Task C: **Linear programming**

To create a dynamic worksheet that illustrates constructing the solution set of linear inequalities and the process of linear programming.
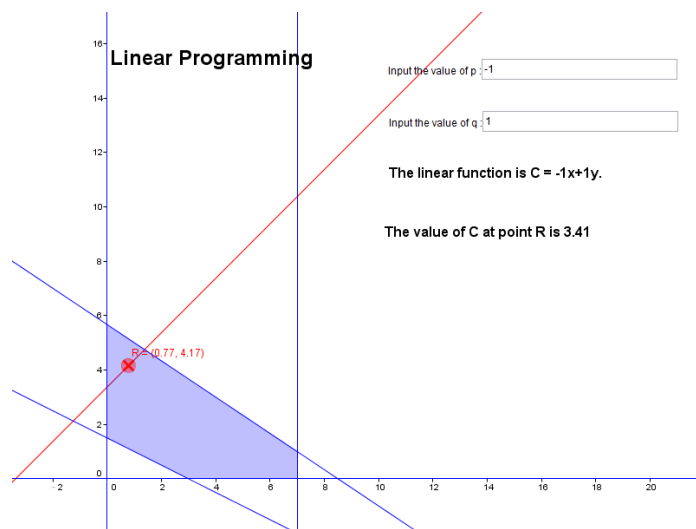
Create objects on the Graphics window as follows:

| Steps	Objects to be created	Action
1.	The solution set of the linear inequality $x + 2y \geq 3$	◆ Type "x + 2y >= 3" in the input field ◆ Select ▨ "Point on object", add a point in the solution set of the inequality and rename the point as A ◆ Type "k=x(A)+2*y(A)" in the input field ◆ Select ▨ "Text box" and type "Substituting A into the inequality, x + 2y = k" where k is selected from "Objects" ◆ Select ▨ "New Point", add a point outside the solution set of the inequality and rename the point as B ◆ Type "k'=x(B)+2*y(B)" in the input field ◆ Select ▨ "Text box" and type "Substituting B into the inequality, x + 2y = k'" where k' is selected from "Objects"

Steps	Objects to be created	Action
2.	The constrained solution set of the system of linear inequalities: $$\begin{cases} x + 2y \geq 3 \\ 2x + 3y \leq 17 \\ 0 \leq x \leq 7 \\ 0 \leq y \end{cases}$$	◆ Hide points A and B, and the text boxes ◆ Key in the inequalities one by one in the input field ◆ Type "a&&b&&c&&d" in the input field (by default, a, b, c and d are the assigned names of the inequalities) ◆ Hide the solution sets of each of the individual inequalities
3.	The optimal solution C of a linear function $C = px + qy$ within the constrained solution set	◆ Type "p=0" and "q=0" in the input field ◆ Select ⬛a=1 "Input box", select "p = 0" in "linked object" and type "Input the value of p" in the caption field ◆ Select ⬛a=1 "Input box", select "q = 0" in "linked object" and type "Input the value of q" in the caption field ◆ Select 🔺 "Point on object", add a point in the constrained solution set and rename the point as R ◆ Type "C=p*x(R)+q*y(R)" in the input field ◆ Type "p*x+q*y=C" in the input field ◆ Select ABC "Text box" and type "The value of C at point R is C ." where C is selected from "Objects"

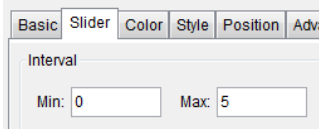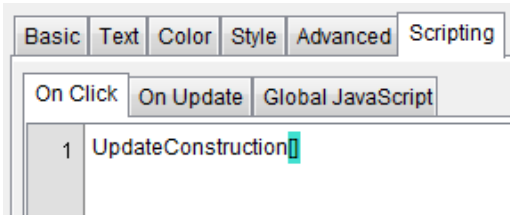**Task D:** <u>**Effect of some common operations on the dispersion of a data set**</u>

To create a dynamic worksheet for students to explore the effect of the following two operations on the dispersion of a data set:

(1) Adding a common constant to each item of the set of data; and

(2) Multiplying each item of the set of data by a common constant.
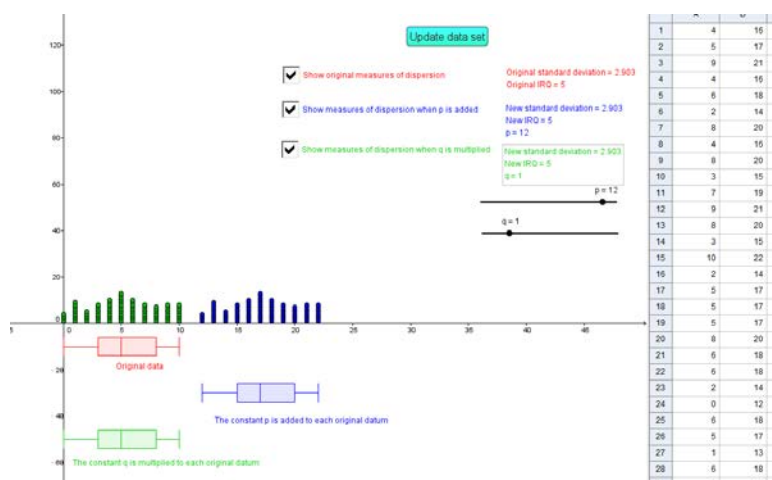
Create objects on the Spreadsheet window and graphic window as follows:

Steps	Objects to be created	Action
1.	A set of randomly generated data	◆ Select "Spreadsheet" in "View" menu over the tool bar ◆ In a cell of the spreadsheet, e.g. cell A1, type "=randombetween(0,10)" and copy this cell to 90 cells vertically (e.g. A1 to A90)
2.	The measures of dispersion and the graphs of representation of the data	◆ In a cell below the data set, say A92, type "=SD[A1:A90]" to calculate the standard deviation of the data set ◆ In another cell, say A93, type "=Q3[A1:A90] - Q1[A1:A90]" to calculate the interquartile range of the data set ◆ In another cell, say A94, type "=DotPlot[A1:A90]" to output the dot plot of the data set ◆ In another cell, say A95, type "=BoxPlot[-10, 4, A1:A90]" to output the box-and-whisker diagram of the data set

Steps	Objects to be created	Action
3.	The new data sets and the measures of dispersion under the operations	◆ Create a slider in the graphic window and rename it as p, setting its interval from -15 to 15 ◆ Create another slider and rename it as q, setting its interval from 0 to 5 ◆ In cell B1, type "=A1+p" ◆ In cell C1, type "=A1*q" ◆ Copy B1 and C1 to cells from B1 to B90 and C1 to C90 ◆ Copy cells between A92 and A95 to respective cells in column B and column C ◆ In cells B95 and C95, change the first parameter in the bracket of the function BoxPlot to –30 and – 50 respectively. i.e. "=BoxPlot[-30, 4, B1:B90]", "=BoxPlot[-50, 4, C1:C90]"
4.	Check boxes to show/hide individual effects	◆ Create three text boxes to show the measures of dispersion on each set of the data ◆ Create three check boxes to show/hide the information of the three data sets respectively
5.	Button to refresh the data set	◆ Select "Button" and type "Update data set" ◆ In "Object Properties", go to "On click" under "Scripting" menu ◆ Type "UpdateConstruction[]" and press OK