

Creating Master Problems in Variate

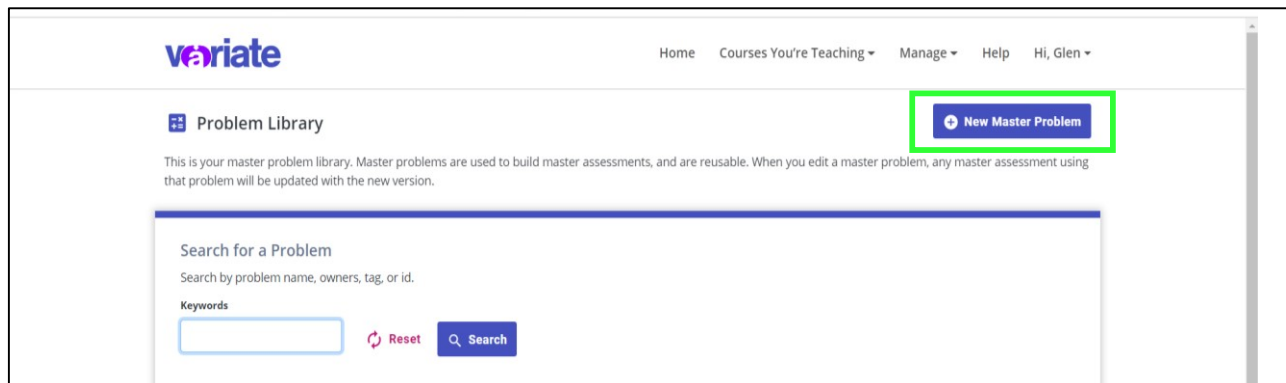
Problems in Variate can be created to allow for automatic randomization of values for each student who completes the problem. Additionally, Variate allows you to create different types of multi-part problems including both multiple choice and numerical or expression free-response.

Prerequisites

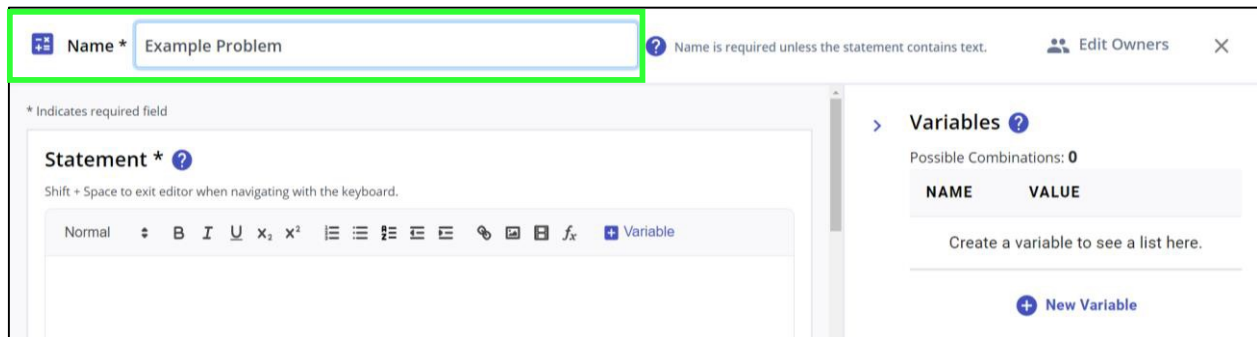
1. **Navigate** to Variate in a web browser, either through your existing [Brightspace course](#) with a Variate external learning tool link, or by using a direct link to [Variate](#). **Log in** using your Purdue Career Account credentials.
2. Under the “Manage” tab, **select** “Problems”.

Creating A New Master Problem

1. **Click** the “New Master Problem” button on the upper right-hand side of the Problem Library.

