

SMART Notebook™ 14 Math Tools

Windows® operating systems

User's guide

SMART®

Product registration

If you register your SMART product, we'll notify you of new features and software upgrades.

Register online at smarttech.com/registration.

Keep the following information available in case you need to contact SMART Support.

Product key:

Date of purchase:

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Chapter 1

Introduction to SMART Notebook Math Tools

If you install SMART Notebook™ Math Tools on your computer, SMART Notebook software includes mathematical features, such as equation editing, handwriting recognition for mathematical terms, additional shape tools and graph generation.

Displaying the SMART Notebook Math Tools buttons

To display the SMART Notebook Math Tools buttons, click **Show Math Buttons** .

To hide the SMART Notebook Math Tools buttons when done, click **Show Math Buttons**  again.

The following table describes the functions of the SMART Notebook Math Tools buttons.

Button	Command	Action
	Graphs	Insert Cartesian, quadrant or number line graphs.
	Irregular Polygons	Insert irregular polygons.
	Graph Tables	Insert graph tables.
	Equations	Insert equations.

In addition to the above buttons, there are two other buttons you use with SMART Notebook Math Tools:

Button	Command	Action
	Regular Polygons	Insert regular polygons.
	Measurement Tools	Use a ruler, protractor or compass.

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Working with equations

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You can insert or write equations in .notebook file pages using SMART Notebook Math Tools.

You can solve inserted or written mathematical expressions at any time.

Inserting equations

You can insert equations into a page using the *Equation* editor.

To insert equations

1. Display the SMART Notebook Math Tools buttons (see page 1).
2. Press **Equations** Σ .
3. Press where you want to place the equation.

The *Equation* editor and a text box appear.

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4. Type the numerals you want to add to your equation. Press the buttons in the *Equation* editor for the mathematical terms you want to add to your equation.
5. After you finish creating your equation, press outside of the text object.

NOTE

If you insert a mathematical expression, you can solve the expression (see *Solving mathematical expressions* on page 8). You can also generate a graph based on this equation (see *Generating graphs from equations* on page 22).

Writing equations

You can write equations on the page using pen tray pens (on interactive whiteboards) or a tethered pen and pen tool buttons (on interactive pen displays).

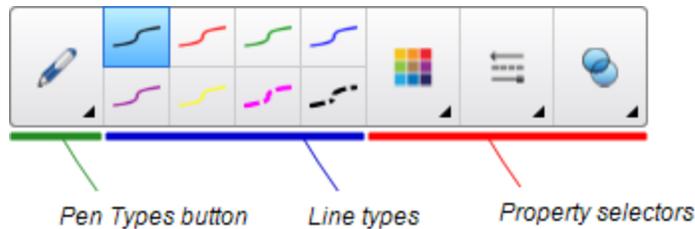
NOTE

You can also insert equations using the *Equation* editor (see *Inserting equations* on the previous page).

To write equations

1. Press **Pens** .

The Pens tool buttons appear.



2. Press **Pen Types**, and then select **Pen**.
3. Select a line type.
4. Write the equation on the interactive screen using the tips in the following sections.
5. Press the equation's menu arrow, and then select **Recognize Math Ink**.

The equation appears surrounded by a blue border. A green circle  and a red circle  appear below the equation.

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6. If the equation appears correctly, press the green circle .



NOTES

- SMART Notebook Math Tools recognizes many characters, including numbers, operators, Roman letters, Greek letters and other mathematical symbols (see *Recognized mathematical symbols* on the next page).
- SMART Notebook Math Tools also recognizes many mathematical functions (see *Recognized mathematical functions* on page 7).
- If you write a mathematical expression, you can solve it (see *Solving mathematical expressions* on page 8). You can also generate a graph based on this equation (see *Generating graphs from equations* on page 22).

If your equation appears incorrectly, press the red circle , erase the equation and write it again. Don't attempt to write over your original equation.

