

## Module 12: Statistics

### Topic 2: Using Mathematical Models of Quadratic Functions to Make Predictions

#### Introduction



**Today's Lesson**

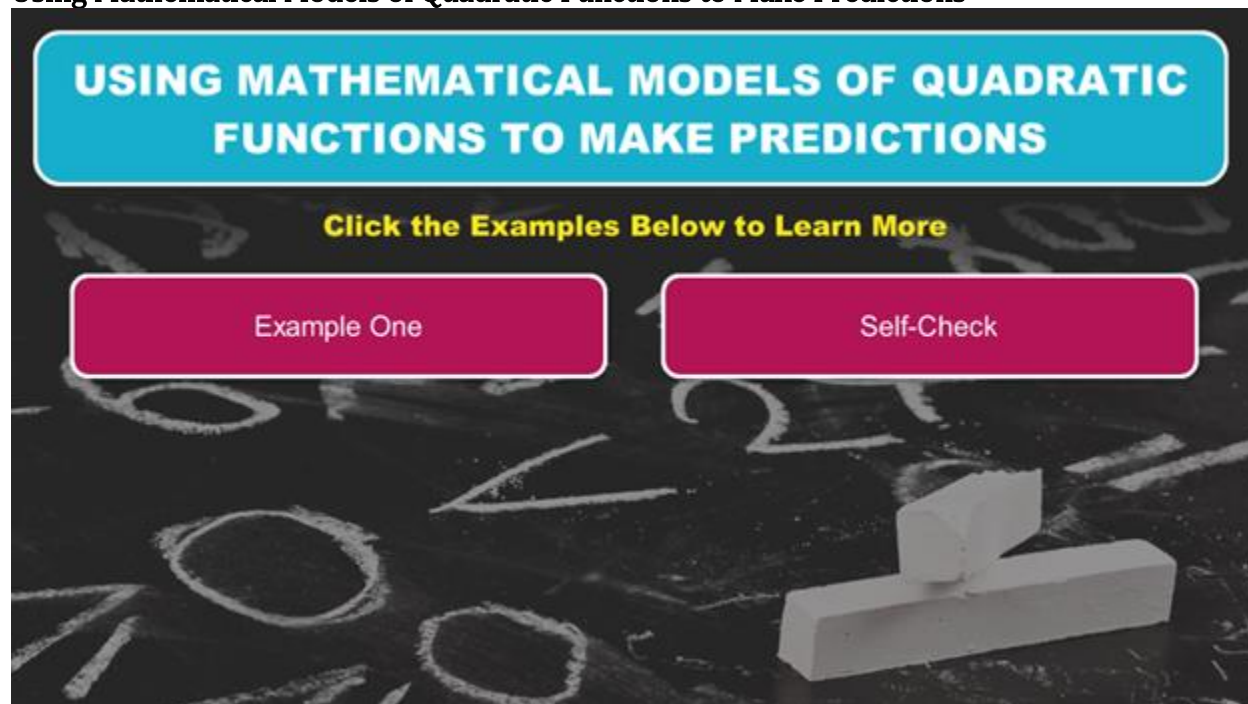
- You will learn how to use the mathematical models of quadratic functions to make predictions.

Hello and welcome! I'm so glad to have you here for this lesson in Algebra I, where you will learn how to use mathematical models of quadratic functions to make predictions.

## Module 12: Statistics

### Topic 2: Using Mathematical Models of Quadratic Functions to Make Predictions

#### Using Mathematical Models of Quadratic Functions to Make Predictions

An interactive learning interface with a dark background featuring faint chalkboard-style mathematical symbols like pi, infinity, and numbers. At the top, a blue rounded rectangle contains the title 'USING MATHEMATICAL MODELS OF QUADRATIC FUNCTIONS TO MAKE PREDICTIONS' in white. Below it, yellow text says 'Click the Examples Below to Learn More'. Two pink rounded rectangles are positioned side-by-side, labeled 'Example One' and 'Self-Check'. In the bottom right corner, there is a 3D rendering of a white rectangular prism with a smaller white cube on top of it.

**USING MATHEMATICAL MODELS OF QUADRATIC FUNCTIONS TO MAKE PREDICTIONS**

Click the Examples Below to Learn More

Example One


Self-Check

Click the examples below to learn more.