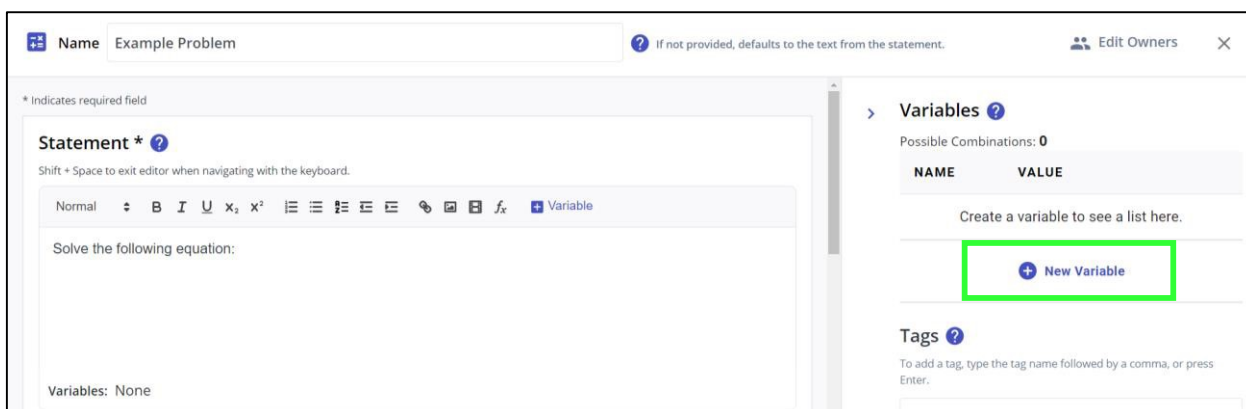


2. **Name** the problem in the space provided.

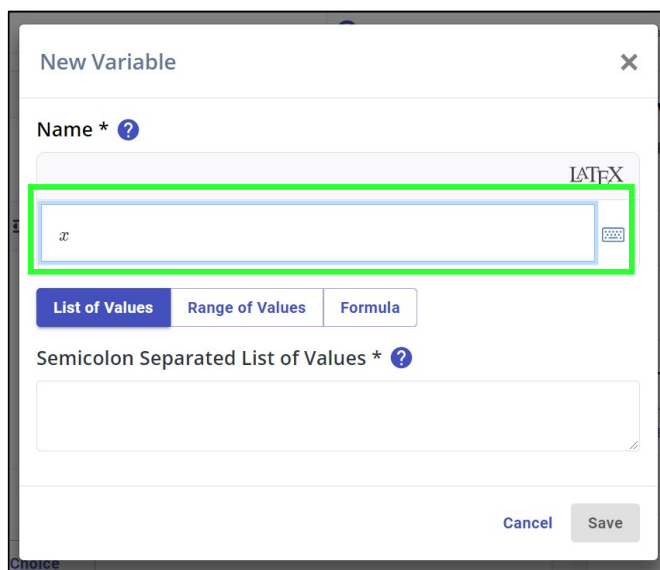


Creating Variables

1. You can **create** variables with defined parameters so that they can be randomized for each student who completes the problem. Variables can be used in problem statements, response formulas, multiple choice options, or to calculate other variables. There are a variety of ways to add variables, and for more details you can view the Variate help section (<https://purdue.variate.org/help#variables>). For our purposes, you can create a variable by selecting “New Variable” on the right-hand side of the screen.

