

# Symbolic Equation Module

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## Symbolic Equation Module

The Symbolic Equation Module (SEM) allows students to enter answers in a variety of formats, ranging from simple numbers or letters to complex mathematical equations. The screenshot below shows an example of an SEM question. The SEM toolbar is highlighted by the red oval.

The screenshot shows a web browser window displaying a Smartwork5 question. The question is titled "01 Question (1 point)" and is worth 1 point. The question text is: "In a mixture of three gases (A, B, and C), the number of moles of each gas is known ( $n_A$ ,  $n_B$ , and  $n_C$ ). How would the mole fraction of gas A ( $\chi_A$ ) be calculated using the values  $n_A$ ,  $n_B$ , and  $n_C$ ?" Below the question is a text input field with the label  $X_A =$ . A red oval highlights the SEM toolbar, which contains the following symbols:  $x$ ,  $x$ ,  $-$ ,  $+$ ,  $\log$ ,  $\cos$ , and  $\delta$ . The toolbar is located at the bottom of the question area.

An enlarged version of the SEM Toolbar (the highlighted area above) is shown below.



The table below provides a summary of each of the tools and their functions:

| SEM Tool Symbols | SEM Tool Names | SEM Tool Functions |
|------------------|----------------|--------------------|
|------------------|----------------|--------------------|

|   |  |   |
|---|--|---|
|    | <p>Superscript</p>   | <p>The <i>superscript</i> tool is generally used when adding exponents to a variable or expression. This tool can also be accessed via the hotkey SHIFT+^</p>                                     |
|    | <p>Subscript</p>   | <p>The <i>subscript</i> tool is used to add numbers to a chemical formula or labels to variables. This tool can also be accessed via the hotkey SHIFT+_</p>                                       |
|  | <p>Parentheses</p>   | <p>The <i>Parentheses</i> menu is used to add a fraction bar, a set of parentheses, or brackets to an expression or equation. The tool contains a dropdown menu, which provides four options.</p> |
|   | <p>Parentheses dropdown menu</p>  | <p>In the Parentheses dropdown menu, the four options from left to right are: fraction bar, parenthesis, brackets, and absolute value.</p>  |
|   | <p>Simple math</p>   | <p>The <i>Simple math</i> menu is used to insert a variety of basic math functions and symbols. The tool contains a dropdown menu, which provides 21 options.</p>                                 |



Simple math dropdown menu



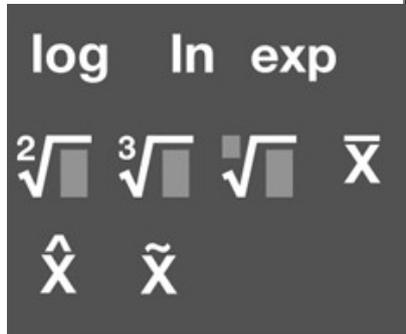
The Simple math dropdown menu contains a variety of basic math functions and notations, including operations, equality/inequality symbols, exponential notation, and other useful mathematics symbols.



Advanced math

The *Advanced math* menu is used to insert more complicated math functions and symbols. The tool contains a dropdown menu, which provides nine options.

Advanced math dropdown menu



The Advanced math dropdown menu includes log, natural log, and exponential functions. It also contains root functions and other mathematical variable labels.



Trigonometry function

The *Trigonometry function* menu is used to insert trigonometry functions. The tool contains a dropdown menu, which provides six options.

Trigonometry function dropdown menu

The trigonometry functions contained within the dropdown

|   |  |   |
|---|--|---|
|   |                                     | <p>menu are: sine, cosine, tangent, cotangent, secant, and cosecant.</p>  |
|  | <p>Greek letters</p>   | <p>The <i>Greek letters</i> menu allows students to enter the appropriate upper- or lower-case Greek letter(s) into the answer blank. Clicking the icon opens the Greek letter dropdown menu.</p> |
|   | <p>Greek letter dropdown menu</p>  | <p>The Greek letter dropdown menu gives access to both lower-case (top) and upper-case (bottom) Greek letters.</p>  |

Here is a video introduction of the Symbolic Equation Module:

Your browser does not support HTML5 video.

## Using the Symbolic Equation Module (SEM)

### How to use the superscript tool

The superscript tool within the SEM functions identically to the superscript tool in the Chemical Equation Module. An example problem that requires the use of the superscript tool is shown below.

How to use SW5 - S... 12/31/17 SCORE --% helpnotestudent@gmail.com

1st attempt

Part 1 (1 point) [See Periodic Table](#) [See Hint](#)

$$\frac{3.000 \times 10^2 \frac{\text{m}}{\text{s}}}{227.7 \text{ m}} = 1.32$$

Part 2 (1 point) [See Hint](#)

05/15 [SUBMIT ANSWER](#)

To enter the answer ( $\text{s}^{-1}$ ), click in the light-gray answer blank to activate the cursor.