Tips for writing equations

Consider the following when you write equations:

- Write each symbol clearly and don't overlap symbols.
- Leave space between the characters, symbols, formulas and equations that you write.
- Draw a multiplication symbol as a six-pointed asterisk, for example, \times $*$.
- If your equation involves multiple lines, such as fractions, leave space between these lines. However, don't separate a single line equation over multiple lines.
- Align superscripts, such as exponents, to the right of and above the adjacent character or symbol. Don't allow a character and a superscript to overlap.
- Write problems sequentially from left to right and from top to bottom.
- Tap to make a decimal point. Don't draw a tiny ball or scribble a mark.
- Don't use j as a variable unless you're writing a trigonometric expression or a complex expression. Don't use i or o as variables unless you're writing a trigonometric expression.
- Don't use e as a variable unless you're writing an exponential expression.
- Enclose exponents in parentheses.

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Tips for writing trigonometric equations

Consider the following when you write trigonometric equations:

- Enclose variables in parentheses, for example, $\sin(x)$.
- Separate multiple trigonometric expressions using a multiplication sign, for example, $\sin(A)\cos(A)$.

Tips for writing logarithmic equations

Consider the following when you write exponents, logarithms and geometric series:

- SMART Notebook Math Tools recognizes $\log(N)$ as $\log_{10}N$.
- SMART Notebook Math Tools recognizes $\log M$ as $\log m$ or $\log M$ (natural log).
- SMART Notebook Math Tools supports $\log_2 M$ and $\log_{10} M$ only.
- Write the natural logarithm (\ln) as \log .
- Write \log_2 as $\log 2$. Write \log_{10} as $\log 10$. SMART Notebook Math Tools doesn't support subscripts.

Tips for solving multiple line equations

SMART Notebook Math Tools can solve some multiple-lined equations if you select all the equations, press the equation's menu arrow, and then select **Recognize Math Ink**.

Recognized mathematical symbols

SMART Notebook Math Tools recognizes the mathematical symbols and functions in your equation and converts them into typed text. SMART Notebook Math Tools recognizes many symbols, including numbers, operators, Roman letters, Greek letters and other mathematical symbols.

Numbers

1 2 3 4 5 6 7 8 9 0
+ 7 8

Operators

+ - * / — √ > < ≥ ≤ ≠ ∑ ∏ lim
→

Roman letters

a b c d e f g h i j k l m n o p q r s t u v w x y z
b d f h i k l p y
A B D E F G H L M N Q R T
E G M N

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Greek letters

$\alpha \beta \gamma \delta \varepsilon \mu \nu \lambda \eta \rho \sigma \pi \psi \tau$

Other mathematical symbols

$()^2 e (0..1) \dot{x}(t) \int \infty$

Recognized mathematical functions

SMART Notebook Math Tools recognizes the mathematical symbols and functions in your equation and converts them into typed text. SMART Notebook Math Tools recognizes mathematical functions in the following categories:

- Logarithmic functions
- Trigonometric functions

Logarithmic functions

Function	Description
$\log(a)$	natural logarithm
$\log_{10}(a)$	base 10 logarithm
$\log_2(a)$	base 2 logarithm

Trigonometric functions

Function	Description
$\text{acos}(a)$	inverse cos function
$\text{asin}(a)$	inverse sin function
$\text{atan}(a)$	inverse tan function
$\text{cos}(a)$	cos function
$\text{cosh}(a)$	hyperbolic cos function
$\text{cot}(a)$	cot function
$\text{coth}(a)$	hyperbolic cot function
$\text{csc}(a)$	cosecant function
$\text{sec}(a)$	secant function
$\text{sin}(a)$	sin function
$\text{sinc}(a)$	sinc function

Function	Description
$\sinh(a)$	\sinh function
$\tan(a)$	\tan function
$\tanh(a)$	\tanh function

Solving mathematical expressions

If you insert or write a mathematical expression on a page, you can solve this expression and display the complete equation using the available menu options.



NOTES

- You can also generate graphs from equations (see *Generating graphs from equations* on page 22).
- SMART Notebook Math Tools can solve some equations numerically but not symbolically, and it can solve some equations symbolically but not numerically. If a solution type isn't available, you're unable to select it in the menu.
- Write equation in the form $y = f(x)$.

To solve an expression numerically

1. Select the equation.
2. Press the equation's menu arrow, and then select **Math Actions > Simplify Numerically**.

To solve an expression symbolically

1. Select the equation.
2. Press the equation's menu arrow, and then select **Math Actions > Simplify Symbolically**.

To find an equation's zero value

1. Select the equation.
2. Press the equation's menu arrow, and then select **Math Actions > Find Zeroes**.

To find an equation's minimum and maximum values

1. Select the equation.
2. Press the equation's menu arrow, and then select **Math Actions > Find Extrema**.

Chapter 3

Working with shapes

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With SMART Notebook Math Tools, you can create regular and irregular polygons and then edit these shapes' interior angles, side lengths and vertices.