## Module 12: Statistics

### Topic 2: Using Mathematical Models of Quadratic Functions to Make Predictions

#### Example 1



**Example 1**

Year	Number of People (thousands)
1	24
2	18
3	14
4	16
5	15
6	19
7	20
8	27

For several years, the owner of a local gym has collected data on the number of people in the city who choose to exercise at home. The data is displayed in the table. Use a quadratic model to predict the number of people who will exercise at home during Year 11.

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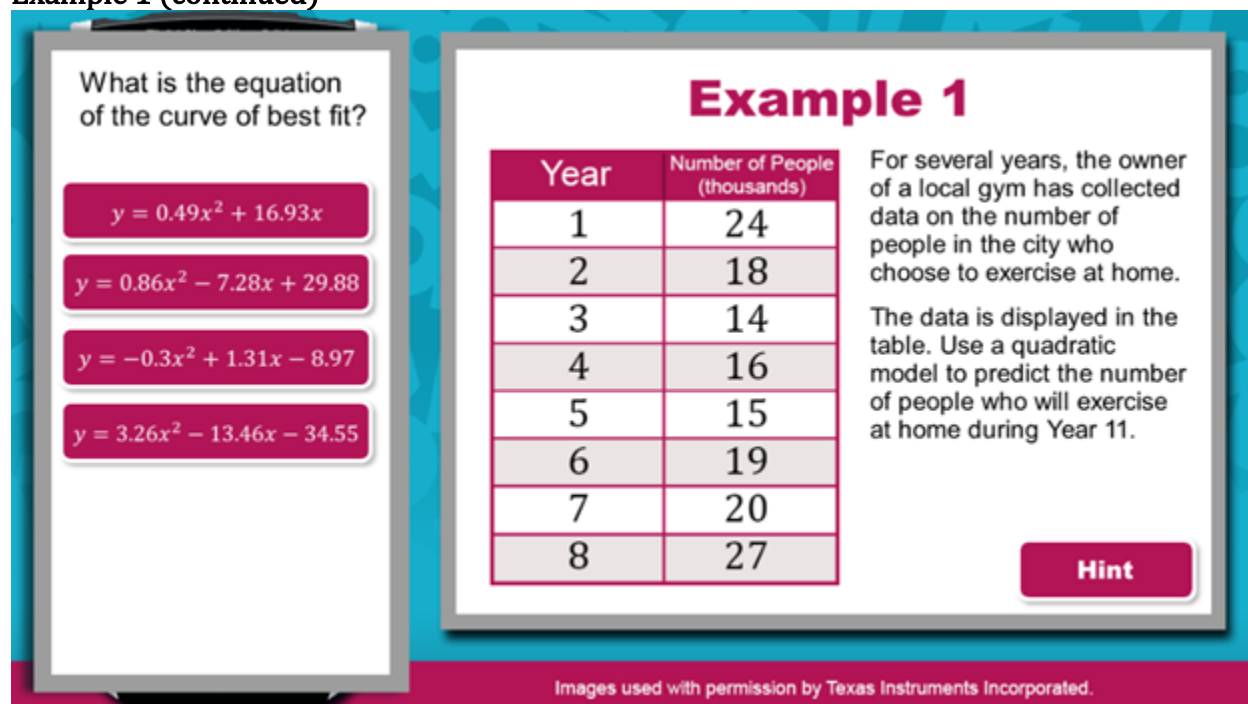
For several years, the owner of a local gym has collected data on the number of people in the city who choose to exercise at home. The data is displayed in the table. Use a quadratic model to predict the number of people who will exercise at home during Year 11.

Year	Number of People (thousands)
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2	18
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8	27

## Module 12: Statistics

### Topic 2: Using Mathematical Models of Quadratic Functions to Make Predictions

#### Example 1 (continued)



What is the equation of the curve of best fit?

$y = 0.49x^2 + 16.93x$

$y = 0.86x^2 - 7.28x + 29.88$

$y = -0.3x^2 + 1.31x - 8.97$

$y = 3.26x^2 - 13.46x - 34.55$

### Example 1

Year	Number of People (thousands)
1	24
2	18
3	14
4	16
5	15
6	19
7	20
8	27

For several years, the owner of a local gym has collected data on the number of people in the city who choose to exercise at home.