How to use SW5 - S... 12/31/17 SCORE --% helpnotestudent@gmail.com

1st attempt

Part 1 (1 point) [See Periodic Table](#) [See Hint](#)

$$\frac{3.000 \times 10^2 \frac{\text{m}}{\text{s}}}{227.7 \text{ m}} = 1.32$$

Part 2 (1 point) [See Hint](#)

05/15 [SUBMIT ANSWER](#)

In the answer blank, type "s" and then click on the superscript icon, . This opens the superscript window within the answer blank.

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How to use SW5 - S... 12/31/17 SCORE --% helpnotestudent@gmail.com

1st attempt

Part 1 (1 point) See Periodic Table See Hint

$$\frac{3.000 \times 10^2 \frac{\text{m}}{\text{s}}}{227.7 \text{ m}} = 1.32 \text{ s}$$

Part 2 (1 point) See Hint

05/15 SUBMIT ANSWER

In the superscript window, enter the exponent for the answer (-1) and click outside the answer blank. You are now ready to submit your answer.

Digital Resources for Chem Smartwork5

How to use SW5 - S... 12/31/17 SCORE --% helpnotestudent@gmail.com

1st attempt

Part 1 (1 point) See Periodic Table See Hint

$$\frac{3.000 \times 10^2 \frac{\text{m}}{\text{s}}}{227.7 \text{ m}} = 1.32 \text{ s}^{-1}$$

Part 2 (1 point) See Hint

05/15 SUBMIT ANSWER

Here is a video demonstration of the superscript tool:

Your browser does not support HTML5 video.

## How to use the subscript and parentheses tools

To answer the question below, we will need to make use of the subscript (  $X_{\cdot}$  ) and parentheses (  $\frac{\quad}{\quad}$  ) tools. While the *subscript* tool can be used in a very similar manner to the *superscript* tool (described above), there is also an alternate method to using these tools which can be helpful in some instances. The problem below asks us to express the mole fraction of gas A ( $X_A$ ) in terms of the moles of gases A, B, and C,  $n_A$ ,  $n_B$ , and  $n_C$ , respectively.

The answer is: 
$$\frac{n_A}{n_A + n_B + n_C}$$

The screenshot shows a web browser window with a Smartwork5 interface. The page title is "How to use SW5 - S...". The date is 12/31/17. The user's email is helpnotestudent@gmail.com. The problem is titled "1st attempt". It asks: "In a mixture of three gases (A, B, and C), the number of moles of each gas is known ( $n_A$ ,  $n_B$ , and  $n_C$ ). How would the mole fraction of gas A ( $X_A$ ) be calculated using the values  $n_A$ ,  $n_B$ , and  $n_C$ ?" Below the question is a calculator tool with a toolbar containing symbols for multiplication, division, addition, subtraction, logarithm, cosine, and delta. The input field shows  $X_A =$  followed by a light-gray box for the answer. At the bottom, there is a navigation bar with "01/15" and a "SUBMIT ANSWER" button.

To enter the answer, click in the answer blank (light-gray) to activate the cursor.

How to use SW5 - S... 12/31/17 SCORE --% helpnotestudent@gmail.com

1st attempt

[See Periodic Table](#) [See Hint](#)

In a mixture of three gases (A, B, and C), the number of moles of each gas is known ( $n_A$ ,  $n_B$ , and  $n_C$ ).

How would the mole fraction of gas A ( $\chi_A$ ) be calculated using the values  $n_A$ ,  $n_B$ , and  $n_C$ ?

$X_A =$

< 01/15 >

To format our answer correctly, we must add a fraction bar. To do this, click on the parentheses tool, . This will display the dropdown menu.

How to use SW5 - S... 12/31/17 SCORE --% helpnotestudent@gmail.com

1st attempt

[See Periodic Table](#) [See Hint](#)

In a mixture of three gases (A, B, and C), the number of moles of each gas is known ( $n_A$ ,  $n_B$ , and  $n_C$ ).

How would the mole fraction of gas A ( $\chi_A$ ) be calculated using the values  $n_A$ ,  $n_B$ , and  $n_C$ ?

$X_A =$

< 01/15 >

From the dropdown menu, select the Fraction option (circled in red above) to add the Fraction bar to the answer blank.

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1st attempt

See Periodic Table See Hint

In a mixture of three gases (A, B, and C), the number of moles of each gas is known ( $n_A$ ,  $n_B$ , and  $n_C$ ).

How would the mole fraction of gas A ( $\chi_A$ ) be calculated using the values  $n_A$ ,  $n_B$ , and  $n_C$ ?