You can also divide a circle, square or rectangle into separate pieces of equal area.

Inserting regular polygons

You can insert regular polygons with 3 to 15 sides using the Regular Polygons tool.

To insert a regular polygon

1. Press **Regular Polygons** .

The Regular Polygons tool buttons appear.

2. Select a polygon. The number in the polygon represents the number of sides.



TIP

To display more polygons, click the down arrow ▼.

3. Create a shape by pressing where you want to place the shape and dragging until the shape is the size you want.

Inserting irregular polygons

In addition to creating shapes using the SMART Notebook software Shapes tool, you can insert irregular polygons using the Irregular Polygons tool.

To insert irregular polygons

1. Display the SMART Notebook Math Tools buttons (see page 1).
2. Press **Irregular Polygons** .
3. Press where you want to place the shape's first vertex.
The first vertex appears as a small red circle.
4. Press where you want to place the next vertex.
A line appears between the two vertices.
5. Repeat step 4 to add more vertices.
6. Press the first vertex's red circle to stop adding vertices and complete the shape.



NOTE

After creating an irregular polygon, you can display its interior angles and display its side lengths (see *Displaying interior angles* below and *Displaying and editing side lengths* on the next page).

Displaying interior angles

You can display the interior angles of a shape.



NOTES

- If you display these angles and then edit the vertices of the shape (see *Displaying and editing the vertices of a shape* on page 12), SMART Notebook Math Tools updates the labels and displays the new interior angles.
- You can also display side lengths (see *Displaying and editing side lengths* on the next page).

To display interior angles

1. Select the shape.
2. Press the shape's menu arrow, and then select **Show/Hide Interior Angles**.



NOTE

To hide interior angles, press the shape's menu arrow, and then select **Show/Hide Interior Angles** again.

Displaying and editing side lengths

You can display the side lengths of a shape. If you edit the displayed length, SMART Notebook Math Tools recalculates and displays the lengths of the other sides.



NOTES

- If you display these lengths and then edit the vertices of the shape (see *Displaying and editing the vertices of a shape* on the next page), SMART Notebook Math Tools updates the labels and displays the new side lengths.
- You can also display interior angles (see *Displaying interior angles* on the previous page).

To display side lengths

1. Select the shape.
2. Press the shape's menu arrow, and then select **Show/Hide Side Lengths**.

SMART Notebook Math Tools calculates the lengths based on the ruler's default units.



NOTE

To hide side lengths, press the shape's menu arrow, and then select **Show/Hide Side Lengths** again.

To edit side lengths

1. If you haven't done so already, display the side lengths.
2. Double-click the side length you want to change.
3. Type the new length.
4. Press somewhere else on the page.

SMART Notebook Math Tools recalculates and displays the lengths of the other sides.

Displaying and editing the vertices of a shape

You can edit the position of a shape's vertices. If you're displaying the shape's interior angles or side lengths, SMART Notebook Math Tools updates the labels and displays the new interior angles or side lengths automatically.

To display the vertices of a shape

1. Select the shape.
2. Press the shape's menu arrow, and then select **Show/Hide Vertices**.

A red circle replaces each of the shape's vertices.

To edit the vertices of a shape

1. If you haven't done so already, display the shape's vertices.
2. Drag a red circle to move that vertex.
3. When you finish editing the shape's vertices, press anywhere else on the page.

To hide the vertices of a shape

1. Select the shape.
2. Press the shape's menu arrow, and then select **Show/Hide Vertices** again.

Dividing shapes

You can divide a circle, square or rectangle into separate pieces of equal area. You can then edit and manipulate these pieces as individual objects.



NOTE

You're unable to divide other shape types in this way.

To divide a shape

1. Select the shape.
2. Press the shape's menu arrow, and then select **Divide Shape**.

The *Shape Division* dialog box appears.

3. Select the number of pieces you want to divide the shape into from the *Divide shape into* drop-down list.

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4. Press **OK**.

The shape divides into separate objects.

Chapter 4

Working with graphs

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With SMART Notebook Math Tools, you can create Cartesian, quadrant and number line graphs, as well as generate graphs from equations and tables and tables from graphs.