The data is displayed in the table. Use a quadratic model to predict the number of people who will exercise at home during Year 11.

**Hint**

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To predict the number of people who will exercise at home during Year 11, begin by using the graphing calculator to determine the equation of the curve of best fit. The year number is the independent variable. Enter these values into L1. The number of people is the dependent variable. Enter these values into L2.

What is the equation of the curve of best fit?

- A)  $y = 0.49x^2 + 16.93x$
- B)  $y = 0.86x^2 - 7.28x + 29.88$
- C)  $y = -0.3x^2 + 1.31x - 8.97$
- D)  $y = 3.26x^2 - 13.46x + 34.55$

## Module 12: Statistics

### Topic 2: Using Mathematical Models of Quadratic Functions to Make Predictions

#### Example 1 (continued)

What is the equation of the curve of best fit?

$y = 0.49x^2 + 16.93x$

$y = 0.86x^2 - 7.28x + 29.88$

$y = -0.3x^2 + 1.31x - 8.97$

$y = 3.26x^2 - 13.46x - 34.55$

### Example 1

Year	Number of People (thousands)
1	24
2	18
3	14
4	16
5	15
6	19
7	20
8	27

**HINT:** To determine the equation of the line of best fit, press **STAT**. Then, press **ENTER** to choose the Edit function. Enter the values in the first column into L1. Enter the values in the second column into L2.

Images used with permission by Texas Instruments Incorporated.

**Hint:** To determine the equation of the line of best fit, press **STAT**. Then, press **ENTER** to choose the Edit function. Enter the values in the first column into L1. Enter the values in the second column into L2.

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### Topic 2: Using Mathematical Models of Quadratic Functions to Make Predictions

#### Example 1 (continued)

The equation of the curve of best fit is  
 $y = 0.86x^2 - 7.28x + 29.88$

$y = 0.86x^2 - 7.28x + 29.88$

[View The Steps](#)

[Next](#)

### Example 1

Year	Number of People (thousands)
1	24
2	18
3	14
4	16
5	15
6	19
7	20
8	27

For several years, the owner of a local gym has collected data on the number of people in the city who choose to exercise at home.

The data is displayed in the table. Use a quadratic model to predict the number of people who will exercise at home during Year 11.

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The equation of the line of best fit is  $y = 0.86x^2 - 7.28x + 29.88$ .

## Module 12: Statistics

### Topic 2: Using Mathematical Models of Quadratic Functions to Make Predictions

#### Example 1 (continued)

Press **STAT**.

Then, press **ENTER** to choose the Edit function.

**Step 2**

**Next**

NORMAL FLOAT AUTO REAL RADIAN MP

**EDIT** CALC TESTS

1:Edit...

2:SortA()

3:SortD()

4:ClrList

5:SetUpEditor

Images used with permission by Texas Instruments Incorporated.

Press **STAT**. Then, press **ENTER** to choose the Edit function.

## Module 12: Statistics

### Topic 2: Using Mathematical Models of Quadratic Functions to Make Predictions

#### Example 1 (continued)

Enter the values in the first column into L1.

Enter the values in the second column into L2.

Step 3

Next


NORMAL FLOAT AUTO REAL RADIAN MP 🔋

L1	L2	L3	L4	L5	2
1	24	-----	-----	-----	
2	18				
3	16				
4	14				
5	15				
6	19				
7	20				
8	27				
-----	-----				

L2(9)=

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Enter the values in the first column into L1. Enter the values in the second column into L2.



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## Module 12: Statistics

### Topic 2: Using Mathematical Models of Quadratic Functions to Make Predictions

#### Example 1 (continued)

Next, press **STAT**.

Then, press the right arrow key to access the **Calculate** menu.

Press the down arrow until the cursor reaches the fifth option in the list, **QuadReg**.

Then, press **ENTER**.