X X  $\frac{\square}{\square}$  + log cos  $\delta$

$X_A = \frac{\square}{\square}$

< 01/15 > SUBMIT ANSWER

Click in the top entry blank within the fraction bar window. Using your keyboard, type "nA" (without the quotes) into the blank.

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1st attempt

See Periodic Table See Hint

In a mixture of three gases (A, B, and C), the number of moles of each gas is known ( $n_A$ ,  $n_B$ , and  $n_C$ ).

How would the mole fraction of gas A ( $\chi_A$ ) be calculated using the values  $n_A$ ,  $n_B$ , and  $n_C$ ?

X X  $\frac{\square}{\square}$  + log cos  $\delta$

$X_A = \frac{nA}{\square}$

< 01/15 > SUBMIT ANSWER

To format the A into subscript notation, highlight the A by clicking and dragging the cursor. When you release the mouse button, the A will be highlighted.

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1st attempt

See Periodic Table See Hint

In a mixture of three gases (A, B, and C), the number of moles of each gas is known ( $n_A$ ,  $n_B$ , and  $n_C$ ).

How would the mole fraction of gas A ( $\chi_A$ ) be calculated using the values  $n_A$ ,  $n_B$ , and  $n_C$ ?

$\chi_A = \frac{n_A}{\quad}$

01/15 SUBMIT ANSWER

With the A highlighted, click on the subscript icon,  $\chi_A$ , in the toolbar. The A should now be properly formatted. Note: this alternate method can be similarly used for the superscript tool as well.

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How to use SW5 - S... 12/31/17 SCORE --% helpnotestudent@gmail.com

1st attempt

See Periodic Table See Hint

In a mixture of three gases (A, B, and C), the number of moles of each gas is known ( $n_A$ ,  $n_B$ , and  $n_C$ ).

How would the mole fraction of gas A ( $\chi_A$ ) be calculated using the values  $n_A$ ,  $n_B$ , and  $n_C$ ?

$\chi_A = \frac{n_A}{\quad}$

01/15 SUBMIT ANSWER

To complete the answer, click on the bottom entry blank within the fraction bar window,

and type in "nA+nB+nC" (without the quotes).

**Note:** the answer blank will automatically format the spacing between the addition symbol and the variables. There is no need to manually put spaces between them.

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1st attempt

See Periodic Table See Hint

In a mixture of three gases (A, B, and C), the number of moles of each gas is known ( $n_A$ ,  $n_B$ , and  $n_C$ ).

How would the mole fraction of gas A ( $\chi_A$ ) be calculated using the values  $n_A$ ,  $n_B$ , and  $n_C$ ?

X X  $\frac{\square}{\square}$  + log cos  $\delta$

$X_A = \frac{n_A}{n_A + n_B + n_C}$

< 01/15 > SUBMIT ANSWER

Using the method described above, highlight the A followed by clicking the subscript icon to properly format it. You can follow this same procedure to format the B and C in subscript notation. Note: using this method, you can only highlight/format one letter at a time.

Digital Resources for Chem 101 - Smartwork5

How to use SW5 - S... 12/31/17 SCORE -- % helpnotestudent@gmail.com

1st attempt

See Periodic Table See Hint

In a mixture of three gases (A, B, and C), the number of moles of each gas is known ( $n_A$ ,  $n_B$ , and  $n_C$ ).

How would the mole fraction of gas A ( $\chi_A$ ) be calculated using the values  $n_A$ ,  $n_B$ , and  $n_C$ ?

X X  $\frac{\square}{\square}$  + log cos  $\delta$

$X_A = \frac{n_A}{n_A + n_B + n_C}$

< 01/15 > SUBMIT ANSWER

Here is a video demonstration of the subscript and parentheses tools:

Your browser does not support HTML5 video.

### How to use the simple math and advanced math tools

The simple and advanced math tools contain a variety of mathematical functions, which can be used to write math equations or expressions in the answer blanks. Both tools, as evidenced by the small triangle on the lower-right side of their icons, contain dropdown menus which are displayed upon clicking on the icons.

The simple math dropdown contains basic math operations (addition, multiplication, percent, etc.) and other standard symbols (degree, pi, infinity, etc.). While available via the dropdown menu, many of these can also be typed into the answer blanks. The advanced math tool contains more complex operations such as logs, natural logs, and various roots.

In Part 2 of the problem below, we are asked to solve for x. To input our answer properly, we will use both the simple and advanced math tools. Additionally, we will need to use the parentheses tool,  .

$$\log \left( \frac{a}{b} \right) - 5$$

The correct answer for the problem is:

How to use SW5 - Symbolic Editor 12/31/17 SCORE 3% helpnotestudent@gmail.com

## 12 Question (4 points)

Solve each of these equations for x in the provided equation editor modules. Do not substitute the numerical values of any base 10 logarithms in your calculations, i.e. keep the logarithmic functions in your answer where applicable.

