

Name: _____

Class: _____

Class #: _____

Section #: _____

Instructor: Monica Vesely

Assignment: Demonstration of Question Types

Question 1: (6 points)**Matching Questions**

Matching questions display a list of items and a list of attributes. Students are required to match items with attributes.

Options/Features

- *Algorithmic variables* can be created for use in the question statement, answer, hint, feedback, and solution fields.
- *Symbolic and numeric math operations* can be used in the question.
- Use MathML to define math content for display.

Question:

Match each of the triangle types with its definition using the drop-down menus:

___ Acute ___ Scalene ___ Right
 ___ Equilateral ___ Isosceles ___ Obtuse

1. Three sides of equal length
2. Three angles less than 90 degrees
3. One angle greater than 90 degrees
4. No sides of equal length
5. Two sides of equal length
6. One angle equal to 90 degrees

Question 2: (1 point)

Fill in the blanks:

Blanks featuring drop-down menus

Fill-in-the-blank questions are available using text boxes or drop-down menus. In this question, students select their response from a drop-down menu of options.

Options/Features

- *Symbolic and numeric math operations* can be used in the question.
- Blanks can be configured to require a free-response entry or a list of options.

- The question statement can be set in a sentence or paragraph form, or it can be formatted HTML (for example, providing a fill-in-cells in a HTML table).

Question:

The theorem used to prove that there is a point on a curve at which the derivative is equal to the slope of the straight line connecting the endpoints of an interval is the _____ .

Question 3: (1 point)

Short Phrase Question

Short Phrase questions require the text of student responses to match the correct answer *exactly*. Short Phrase questions are another form of fill-in-the-blank questions.

Options/Features

- Extra whitespace and capitalization are ignored, but otherwise the phrase match must be exact.
 - *Algorithmic variables* can be created for use in the question statement, answer, hint, feedback, and solution fields.
 - **Note:** Short Phrase questions must be created and edited in LaTeX or script files.
-

Question:

If, at a point a , the first derivative of a function is zero, $f'(a) = 0$, and the second derivative is positive, $f''(a) > 0$, what type of critical point is a ?

Question 4: (1 point)

Key Word Question

Key Word questions evaluate student responses for the inclusion of certain key phrases. All other text in the student response is ignored. Key Word questions are another form of fill-in-the-blank questions.

Options/Features

- *Algorithmic variables* can be created for use in the question statement, answer, hint, feedback, and

solution fields.

- *Symbolic and numeric math operations* can be used in the question.
 - **Note:** Key Word questions must be created and edited in LaTeX or script files.
-

Question:

Translate into French: "twelve cats".

Question 5: (1 point)

Multiple Choice Questions

Multiple Choice questions can offer any number of answer choices. Students are required to identify **one** correct answer.

Options/Features

- *Algorithmic variables* can be created for use in the question statement, answer, hint, feedback, and solution fields.
 - *Response-specific feedback* for each selected response.
 - *Symbolic and numeric math operations* can be used in all parts of the question.
 - *Permuting* randomly shuffles the response order.
 - *Non-permuting* displays the same response order.
-

Question:

What is $4 + 2$?

- (a) 5
 - (b) 6
 - (c) 8
-

Question 6: (4 points)**Multiple Selection Questions**

Multiple Selection questions can offer any number of answer choices. Students are required to identify **more than one** correct answer. The student receives full credit for selecting all correct responses, or partial credit for selecting only some correct responses.

Options/Features

- *Algorithmic variables* can be created for use in the question statement, answer, hint, feedback, and solution fields.
 - *Symbolic and numeric math operations* can be used in all parts of the question.
 - *Permuting* randomly shuffles the response order.
 - *Non-permuting* delivers the same response order.
-

Question:

Which of these numbers are even?

- (a) 5
 - (b) 19
 - (c) 14
 - (d) 12
 - (e) 6
 - (f) 20
-

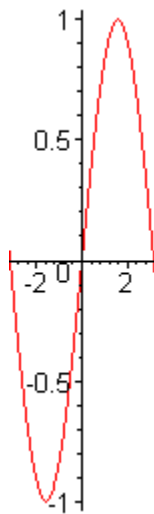
Question 7: (2 points)**Clickable Image Questions**

Clickable Image questions present an image with a number of hotspots. Students are required to identify the correct image element by clicking the corresponding hotspot.

Options/Features

- An authoring tool in the system Question Bank Editor makes creating clickable image questions easy.
 - *Algorithmic variables* can be used to randomly pick targets for answers.
 - Use MathML to define math content for display.
-

Question:



Click a **positive** region on the graph.

Question 8: (9 points)

Multipart Questions

Multipart questions can consist of any number of subquestions, each of which can be of any type. Since multipart questions themselves can be subquestions, any number of levels of multipart are supported.

For example, this question has the following structure:

- (a) Multiple choice question
- (b) (i) Formula question
- (b) (ii) Formula question
- (c) Fill-in-the-blank

Options/Features

- Question authors specify the relative weighting of each part. In this case, the weighting is 1:1:1.
- *Algorithmic variables* can be created for use in the question statement, answer, hint, feedback, and solution fields.
- Requirements for student responses (for example, symbolic, numeric, or units in math expressions) can vary by subpart, depending on selected question types.
- Numeric responses can be expressed in *decimal form* or *scientific notation* (for example, 3.24E4).
- Correct answers can be specified with a *margin of error* or *range of tolerance*.
- Use *MathML* to define math content for display.
- The system automatically grades *equivalent expressions* correct.