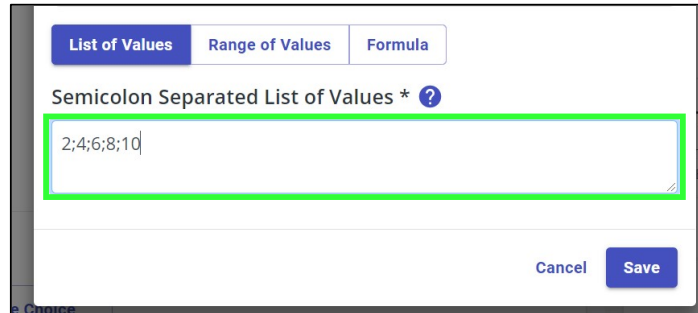


2. Next, **name** the variable you are creating. Variable names can be letters, words, or symbols.



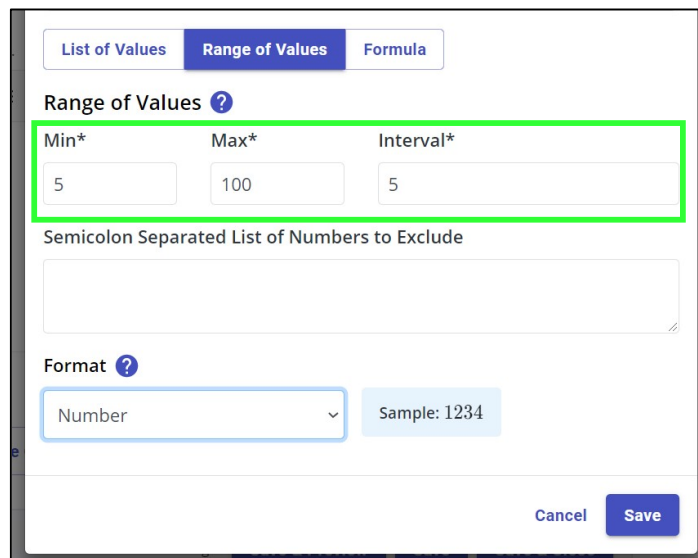
3. After naming the variable, **define** what values that variable will be permitted to take on when randomized. You can do this by creating a list of values, a range of values, or creating a formula.

List of Values: Simply list all possible values of the variable with each value separated by semicolons.



The screenshot shows a configuration window with three tabs: 'List of Values' (selected), 'Range of Values', and 'Formula'. Below the tabs is the text 'Semicolon Separated List of Values * ?'. A text input field contains the value '2;4;6;8;10'. At the bottom right, there are 'Cancel' and 'Save' buttons.

Range of Values: Select the minimum and maximum values of the range of the variable. You may also indicate for the variable to increase by a certain interval (in this example, by increments of 5). And finally, if the variable should not take on certain values within this range, simply exclude those values by creating a semicolon separated list. The number format chosen will change how a variable appears to a student in the problem statement.



The screenshot shows a configuration window with three tabs: 'List of Values', 'Range of Values' (selected), and 'Formula'. Below the tabs is the text 'Range of Values ?'. A table with three columns is highlighted with a green border:

Min*	Max*	Interval*
5	100	5

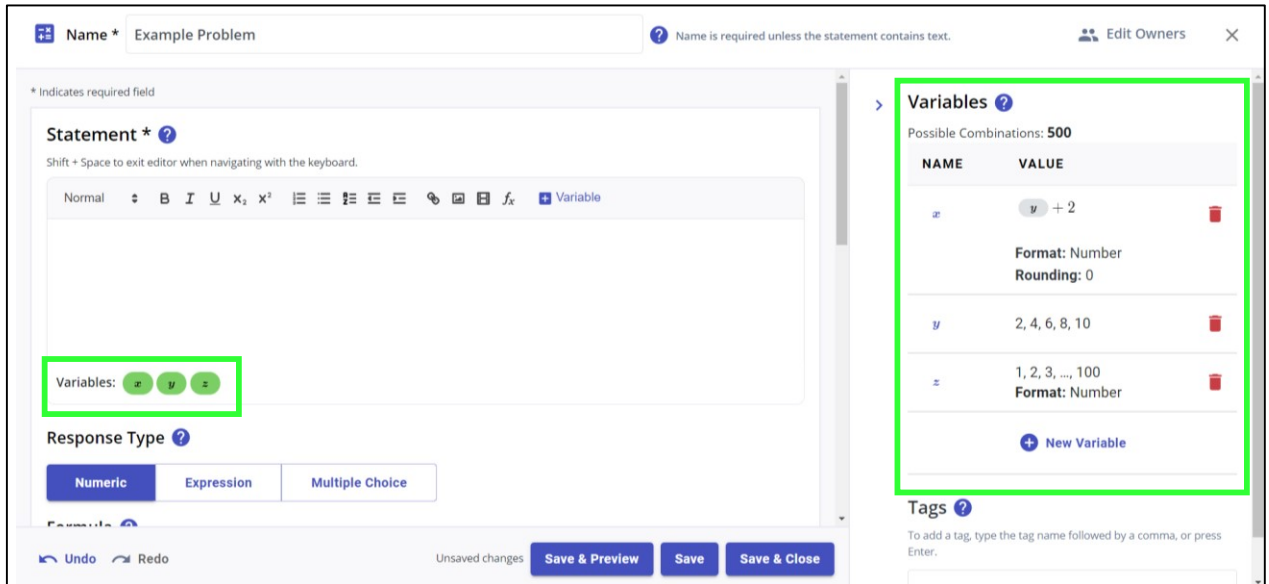
Below the table is a text input field labeled 'Semicolon Separated List of Numbers to Exclude'. Underneath is a 'Format ?' section with a dropdown menu set to 'Number' and a 'Sample: 1234' display. At the bottom right, there are 'Cancel' and 'Save' buttons.