**Step 4**

**Next**

NORMAL FLOAT AUTO REAL Radian MP

EDIT **CALC** TESTS

1:1-Var Stats

2:2-Var Stats

3:Med-Med

4:LinReg(ax+b)

**5:QuadReg**

6:CubicReg

7:QuartReg

8:LinReg(a+bx)

9↓LnReg

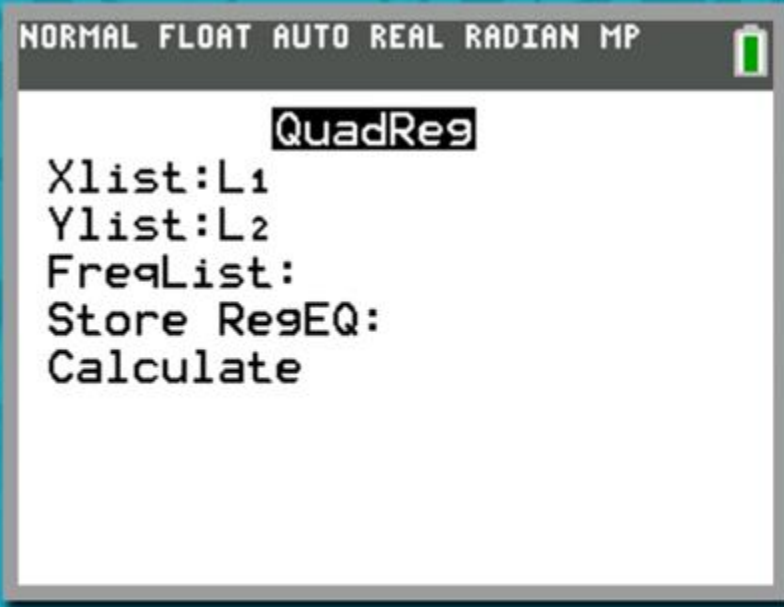
Images used with permission by Texas Instruments Incorporated.

Next, press **STAT**. Then, press the right arrow key to access the **Calculate** menu. Press the down arrow until the cursor reaches the fifth option in the list, **QuadReg**. Then, press **ENTER**.

## Module 12: Statistics

### Topic 2: Using Mathematical Models of Quadratic Functions to Make Predictions

#### Example 1 (continued)



The image shows a TI-84 Plus calculator screen with the following text: "NORMAL FLOAT AUTO REAL RADIAN MP" at the top, a battery icon on the right, and "QuadReg" in the center. Below "QuadReg" are the prompts: "Xlist:L1", "Ylist:L2", "FreqList:", "Store RegEQ:", and "Calculate".

Press **ENTER** to progress through each prompt in the Quadratic Regression menu.

**Step 5**

**Next**

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Press ENTER to progress through each prompt in the Quadratic Regression menu.

## Module 12: Statistics

### Topic 2: Using Mathematical Models of Quadratic Functions to Make Predictions

#### Example 1 (continued)

If the values of  $a$ ,  $b$ , and  $c$  are rounded to the nearest hundredths, the equation of the curve of best fit can be written as

$$y = 0.86x^2 - 7.28x + 29.88$$

**Next**

NORMAL FLOAT AUTO REAL Radian MP

**QuadReg**

$$y = ax^2 + bx + c$$
$$a = .8630952381$$
$$b = -7.279761905$$
$$c = 29.875$$


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If the values of  $a$ ,  $b$ , and  $c$  are rounded to the nearest hundredths, the equation of the curve of best fit can be written as  $y = 0.86x^2 - 7.28x + 29.88$ .

## Module 12: Statistics

### Topic 2: Using Mathematical Models of Quadratic Functions to Make Predictions

#### Example 1 (continued)



**Example 1**

$$y = 0.86x^2 - 7.28x + 29.88$$
$$y = 0.86(11)^2 - 7.28(11) + 29.88$$

Which number is the best prediction of the number of people who will exercise at home in Year 11?

41,000    54,000    119,000    214,000

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Now that you have determined the equation of the curve of best fit, you can use it to predict the number of people who will exercise at home in Year 11.

Substitute 11 for  $x$ . Then, evaluate the expression on the right side of the equation.

$$y = 0.86x^2 - 7.28x + 29.88$$
$$y = 0.86(11)^2 - 7.28(11) + 29.88$$


Which number is the best prediction of the number of people who will exercise at home in Year 11?

