Using Graphing Calculators
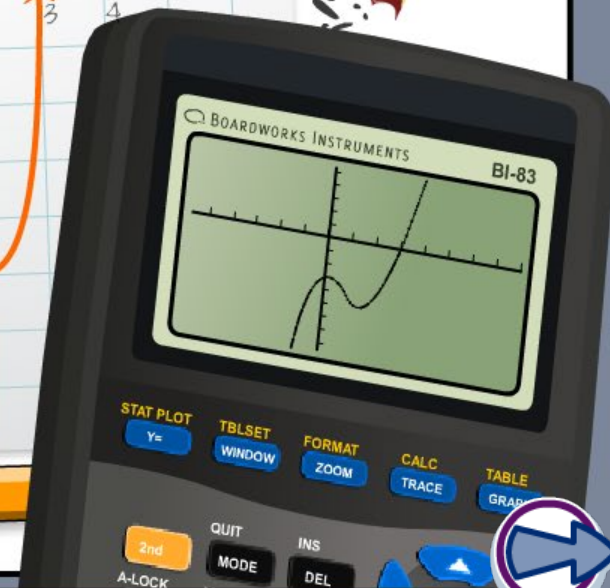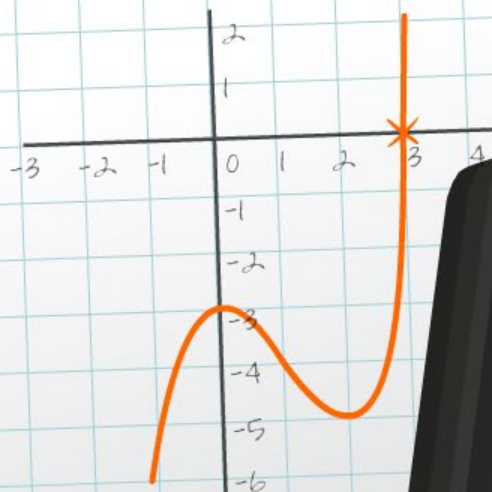
Common core icons

This icon indicates a slide where the Standards for Mathematical Practice are being developed. Details of these are given in the Notes field.

MODELING

Slides containing examples of mathematical modeling are marked with this stamp.

This icon indicates an opportunity for discussion or group work.

The **Standards for Mathematical Practice** outlined in the Common Core State Standards for Mathematics describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

These are:

1) **Make sense of problems and persevere in solving them.**

2) **Reason abstractly and quantitatively.**

3) **Construct viable arguments and critique the reasoning of others.**

4) **Model with mathematics.**

5) **Use appropriate tools strategically.**

6) **Attend to precision.**

7) **Look for and make use of structure.**

8) **Look for and express regularity in repeated reasoning.**

This icon indicates that the slide contains activities created in Flash. These activities are not editable.

This icon indicates teacher's notes in the Notes field.

Main features of a graphing calculator

A graphing calculator can be used to find or verify a solution.

The list below shows the most useful calculator features that can be used for solving Algebra II problems.

- **Graphing**: enter one or more functions and plot graphs; find intersections, maximums, minimums, and other points.

- **Sequences**: generate, sum or graph sequences.

- **Tables**: create tables of values for functions.

- **Regression**: find a function to fit a set of data.

- **Statistics**: analyze one- and two-variable lists of data.

Mode settings

It is important to check the mode settings on your graphing calculator before performing a calculation. These settings determine how the calculator displays and interprets the information you input.

Press the "MODE" button on the calculator to see the important settings to be aware of.
Press on each row to learn more.

Algebra test scores

A class's average was low on their last algebra test. The teacher decided to raise all of the scores, so that the lowest score of 42 became 60 and the highest, 84, became 95. Here are the original scores:

63 60 47 63 42 50 84 66 55 78 82 75 73 77 81

1) **Write a linear function that can be used to obtain the new grades from the original ones.**

2) **Use your graphing calculator to:**

   a) **sort the grades into ascending order**

   b) **obtain the new list of grades**

   c) **find the original mean grade and new mean grade.**

The formula $h(t) = -16t^2 + v_0t + h_0$, where v_0 is the initial velocity in ft/sec, h_0 is the initial height in feet and t is the time taken in seconds, describes the height of a ball that has been hit into the air.

A baseball player hit a ball with an initial velocity of 100 ft/sec and it was 3.2 feet off the ground when the bat made contact with the ball.