Inserting Cartesian graphs

You can insert a Cartesian graph into a page. You can include the default Cartesian graph or create a graph with customized axes and insert this instead. After you insert the graph, you can add points to it.



NOTE

After you insert the graph, you can also manipulate its position, size and rotation, as well as customize its title, axes and labels (see *Manipulating graphs* on page 19 and *Customizing graphs* on page 20).

To insert the default Cartesian graph

1. Display the SMART Notebook Math Tools buttons (see page 1).
2. Press **Graphs** , and then press **Cartesian** .

A Cartesian graph appears.

To insert a customized Cartesian graph

1. Display the SMART Notebook Math Tools buttons (see page 1).
2. Press **Graphs** , and then press **Wizard** .
The *Insert Graph* dialog box appears.
3. Select **Cartesian**, and then press **Next**.
4. Customize the graph by doing the following:
 - To change the increments of the numbers along either of the graph's axes, type a value in the *Step* box.
 - To change the start and end points of the X (horizontal) axis and Y (vertical) axis, type values in the *Start* and *End* boxes.
 - To display a graph without horizontal lines, clear the **Horizontal Lines** check box.
 - To display a graph without vertical lines, clear the **Vertical Lines** check box.
 - To display a graph without numbers on the axes, clear the **Show Numbers** check box.
5. Press **Finish**.

To insert points in the graph

1. Double-click the position in the graph where you want to place a point.
2. Repeat step 1 until you've placed all the points you want to add to the graph.



NOTE

You can generate a table of values based on your graph (see *Generating tables from graphs* on page 24).

To remove points from the graph

1. Double-click the point you want to remove.
2. Repeat step 1 until you've removed all the points you want to remove from the graph.

Inserting quadrant graphs

You can insert a quadrant graph into a page. You can include the default quadrant graph or create a graph with customized axes and insert this instead. After you've inserted the graph, you can add points to it.



NOTE

After you insert the graph, you can also manipulate its position, size and rotation, as well as customize its title, axes and labels (see *Manipulating graphs* on page 19 and *Customizing graphs* on page 20).

To insert the default quadrant graph

1. Display the SMART Notebook Math Tools buttons (see page 1).
2. Press **Graphs** , and then press **Quadrant** .

A quadrant graph appears.

To insert a customized quadrant graph

1. Display the SMART Notebook Math Tools buttons (see page 1).
2. Press **Graphs** , and then press **Wizard** .
- The *Insert Graph* dialog box appears.
3. Select **Quadrant**, and then press **Next**.
4. Customize the graph by doing the following:
 - To change the increments of the numbers along either of the graph's axes, type a value in the *Step* box.
 - To change the start and end points of the X (horizontal) axis and Y (vertical) axis, type values in the *Start* and *End* boxes.
 - To display a graph without horizontal lines, clear the **Horizontal Lines** check box.
 - To display a graph without vertical lines, clear the **Vertical Lines** check box.
 - To display a graph without numbers on the axes, clear the **Show Numbers** check box.
5. Press **Finish**.

■ To insert points in the graph

1. Double-click the position in the graph where you want to place a point.
2. Repeat step 1 until you've placed all the points you want to add to the graph.



NOTE

You can generate a table of values based on your graph (see *Generating tables from graphs* on page 24).

■ To remove points from the graph

1. Double-click the point you want to remove.
2. Repeat step 1 until you've removed all the points you want to remove from the graph.

Inserting number line graphs

You can insert a number line graph into a page. You can include the default number line or create a customized axis and insert this instead.



NOTE

After you insert the graph, you can also manipulate its position, size and rotation, as well as customize its title, axes and labels (see *Manipulating graphs* on the next page and *Customizing graphs* on page 20).

■ To insert the default number line graph

1. Display the SMART Notebook Math Tools buttons (see page 1).
 2. Press **Graphs** , and then press **Number Line** .
- A number line graph appears.

■ To insert a customized number line graph

1. Display the SMART Notebook Math Tools buttons (see page 1).
 2. Press **Graphs** , and then press **Wizard** .
- The *Insert Graph* dialog box appears.
3. Select **Number Line**, and then press **Next**.