1st attempt

**Part 1 (1 point)** [See Periodic Table](#)

$10^x = a$

$x$   $x$   $-$   $+$   $\log$   $\cos$   $\delta$

x =

**Part 2 (1 point)**

$b \times 10^{(x+5)} = a$

$x$   $x$   $-$   $+$   $\log$   $\cos$   $\delta$

0 OF 15 QUESTIONS COMPLETED < 12/15 > [SUBMIT ANSWER](#)

Click the light-gray answer blank to activate the cursor.

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$x$   $x$   $-$   $+$   $\log$   $\cos$   $\delta$

x =

**Part 2 (1 point)**

$b \times 10^{(x+5)} = a$

$x$   $x$   $-$   $+$   $\log$   $\cos$   $\delta$

x =

**Part 3 (1 point)**

< 12/15 > [VIEW SOLUTION](#) [SUBMIT ANSWER](#)

Click the *advanced math* tool icon, **log**, to display its dropdown menu. From the dropdown, click on the log function. The log function should now appear in the answer blank.

**Note:** If clicking the log function did not make it appear in the answer blank, you may need to again click inside the answer blank to activate it and repeat the steps here to add the log function.

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x =

**Part 2 (1 point)**

$b \times 10^{(x+5)} = a$

x x = + log cos °

x = log

**Part 3 (1 point)**

< 12/15 > VIEW SOLUTION SUBMIT ANSWER

With the cursor active, click on the parenthesis tool, , to reveal its dropdown menu. Click on the second option (parentheses; circled in red below).

How to use SW5 - S... 12/31/17 SCORE 6% helpnotestudent@gmail.com

x =

**Part 2 (1 point)**

$b \times 10^{(x+5)} = a$

x x = + log cos °

x = log

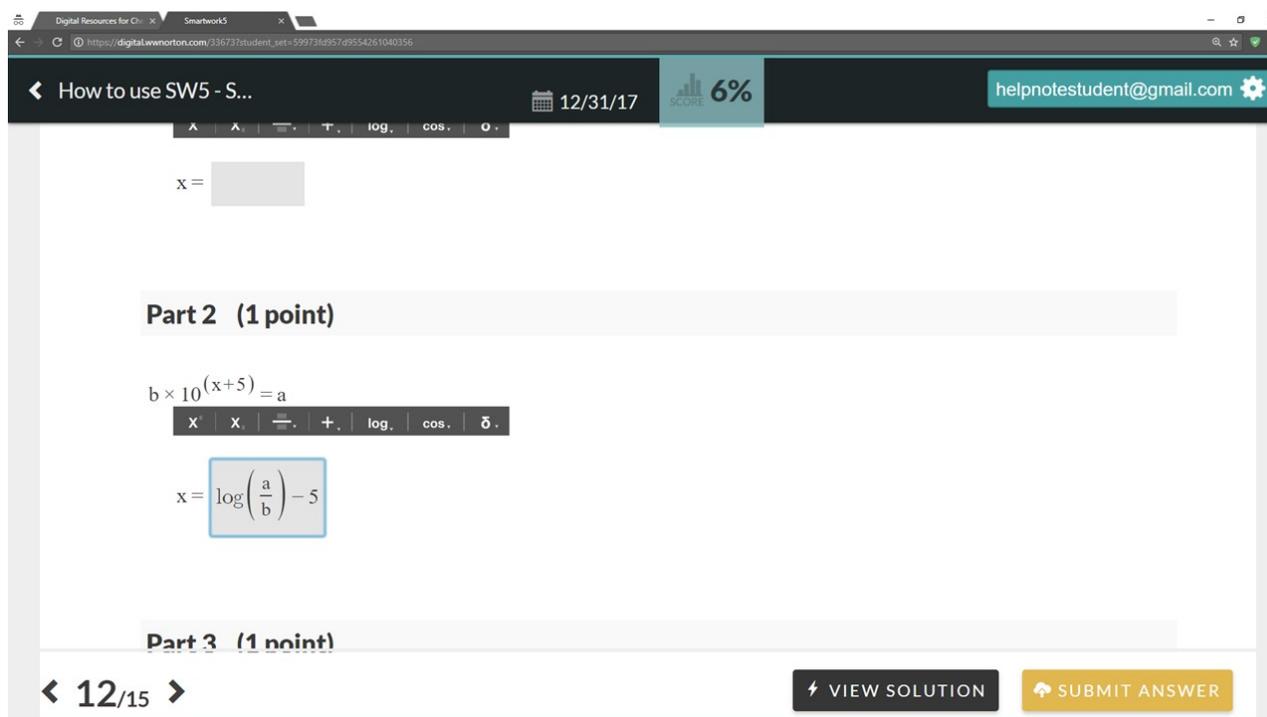
**Part 3 (1 point)**

< 12/15 > VIEW SOLUTION SUBMIT ANSWER





Click in the answer blank to the right of the parentheses. Click on the simple math tool,  , to open its dropdown menu. Click on the subtraction symbol, and type the number "5." Your answer is now complete.