1) Write a quadratic function that models the problem.
2) Using appropriate features of your graphing calculator, determine how many seconds the ball was in the air for after being hit, assuming that no one caught it.
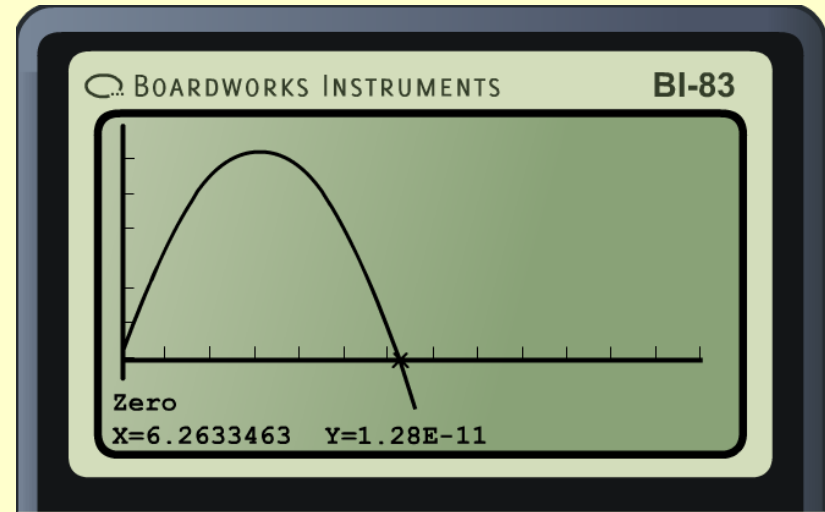
1) substitute v_0 = 100 and h_0 = 3.2: $h(t) = -16t^2 + 100t + 3.2$

2) The ball hits the ground when $h(t) = 0$. Determine this value of t.

This value of t is the x-intercept (the zero) of the graph of the quadratic function.

Press "Y=" then enter the function. Press "2nd TRACE" to get the "CALC" menu and use the "zero" feature to find the zero.

BOARDWORKS INSTRUMENTS   BI-83

Zero
X=6.2633463   Y=1.28E-11

Notice the y-value (the height) is 1.28E−11, not zero.

Sometimes the calculator has difficulty positioning the cross exactly on a specific pixel (here, the pixel where $y = 0$). We have to know that it is actually on $y = 0$.

Students are working on a community service project collecting supplies to send to the Salvation Army. A company donated square pieces of cardboard 40 inches wide to use in the construction of open top delivery boxes. Squares will be cut from the corners and the sides folded up to create the box.

*Press **play** to see how the boxes are made.*

40 inches

Vegetable garden

João wants his new rectangular vegetable garden to have an area of 300 ft^2 and a perimeter of 112 ft.

1) If l is the length of one side of the garden, express the perimeter as a function of l.
2) Use the function (and a calculator) to determine the dimensions of the garden.

1) Let l = the length, then $300/l$ = the width

The function is: $P(l) = 2l + 2(300/l) =$ **$2l + 600/l$**

BOARDWORKS INSTRUMENTS   BI-83

Intersection
X=50   Y=112
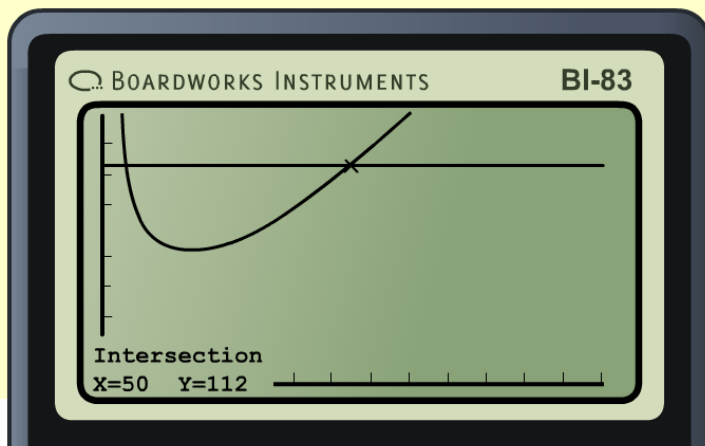
2) Press "Y=" and enter:
Y$_1$ = $2X + 600/X$ and Y$_2$ = 112.

In the "CALC" menu, chose "5:intersect".
Intersections: (6, 112) and (50, 112).

So the garden should be **6 ft by 50 ft**.

After Li's grade school graduation, his father invested $1000 for his college education. His father found a fund that pays 8% annual interest rate compounded quarterly.

Write a function that models the scenario and use it to create a table of values showing the balance in Li's fund at the end of each year.

Formula for compound interest: $A = A_0(1 + r/k)^{kt}$ where t = time (years), A_0 = original amount, r = annual rate and k = times compounded.

So the function is: A **= 1000(1 + 0.08/4)^{4t}**

Put this function in Y_1, then use the "TABLE" feature to create a table and "TBLSET" to specify the start value and the size of the increments between rows.

BOARDWORKS INSTRUMENTS — BI-83

X	Y₁
0	1000
1	1082.4
2	1171.7
3	1268.2
4	1372.8
5	1485.9
6	1608.4

X=0

MODELING

boardworks

Use the table to determine in which year the amount in the fund will have doubled.

X	Y_1	
0	1000	
1	1082.4	
2	1171.7	
3	1268.2	
4	1372.8	
5	1485.9	
6	1608.4	

BOARDWORKS INSTRUMENTS   BI-83

X=0

Press the down arrow to display later years in the table. Find the year in which the money doubles.

X	Y_1	
3	1268.2	
4	1372.8	
5	1485.9	
6	1608.4	
7	1741	
8	1884.5	
9	2039.9	

BOARDWORKS INSTRUMENTS   BI-83

Y_1=2039.88734372

Notice that at the end of the **9th year** the fund contains about $2039.89 implying that during that year the value of the original amount will have doubled.