- A) 41,000
- B) 54,000
- C) 119,000
- D) 214,000

## Module 12: Statistics

### Topic 2: Using Mathematical Models of Quadratic Functions to Make Predictions

#### Example 1 (continued)



**Example 1**

$$y = 0.86x^2 - 7.28x + 29.88$$
$$y = 0.86(11)^2 - 7.28(11) + 29.88$$
$$= 104.06 - 80.08 + 29.88$$
$$= 53.86$$
$$\approx 54$$

The output value represents the number of people measured in thousands. Therefore, according to the curve of best fit, during Year 11 approximately 54,000 will exercise at home.

54,000

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Substitute 11 for  $x$ .

$$y = 0.86x^2 - 7.28x + 29.88$$
$$y = 0.86(11)^2 - 7.28(11) + 29.88$$

Then, evaluate the expression on the right side of the equation.


$$y = 0.86(11)^2 - 7.28(11) + 29.88$$
$$= 104.06 - 80.08 + 29.88$$
$$= 53.86$$
$$\approx 54$$

The output value represents the number of people measured in thousands. Therefore, according to the curve of best fit, during Year 11 approximately 54,000 will exercise at home.

## Module 12: Statistics

### Topic 2: Using Mathematical Models of Quadratic Functions to Make Predictions

#### Self-Check 1

**Self-Check**

A football is punted from a height of 2 feet above the ground. The height of the football at various times is displayed in the table.

Use a quadratic model to predict the height of the football at 3 seconds, assuming that it is not caught by another player on the field.

5 feet       13 feet  
 7 feet       18 feet

**SUBMIT**

Time (seconds)	Height (feet)
0	2
0.5	25
1.0	36
1.5	42
2.0	38
2.5	27

Solve the problem in the image above to check your understanding of the content.


## Module 12: Statistics

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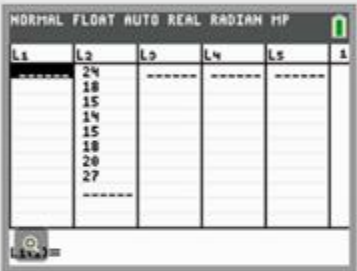
#### Self-Check 1: Answer

**Correct**

That's correct!



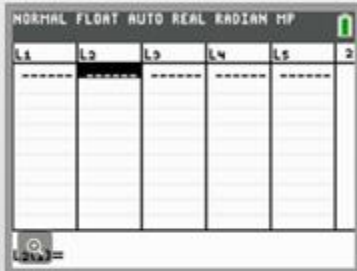
First, clear the date from the previous example. Press **STAT**, then press **ENTER** to choose the Edit function.



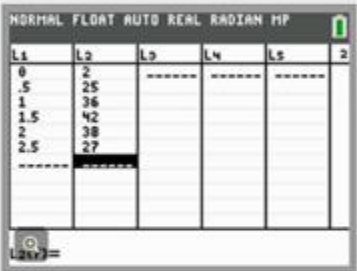
Press the up arrow key to move the cursor to the L1 header. Press **CLEAR**. Then, press **ENTER**.

**SUBMIT**

**Correct**



Next, move the cursor to the L2 header. Press **CLEAR**. Then, press **ENTER**.



Enter the values in the first column into L1. Enter the values in the second column into L2.

**SUBMIT**

For your reference, the images above show the correct solution to the self-check problem.

## Module 12: Statistics

### Topic 2: Using Mathematical Models of Quadratic Functions to Make Predictions

#### Self-Check 1: Answer

**Correct**

**Part One:** Press **STAT**. Press the right arrow key to access the **CALC** menu. Select the fifth option, **QuadReg**, and press **ENTER**.

**Part Two:** Press **ENTER** for each prompt. If  $a$ ,  $b$ , and  $c$  are rounded to the nearest hundredths, the equation of the curve of best fit can be written as  $y = -16.43x^2 + 50.79x + 2.50$ .