The screenshot shows a web browser window with the URL [https://digital.lwwnorton.com/336737/student\\_set=59972f857d9554261040356](https://digital.lwwnorton.com/336737/student_set=59972f857d9554261040356). The page title is "How to use SW5 - S...". The date is 12/31/17, and the score is 6%. The user's email is helpnotestudent@gmail.com.

The main content area shows a math problem:  $x =$  followed by a blank input field. Below this is "Part 2 (1 point)". The equation is  $b \times 10^{(x+5)} = a$ . A dropdown menu is open, showing options:  $x$ ,  $x$ ,  $\frac{\quad}{\quad}$ ,  $+$ ,  $\log$ ,  $\cos$ , and  $\delta$ . The solution shown is  $x = \log\left(\frac{a}{b}\right) - 5$ .

Below the solution is "Part 3 (1 point)". At the bottom of the page, there is a navigation bar with a left arrow, "12/15", a right arrow, a "VIEW SOLUTION" button, and a "SUBMIT ANSWER" button.

Here is a video demonstration of the simple math and advanced math tools:

Your browser does not support HTML5 video.

### How to use the trigonometry, , and Greek letter, , tools

Similar to the *parentheses* and *math* tools described above, the *trigonometry* and *Greek letter* tools also contain dropdown menus. In the case of the trigonometry tool, the dropdown menu provides trigonometric functions, such as sine and cosine. The Greek letter tool dropdown menu contains uppercase and lowercase Greek letters. The use of these tools is identical to the other tools which contain dropdown menus.

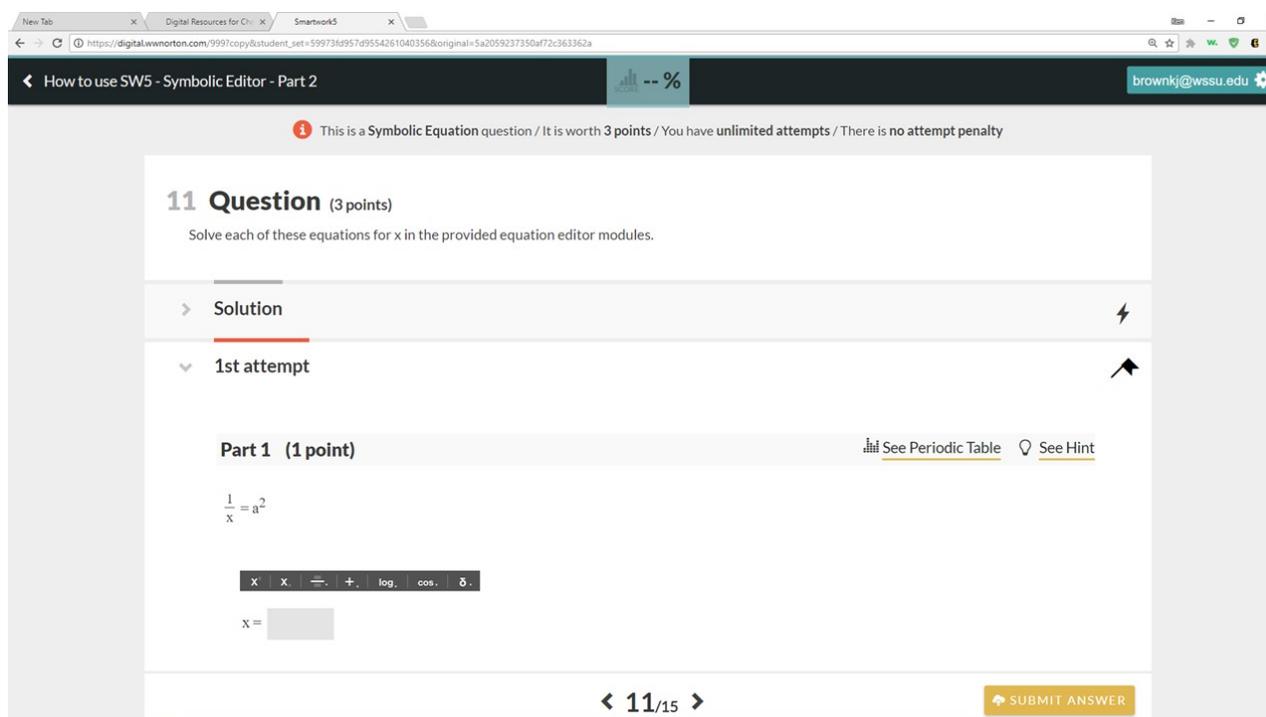
### Entering roots into the Symbolic Equation Module (SEM)

Several of the options within the *advanced math* tool allow students to enter various roots as a portion of their answers. In addition to the options for square roots and cube

roots, there is also an option to enter roots of other powers as well, the Nth root tool.