Regression

The table of values shows the temperature of a turkey after it has been removed from the oven.

time (mins)	temp (°F)
0	180
5	153
10	130
15	112
20	95
25	81
30	70

a) Decide which type of function best models the data in the table.

b) Use a calculator to find the regression model.

c) Examine the correlation coefficient and state how well the choice of function models the data.

Nick messaged 4 friends on a social networking site inviting them to his band's gig that weekend. He asked each friend to also message 4 people, with the same request.

Use the "SEQ" feature on a calculator to determine the number of people who will receive the message if everyone does as they are asked for 8 rounds and no one gets the message twice.

This is a sequence where $a_1 = 4$, $a_2 = 4^2$, $a_3 = 4^3$… and $a_8 = 4^8$.

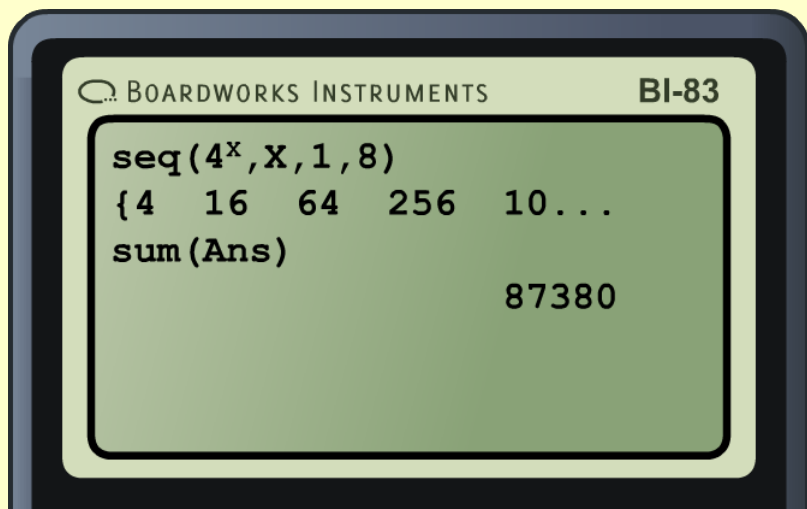Generate all of the terms and find the sum $a_1 + a_2 + a_3 + … + a_8$.

- Press "2nd STAT" to get "LIST", then on the "OPS" menu scroll down to "5:seq(".

- Enter: 4^x, x, 1, 8 (i.e. the sequence formula is 4^x, using the variable x, where x starts at 1 and goes in increments of 1 up to 8).

- Press "ENTER" to see the sequence. Scroll right to see more terms.

```
Q BOARDWORKS INSTRUMENTS        BI-83

seq(4ˣ,X,1,8)
{4   16   64   256   10...
sum(Ans)
                         87380
```

- To sum the terms, press "2nd STAT" to get "LIST", then select "5:sum(" from the "MATH" menu.

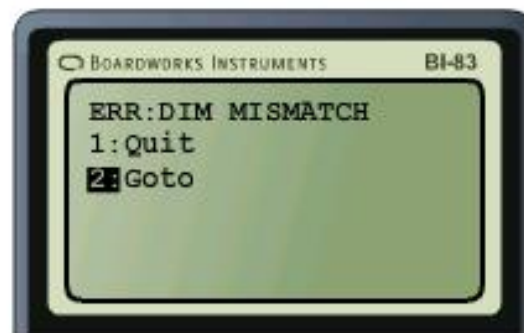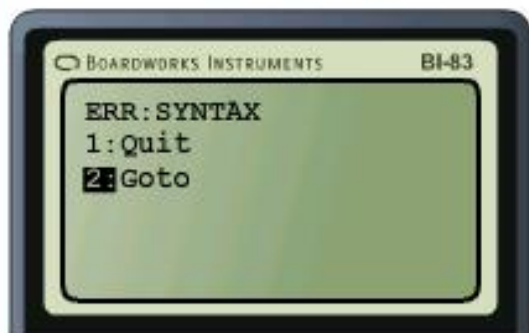- Type "2nd (-)" to insert the sequence just generated, then press "ENTER" to see the sum.

If the chain is unbroken, **87,380 people** will receive the invite.

Troubleshooting

Calculator error messages

If your calculator displays an error, it will tell you the type of error that has occurred. It also gives you the opportunity to "Quit" (which returns to the home screen) or quite often to "Goto". Choose "Goto" if it is available – it will show you where your error is.

Press the error screens to see how to correct the error shown.

```
○ BOARDWORKS INSTRUMENTS          BI-83
  ERR:SYNTAX
  1:Quit
  2:Goto
```

```
○ BOARDWORKS INSTRUMENTS          BI-83
  ERR:WINDOW RANGE
  1:Quit
```

```
○ BOARDWORKS INSTRUMENTS          BI-83
  ERR:DIM MISMATCH
  1:Quit
  2:Goto
```

Press here for other errors: OTHER