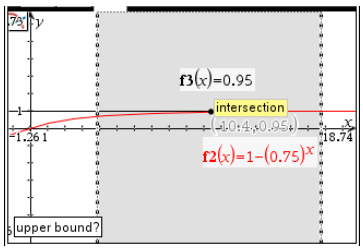
The GDC shows another line and asks you to set the upper bound. Use the touchpad to move the line so that the region between the lower and upper bounds contains the intersection. When the region contains the intersection, the calculator will display the word 'intersection' in a box. Click the touchpad.	
The GDC displays the intersection of the two straight lines at the point $(10.4, 0.95)$ So $1-(0.75)^n > 0.95$ when $n > 10.4$ Hence at least 11 carnations must be picked out of the box to ensure that the probability that there is at least one red carnation among them is greater than 0.95.