Formula: If the value of the variable you are creating is dependent upon another variable you have created; you can create a formula to establish this relationship. In the hypothetical equation below, the variable “x” needs to always be greater than variable “y” by 2, so you can use the formula “y + 2” to determine the value of “x”. The number format and rounding chosen will change how a variable appears to a student in the problem statement.

The screenshot shows a software interface for defining a formula. At the top, there are three tabs: 'List of Values', 'Range of Values', and 'Formula', with 'Formula' being the active tab. Below the tabs, the text 'Formula * ?' is displayed. A text input field contains the formula 'y + 2', which is highlighted with a green rectangular box. To the right of the input field, there is a 'LATEX' icon and a '+ Variable' button. Below the input field, a 'Variables:' section shows a green pill containing the variable 'y'. Further down, there is a 'Format ?' section with a dropdown menu set to 'Number' and a 'Sample: 1234' button. Below that is a 'Rounding ?' section with a dropdown menu set to '0 Decimal Places'. At the bottom right of the interface, there are 'Cancel' and 'Save' buttons.

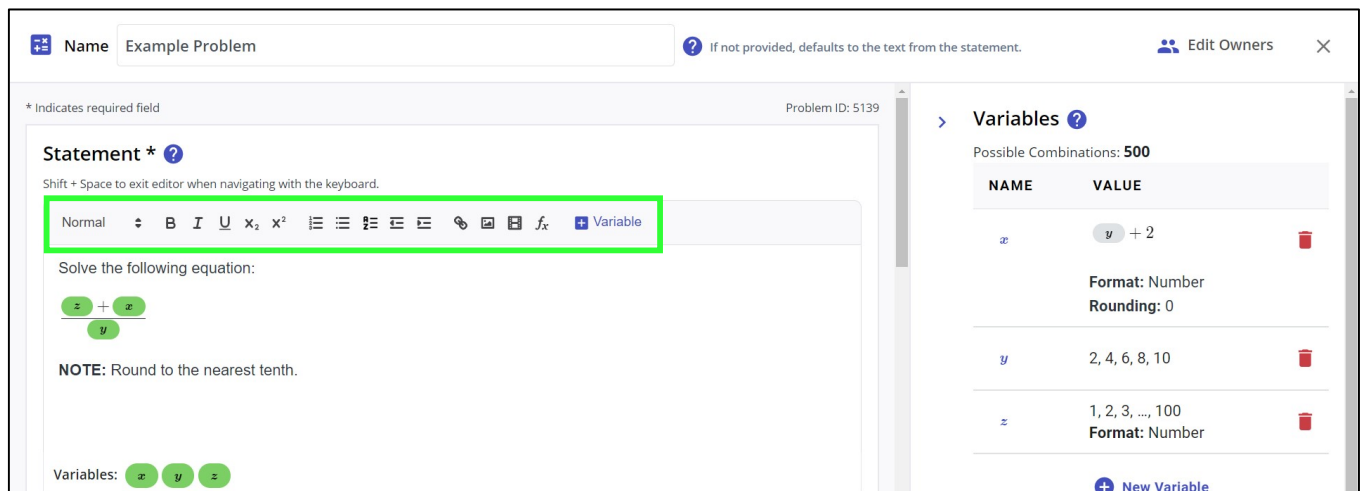
PLEASE NOTE: All variables that have been created within the master problem will be identified as a green “pill”. Any variables you would like to include in your problem must be selected from the list of green “pills”. Simply typing “y” will not be recognized as the variable. However, you may use double brackets as a shortcut when typing. Typing “{{y}}” will automatically be replaced with the green “y” variable pill.

- Once you have defined your variables, they will all be visible on the right-hand side of the screen. You will be able to see the variable name as well as how that variable is defined. Additionally, you will see how many potential problem combinations can be generated from your variables. You will also notice that your variables will be shown as green “pills” under the problem statement section. You will be able to select variables from this list to add them into a problem as will be shown in the next section of this document.