In the problem below, Part 2 provides an example of how to input a root function into the answer blank. We will also need to use the parentheses, , tool. The solution will be shown using the "other power" option, even though the cube root option could be used.

The answer to the question is:  $\sqrt[3]{(c - a)}$



The screenshot shows a web browser window with the URL [https://digital.wmorton.com/999?copy&student\\_set=599734957d95542610403568&original=5a2059237350af72c363362a](https://digital.wmorton.com/999?copy&student_set=599734957d95542610403568&original=5a2059237350af72c363362a). The page title is "How to use SW5 - Symbolic Editor - Part 2". The user is logged in as [brownkj@wssu.edu](mailto:brownkj@wssu.edu). The page content includes a notification: "This is a Symbolic Equation question / It is worth 3 points / You have unlimited attempts / There is no attempt penalty". The main question is "11 Question (3 points)" with the instruction "Solve each of these equations for x in the provided equation editor modules." Below the question is a "Solution" section and a "1st attempt" section. The "1st attempt" section contains "Part 1 (1 point)" with the equation  $\frac{1}{x} = a^2$ . To the right of the equation are links for "See Periodic Table" and "See Hint". Below the equation is a toolbar with symbols for  $x$ ,  $x^2$ ,  $\frac{\square}{\square}$ ,  $+$ ,  $\log$ ,  $\cos$ , and  $\sqrt{\square}$ . Below the toolbar is an input field labeled "x =" with a light-gray cursor. At the bottom of the page, there is a navigation bar with "< 11/15 >" and a "SUBMIT ANSWER" button.

Click the light-gray answer blank to activate the cursor.

How to use SW5 - S...

SCORE -- %

brownkj@wssu.edu

x =

**Part 2 (1 point)**

$x^3 + a = c$

x x - + log cos √

x =

**Part 3 (1 point)**

< 11/15 >

SUBMIT ANSWER

Click the *advanced math* tool icon, **log**, to display its dropdown menu. From the dropdown, click on the Nth root function (circled in red below).

How to use SW5 - S...

SCORE -- %

brownkj@wssu.edu

x =

**Part 2 (1 point)**

$x^3 + a = c$

x x - + log cos √

x =

log ln exp √ √ √ √

**Part 3 (1 point)**

< 11/15 >

SUBMIT ANSWER

The Nth root function should now appear in the answer blank. **Note:** if clicking the Nth root function did not make it appear in the answer blank, you may need to again click

inside the answer blank to activate it and repeat the steps here to add the function.

How to use SW5 - S... SCORE -- % brownkj@wssu.edu

x =

**Part 2 (1 point)**

$x^3 + a = c$

x x<sup>3</sup> - + log cos √

x = √

**Part 3 (1 point)**

< 11/15 > SUBMIT ANSWER

Click in the upper dark-gray box, and type the power of the root (3).