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4. Customize the graph by doing the following:
 - To change the increments of the numbers along the axis, type a value in the *Step* box.
 - To change the start and end points of the axis, type values in the *Start* and *End* boxes.
 - To display a graph without numbers on the axes, clear the **Show Numbers** check box.
5. Press **Finish**.

Selecting graphs

Before you can manipulate a graph or access its menu options, you must select it.

After you select the graph, you can:

- Move the graph.
- Customize the graph.
- Generate a table from the graph.

To select the graph

1. Press **Select** .
2. Press outside but near to the upper-right corner of the graph, and then drag a rectangle to the opposite corner.

A selection rectangle appears around the graph.

- The circle in the graph's lower-right corner is a resize handle.
- The downward arrow in the graph's upper-right corner is a menu arrow.

Manipulating graphs

You can insert a Cartesian graph or quadrant graph into a page or generate a graph from an equation or a table of values. After you insert the graph, you can move or change the zoom level of this graph.



NOTE

You can also customize a graph's title, axes and labels (see *Customizing graphs* on the next page).

To move a graph

1. Select the graph (see page 19).
2. Press somewhere inside the border but outside of the graph, and then drag to a different position on the page.

To change a graph's zoom level

1. Select the graph (see page 19).
2. If no icons appear below the graph, press the two downward arrows  in the graph's lower-right corner.

Eight icons appear below the graph.

3. Press  to zoom in.

OR

Press  to zoom out.

To display a different part of a graph

1. Select the graph (see page 19).
2. If no icons appear below the graph, press the two downward arrows  in the graph's lower-right corner.

Eight icons appear below the graph.

3. Press the hand icon .

4. Drag the graph.

5. When SMART Notebook Math Tools displays the part of the graph you want to view, press the hand icon  again.

Customizing graphs

You can insert a Cartesian graph or quadrant graph into a page or generate a graph from an equation or a table of values. After you insert the graph, you can customize the title of the graph and edit the start point, end point, labels and grid lines of its axes. You can also add a line of best fit based on the points in the graph.



NOTE

You can also manipulate a graph's position and size (see *Manipulating graphs* on the previous page).

To customize a graph using the hidden menu

1. Select the graph (see page 19).
2. If no icons appear below the graph, press the two downward arrows  in the graph's lower-right corner.
3. Use the following icons to customize the graph:

Button	Command	Action
	Show/Hide Lines	Display horizontal and vertical lines on the graph
	Show/Hide Point Labels	Display point labels
	Show/Hide Line of Best Fit	Display a line of best fit, based on the points you add to the graph
	Show/Hide Numbers	Display numbers on the axes
	Show/Hide X/Y Labels and Titles	Display labels on the axes and a title above the graph

To customize a graph using the Properties tab

1. Select the graph (see page 19).
2. Press the graph's menu arrow, and then select **Properties**.
3. Do the following:
 - To include a label above the graph, type it in the *Title* box.
 - To display numbers on the axes, select **Show Numbers** or clear this check box to remove them.
 - To display vertical lines, select **Vertical Lines** or clear this check box to remove them.
 - To display horizontal lines, select **Horizontal Lines** or clear this check box to remove them.
 - To display point labels, select **Show Point Labels** or clear this check box to remove them.
 - To change the labels on the axes, the range of the axes or the increments of the numbers on the axes, type new values in the *Label*, *Start*, *End* and *Step* boxes.

Generating graphs from equations

If you insert or write an equation, you can generate and display a graph based on the equation.

To generate a graph from an equation

1. Select the equation.
2. Press the equation's menu arrow, and then select **Math Actions > Generate Graph**.

The graph appears.



NOTE

After you insert the graph, you can also manipulate its position, size and rotation, as well as customize its title, axes and labels (see *Manipulating graphs* on page 19 and *Customizing graphs* on page 20).

If you update the information in the equation, SMART Notebook Math Tools updates the graph.

To break the connection between an equation and a graph

1. Select the equation or the graph.

A blue highlight appears around both the equation and the graph. An X in a blue circle appears between them.

2. Press the X symbol .

If you update the information in the equation and the connection is broken, SMART Notebook Math Tools doesn't update the graph.

To reconnect an equation and a graph

1. Select the equation.

A selection rectangle appears around the table and a small blue square appears beside it.

2. Select the blue square and drag it over the graph.

Generating graphs from tables

You can create a table of values and then generate a graph based on these values.