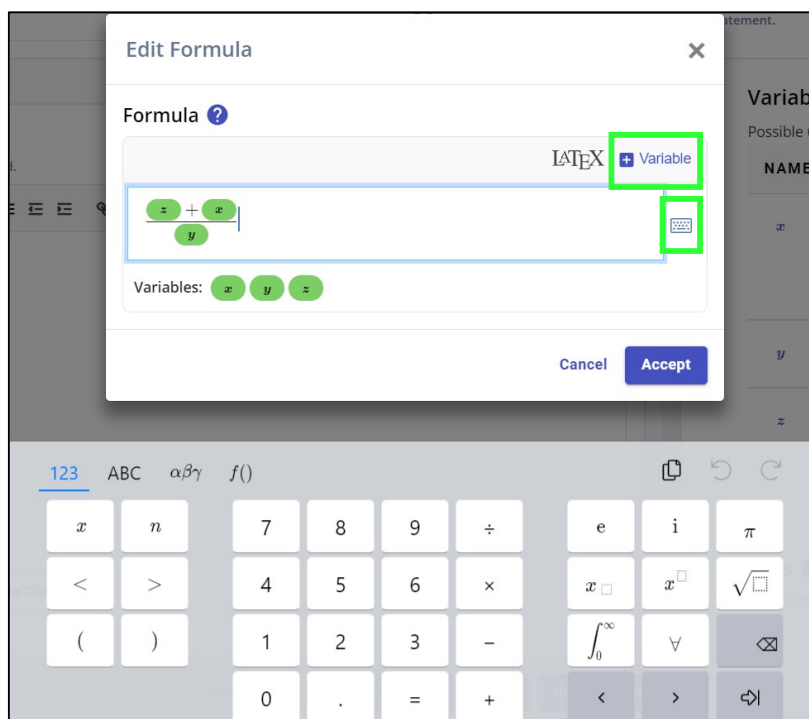
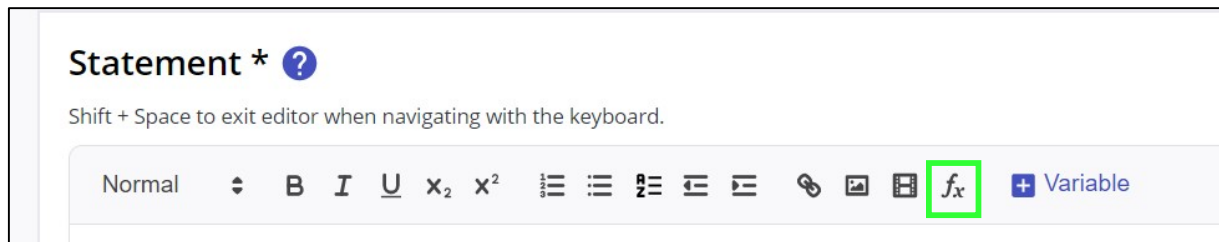


Creating the Problem Statement

- When writing the problem statement, you will have access to many text editing features. This will allow you to format the problem statement as you see fit.



- If you need to include a mathematical expression into the problem statement, you can select the formula button (labeled f_x) to do this. From this screen, you will be able to select from your list of variables and format the equation appropriately.



NOTE: If you need to create additional variables while creating the formula, you can do so by clicking the “+ Variable” button. Also, mathematical symbols can be typed in using your keyboard, or, by selecting the virtual keyboard icon on the right-side of the screen. This will also give you access to additional symbols that are not found on your keyboard.