How to use SW5 - S... SCORE -- % brownkj@wssu.edu

x =

**Part 2 (1 point)**

$x^3 + a = c$

x x<sup>3</sup> - + log cos √

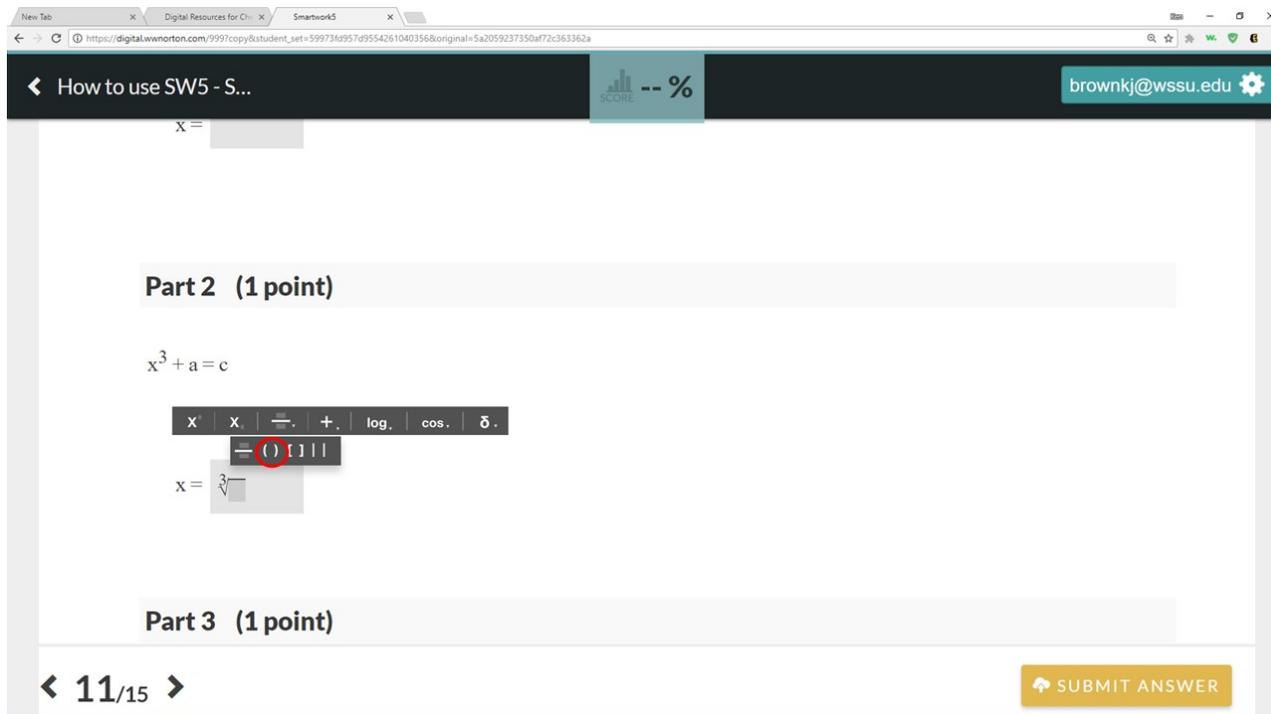
x = √<sup>3</sup>

**Part 3 (1 point)**

< 11/15 > SUBMIT ANSWER

To add "(c - a)" inside the root, click in the dark-gray box under the root symbol. Then

click on the parentheses tool,  , to reveal its dropdown menu. Click on the second option (parentheses; red circle in the picture below).



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x =

**Part 2 (1 point)**

$x^3 + a = c$

x

x

$\frac{\square}{\square}$

+

log.

cos.

$\delta$ .

**( )**

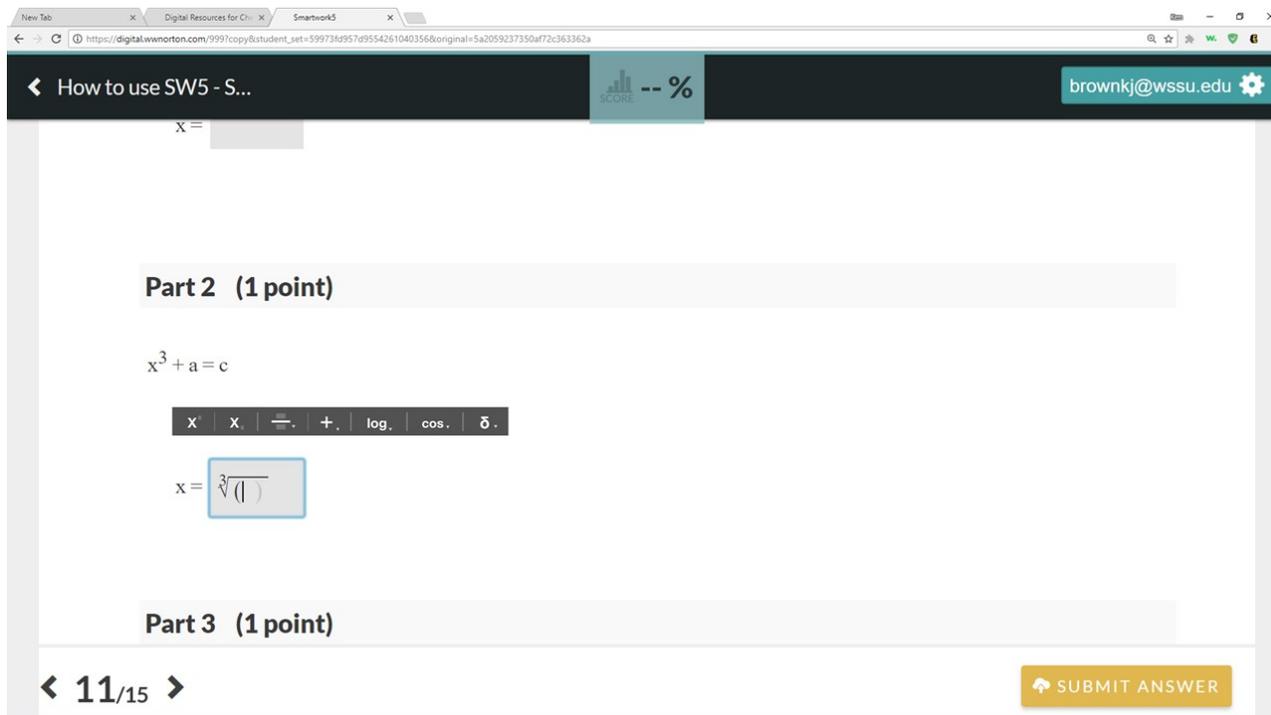
$\sqrt{\square}$

x =  $\sqrt[3]{\square}$

**Part 3 (1 point)**

< 11/15 > SUBMIT ANSWER

This will place the parentheses inside the root function.