To generate a graph from a table

1. Display the SMART Notebook Math Tools buttons (see page 1).
2. Press **Graph Tables** .
A grid appears.
3. Select the number of rows that you want in the table. The cells of the grid correspond to the cells of your table.
The table appears on the page.
4. Type values into the table's cells.
5. Press the table's menu arrow, and then select **Math Actions > Generate Graph**.
If you update the information in the table, SMART Notebook Math Tools updates the graph and vice versa.

To break the connection between a graph and a table

1. Select the table or the graph.
A blue highlight appears around both the table and the graph. An X in a blue circle appears between them.
2. Press the X symbol .
If you update the information in the table and the connection is broken, SMART Notebook Math Tools doesn't update the graph and vice versa.

To reconnect a graph and a table

1. Select the table.
A selection rectangle appears around the table and a small blue square appears beside it.
2. Select the blue square and drag it over the graph.

Generating tables from graphs

If you insert a Cartesian or quadrant graph, and then insert points into it, you can generate a table of values based on these points.

To generate a table from a graph

1. Select the graph.
2. Press the graph's menu arrow, and then select **Math Actions > Generate Table**.

If you add or remove the points in the graph, SMART Notebook Math Tools updates the table and vice versa.

To break the connection between a table and a graph

1. Select the table or the graph.

A blue highlight appears around both the table and the graph. An X in a blue circle appears between them.

2. Press the X symbol .

If you update the information in the graph and the connection is broken, SMART Notebook Math Tools doesn't update the table and vice versa.

To reconnect a table and a graph

1. Select the table.

A selection rectangle appears around the table and a small blue square appears alongside it.

2. Select the blue square and drag it over the graph.

Adding shapes to graphs

You can add a shape to a graph, and then display the coordinates of its vertices.

To add a shape to a graph

1. Create a shape.
2. Press the shape and drag it over the graph.

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To display the coordinates of the shape's vertices

1. Select the shape.
2. Press the shape's menu arrow, and then select **Show/Hide Vertex Points**.



NOTE

To hide the coordinates, press the shape's menu arrow, and then select **Show/Hide Vertex Points** again.

To display side lengths

1. Select the shape.
2. Press the shape's menu arrow, and then select **Show/Hide Side Lengths**.

SMART Notebook Math Tools calculates the lengths based on the graph's units.

To reflect the shape

1. Select the shape.
2. Press the shape's menu arrow, and then select **Reflect Shape**.
3. Select **Reflect over X=0**, **Reflect over Y=0**, **Reflect over Y=X** or **Reflect over Y=-X**.

A reflection of the shape appears on the graph. The original shape doesn't move.

Appendix A

Activating SMART Notebook Math Tools

To activate SMART Notebook Math Tools, you need a product key. This product key is not the same one you used to activate SMART Notebook software.

Purchasing a product key

Purchase a product key from your authorized SMART reseller (smarttech.com/wheretobuy).

TIP

After purchasing a product key, record it in the inside cover of this user's guide for future reference.

Activating SMART Notebook Math Tools with a product key

After obtaining a product key, you can activate SMART Notebook Math Tools.

To activate SMART Notebook Math Tools

1. In Windows® 7 operating systems, select **Start > All Programs > SMART Technologies > SMART Tools > SMART Product Update**.

OR

In Windows 8 or 8.1 operating systems, go to the *Apps* screen and then scroll to and press **SMART Product Update**.

The *SMART Product Update* window appears.

APPENDIX A

Activating SMART Notebook Math Tools

2. Press **Activate** or **Manage** for the software you want to activate.

The *SMART Software Activation* window appears.



NOTE

The value in the *Status* column indicates the status for each product:

Value	Description
<i>Installed</i>	The software is installed.
<i>Activated</i>	The software is installed and activated with a perpetual or maintenance license.
<i>Subscription</i>	The software is installed and activated with a subscription license. The number in parentheses indicates the days remaining in the subscription period.
<i>Expiring</i>	The software is installed but not yet activated. The number in parentheses indicates the days remaining in the evaluation period.
<i>Expired</i>	The software is installed but not yet activated. The evaluation period is over. You're unable to use the software until you activate it.
<i>Unknown</i>	The software's status is unknown.

3. Press **Add**.
4. Follow the on-screen instructions to activate SMART Notebook Math Tools using the product key.

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