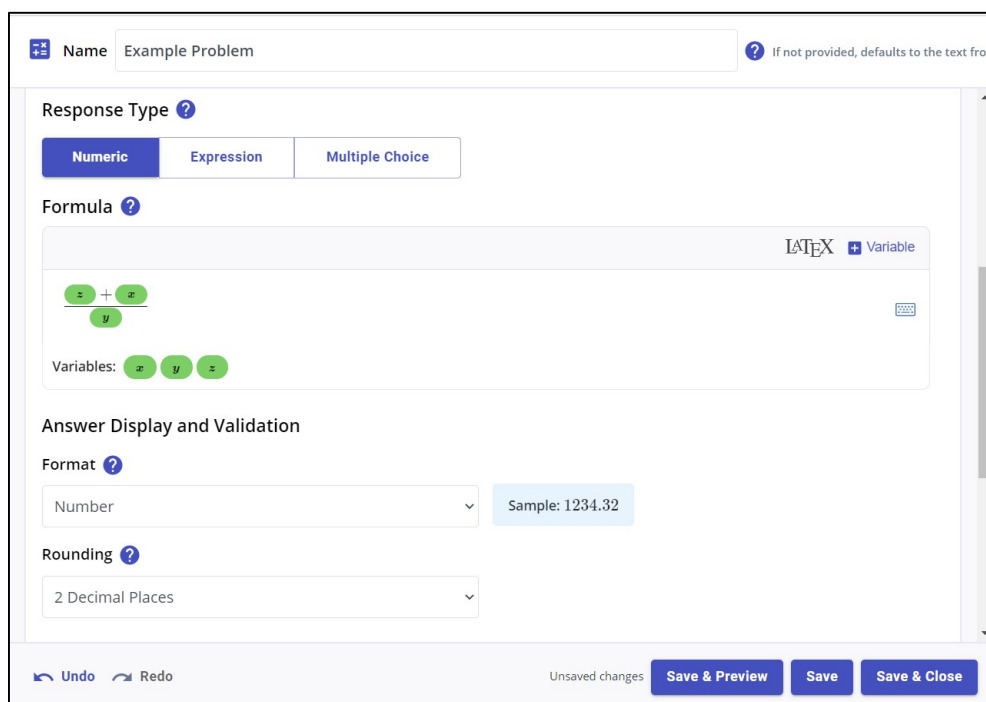
NOTE: You can create multiple problem statements on the same problem. This will allow for you to create multi-part questions with multiple answers. To do this, scroll to the bottom of the problem statement screen and select “Add Prompt”.

Creating Response Types

1. Variate will allow you to create 3 different kinds of response types. These options are numeric, expression, and multiple choice.

Numeric: Selecting this response type will require that a student provide a numeric response to the problem. You will need to enter a formula that will evaluate to the correct answer. Creating the response formula is done in the same way as creating a formula variable (see above).

You will also be able to select if the answer should be rounded, and if so, to how many decimal places. Additionally, you can select how the number should be formatted. This will change how a value is displayed to a student. That does not mean a student is required to answer in this number format. A student's answer is graded on whether it is numerically correct.



The screenshot shows a web interface for creating a problem. At the top, there is a text input field labeled "Name" with the value "Example Problem" and a help icon. Below this is the "Response Type" section, which has three tabs: "Numeric" (selected), "Expression", and "Multiple Choice". Under "Response Type" is the "Formula" section, which contains a formula editor with the expression $\frac{z + x}{y}$. The editor includes a "LATEX" icon and a "Variable" button. Below the formula editor, the variables "x", "y", and "z" are listed. The "Answer Display and Validation" section has a "Format" dropdown set to "Number" with a "Sample: 1234.32" preview, and a "Rounding" dropdown set to "2 Decimal Places". At the bottom, there are "Undo" and "Redo" buttons, a status indicator "Unsaved changes", and three action buttons: "Save & Preview", "Save", and "Save & Close".

Additionally, you may create a tolerance range for the correct answer. This is recommended for problems that might be rounded throughout solving. If the student's answer is within the specified range, it will be counted as correct.

There are also a spaces provided to create an answer prefix and unit that the student will see next to the response box. For example, you might place a “\$” as a prefix to indicate that their answer should represent a monetary value or “lbs” to indicate the appropriate units for a response.

The screenshot shows a configuration panel for a response type. At the top, there is a 'Tolerance' field with a value of '1' and a 'Tolerance Type' dropdown menu set to 'Percent'. A 'Sample' field contains the text '[1221.9768, 1246.6632]'. Below this is the 'Student Input Display' section, which includes a 'Prefix' field containing '=' and a 'Unit' field containing 'km, pounds, degrees'. At the bottom of the panel, there is an 'Add Response' button with a plus icon, and a footer area with 'Undo' and 'Redo' icons, the text 'Unsaved changes', and three buttons: 'Save & Preview', 'Save', and 'Save & Close'.