How to use SW5 - S... SCORE -- % brownkj@wssu.edu

x =

**Part 2 (1 point)**

$x^3 + a = c$

x

x

$\frac{\square}{\square}$

+

log.

cos.

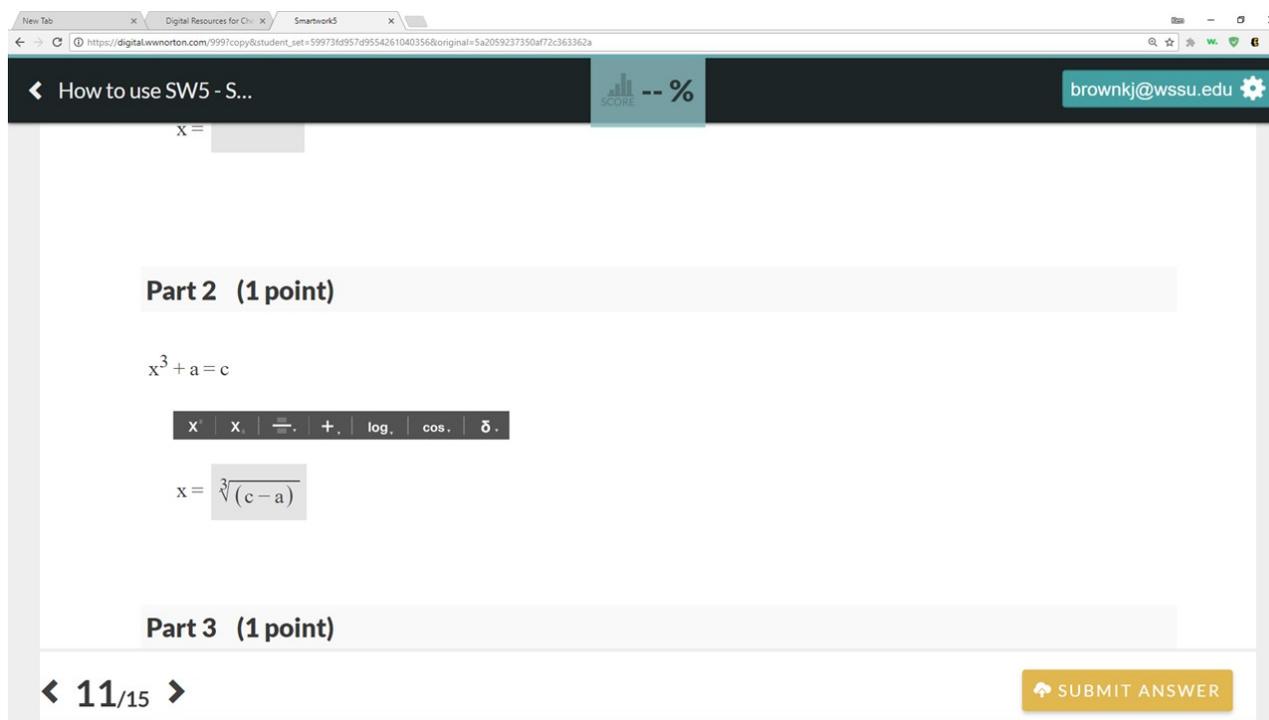
$\delta$ .

x =  $\sqrt[3]{( )}$

**Part 3 (1 point)**

< 11/15 > SUBMIT ANSWER

With the cursor active in the answer blank, enter "c - a" (without the quotes). **Note:** you could have also used the simple math tool, , to add the subtraction symbol. The answer is now complete and ready for submission.



x =

**Part 2 (1 point)**

$x^3 + a = c$

x =  $\sqrt[3]{(c-a)}$

**Part 3 (1 point)**

< 11/15 > SUBMIT ANSWER

Here is a video demonstration that covers adding roots:

Your browser does not support HTML5 video.

## Tips and Suggestions for using the Symbolic Equation Module (SEM)

- 1) Before switching tools within the same answer blank, you will need to click in the answer blank (away from your entered answer) to exit the current tool and then click the icon for the next tool you need. If you do not do this, you may encounter some formatting issues that will affect how the system grades your answer.
- 2) If you are having difficulty with formatting an answer properly, it may be simpler to delete your answer completely and reenter it rather than trying to fix it.