Buttons: Part One, Part Two, Part Three, Part Four, Continue

**SUBMIT**

**Correct**

Now that you have determined the equation of the curve of best fit, you can use it make a prediction of the height of the football at 3 seconds. Substitute 3 for  $x$ . Then, evaluate the expression on the right side of the equation.

$$\begin{aligned}y &= -16.43x^2 + 50.79x + 2.50 \\y &= -16.43(3)^2 + 50.79(3) + 2.50 \\y &= -16.43(3)^2 + 50.79(3) + 2.50 \\&= -147.87 + 152.37 + 2.50 \\&= 7\end{aligned}$$

Based on the quadratic model, at 3 seconds the football will be at a height of **7 feet**.

Buttons: Part One, Part Two, Part Three, Part Four, Continue

**SUBMIT**

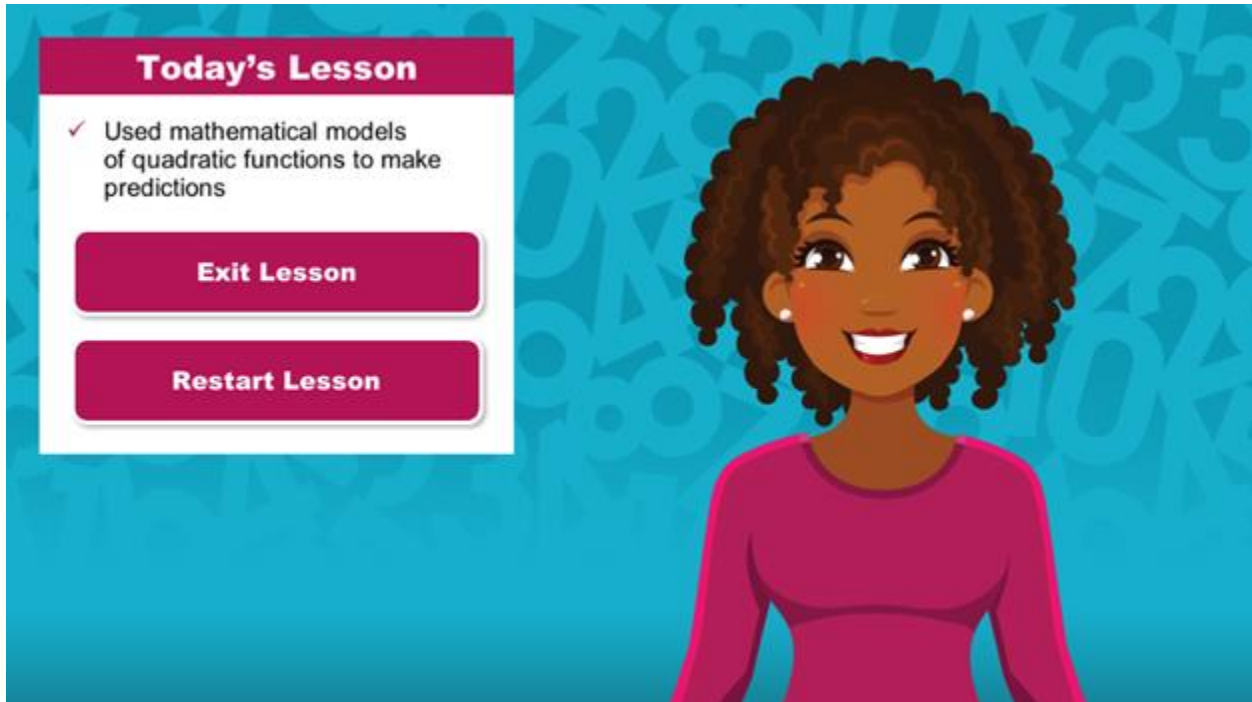
For your reference, the images above show the correct solution to the self-check problem.



## Module 12: Statistics

### Topic 2: Using Mathematical Models of Quadratic Functions to Make Predictions

#### Conclusion

A digital interface for a lesson conclusion. On the left, a white box with a pink header titled "Today's Lesson" contains a checkmark and the text "Used mathematical models of quadratic functions to make predictions". Below this are two pink buttons: "Exit Lesson" and "Restart Lesson". On the right, a cartoon illustration of a smiling woman with dark curly hair and a pink top is set against a blue background with faint mathematical symbols like pi, infinity, and numbers.

You have reached the conclusion of this lesson where you learned how to use mathematical models of quadratic functions to make predictions.