Expression: Selecting this response type will require a student to enter a simplified mathematical expression rather than a specific numeric answer. Similarly, to the numeric response option, you will need to provide a formula that will be equivalent to the correct answer.

This response option will also allow you to add a prefix to the response box. Additionally, you have two options to set the strictness of the comparison between the correct answer and student answer. For more information, you may view the Variate help section about expression equivalence.

<https://purdue.variate.org/help#response-expression-equivalence>

Multiple Choice: Selecting this response type will require the student to choose the correct answer from multiple options. Create a response that you would like to label as correct. Then, create as many incorrect options as you would like. Both the correct and incorrect answers can take the form of formulas, pictures, or text. Once you have created all your answer choices, be sure to select which answer is the correct one. When students are taking the problem, answer choices will be presented in random order.

NOTE: On all response types, you are permitted to make a multi-part question with multiple answers. To add an additional answer, **click** “Add Response” at the bottom of the “Response Type” section.

Answer Display and Validation

Format [?]

Number Sample: 1234.32

Rounding [?]

2 Decimal Places

Tolerance [?] Tolerance Type

± 1 Percent Sample: [1221.9768, 1246.6632]

Student Input Display

Prefix Unit

= km, pounds, degrees

+ Add Response

Undo Redo Unsaved changes **Save & Preview** **Save** **Save & Close**

Previewing and Saving Master Problems

1. While creating a master problem, **save** your work and progress regularly. This can be done at any point by selecting the blue “Save” button at the bottom of the screen.

Also, at any point, you may select “Save & Preview”. This will save all your work and show you a preview of what your master problem will look like from the perspective of the student.

2. While **previewing** a problem, you will see the problem statement and response box in the form in which they will be presented to the student. Underneath the problem, you will see what the correct answer is (use this to verify the accuracy of your formulas) and the permitted tolerance for the students’ answers.

To further test your problem, you can select the blue “Randomize” button in the lower right-hand corner and a new problem will be generated for you to evaluate.

Preview

Solve the following equation:

$$\frac{64 + 4}{2}$$

NOTE: Round to the nearest tenth.

Unlimited attempts Test

VARIABLE NAME	VALUE	RESPONSE	CORRECT ANSWER	CORRECT ANSWER RANGE
x	4	1.	34.00	[33.66, 34.34]
y	2			

Close Randomize

3. You may **tag** your problem with certain keywords that will make it easier to identify and search for in your problem library. Be sure to separate each tag with a comma or by using the “Enter” key on your keyboard.

Name Example Problem

Statement *

Solve the following equation:

$$\frac{x + x}{y}$$

NOTE: Round to the nearest tenth.

Variables: x, y, z

Response Type: Numeric Expression Multiple Choice

Formula

Variables

NAME	VALUE
x	y + 2
y	2, 4, 6, 8, 10
z	1, 2, 3, ..., 100

Tags

Example x Math x

4. If you would like to allow other people to access this master problem in Variate, you can do so by selecting “Edit Owners” in the upper right-hand side of the screen. After the window opens, enter

the Purdue career account or PUID of the individual you would like to share the problem with.
NOTE: This will allow the individual to make changes to the problem.

Name: Example Problem

Statement: Solve the following equation: $x + y = z$. NOTE: Round to the nearest tenth.

Response Type: Numeric

Variables:

NAME	VALUE
x	$y + 2$
y	2, 4, 6, 8, 10
z	1, 2, 3, ..., 100

Tags: Example, Math

- Once you have **saved** a problem, it will be accessible in your “Problem Library”. If the problem is marked with a green checkmark, solutions can be calculated and the problem is available for use in assessments.

Problem Library

Search for a Problem

ID	NAME	TAGS	OWNERS	UPDATED	ACTIONS
5139	✓ Example Problem	Example, Math	Glen Schroering	2/10/21 6:21 PM EST	Edit
4812	✓ Solving for Missi...	MissingVariable	Glen Schroering	1/25/21 12:09 PM EST	Edit
4811	✓ Division Problem	Division	Glen Schroering	1/25/21 12:03 PM EST	Edit
4810	✓ Multiplication P...	Multiplication	Glen Schroering	1/25/21 11:56 AM EST	Edit
4809	✓ Subtraction Pro...	Subtraction	Glen Schroering	1/25/21 11:57 AM EST	Edit