Question:

This question concerns the integral of the function x^7 .

(a) In the first part, use a geometric argument to decide whether $\int_{-1}^1 x^7 dx$ is:

- (a) zero
- (b) positive
- (c) negative

(b) In the second part, check your response by computing the integral.

(i) Evaluate $\int x^7 dx$.

(ii) Use the indefinite integral above to compute $\int_{-1}^1 x^7 dx$

(c) Fill in the blanks:

The geometric argument in the first part was based on the fact that x^7 is an ____ function.

Question 9: (6 points)

Multipart Formula Questions

Multipart Formula questions are a multipart question consisting of one or more formula questions.

Options/Features

- *Algorithmic variables* can be created for use in the question statement, answer, hint, feedback, and solution fields.
- *Symbolic and numeric math operations* can be used in all parts of the question.
- Use *MathML* to define math content for display.
- The system automatically grades *equivalent expressions* correct.
- **Note:** Multipart Formula questions must be created and edited in LaTeX or script files.

Question:

Let $y = x^{17}$.

(a) What is the derivative of y with respect to x ? Enter only the expression for the derivative, omitting " $y' =$ ".

(b) What is $\int y dx$?

Question 10: (2 points)

Formula Questions

Formula questions display the problem statement and require a mathematical expression as an answer. Unlike standard quiz engines, **Maple T.A.** contains a powerful math parser that understands algebraic expressions (and many other math and science content types). In this question, a response is graded correct if it is algebraically equivalent to the correct answer.

Options/Features

- *Algorithmic variables* can be created for use in the question statement, answer, hint, feedback, and solution fields.
- *Symbolic and numeric math operations* can be used in all parts of the question.
- Use *MathML* to define math content for display.
- The system automatically grades *equivalent expressions* correct.

Question:

Let $y = x^{20}$. What is the derivative of y with respect to x ? Enter only the expression for the derivative, omitting "y' =".

Question 11: (2 points)

Equation Questions

Equation questions require responses in the form of mathematical equations. An equation question is different from a formula question because it contains an "=" sign in the response. Any equation that is algebraically equivalent to the correct answer is graded correct. If the correct answer is $x+2=z$, the responses $x+2=z$, $x=z-2$, and $x+1=z-1$ are graded correct.

Options/Features

- *Algorithmic variables* can be created for use in the question statement, answer, hint, feedback, and solution fields.
 - *Symbolic and numeric math operations* can be used in all parts of the question.
 - Use *MathML* to define math content for display.
 - The system automatically grades *equivalent expressions* correct.
 - Note: The feedback for this question includes HTML and MathML.
-

Question:

What is the equation of the straight line passing through the point (5, 4.3) with a slope 7?

Question 12: (2 points)

Numeric Questions

Numeric questions can accept numbers without units as valid responses. The correct answer must be expressed as a number. The student response can be an expression (such as "1+2+3+4").

Options/Features

- Numeric responses can be expressed in *decimal form* or *scientific notation* (for example, 3.24E4).
 - Correct answers can be specified with a *margin of error* or *range of tolerance*.
 - *Algorithmic variables* can be created for use in the question statement, answer, hint, feedback, and solution fields.
 - Use *MathML* to define math content for display.
 - The system automatically grades *equivalent numeric expressions* correct.
-

Question:

Estimate the length of the shadow cast by a 79 foot building when the sun is 55 degrees above the horizon. Round your response to the nearest foot. Do not include units in your response.

Question 13: (3 points)**Numeric Questions with Physical Units**

Numeric questions require a response that includes a number and physical units.

Options/Features

- The system understands physical equivalents, so two equal quantities expressed in different units are graded the same, for example, 500cm and 0.5m.
- Equivalent units are programmable at the level of question banks, to allow for discipline-specific requirements.
- The system automatically grades *equivalent numeric expressions* correct.
- *Algorithmic variables* can be created for use in the question statement, answer, hint, feedback, and solution fields.
- This question accepts only numeric responses with a physical unit dimension in answers.
- The numeric component of the response can be expressed in *decimal form* or *scientific notation* (for example, 3.24E4).
- Correct answers can be specified with a *margin of error* or *precision*.
- Use *MathML* to define math content for display.
- Note: The feedback for this question includes HTML and MathML.

Question:

What is the volume of a rectangular solid 38 cm high, 38 cm wide, and 33 cm deep?

Question 14: (1 point)**Indefinite Integral Questions**

Indefinite Integral questions are used to grade questions involving indefinite integrals where answers differing by a constant are graded correctly.

Options/Features

- *Algorithmic variables* can be created for use in the question statement, answer, hint, feedback, and solution fields.
- *Symbolic and numeric math operations* can be used in all parts of the question.
- Use *MathML* to define math content for display.
- The system automatically grades expressions *equivalent up to an additive constant* correct.
- Note: The feedback for this question includes HTML and MathML.

Question:

Evaluate $\int 7x^7 + 7x^4 + 11x^2 dx$

Question 15: (1 point)**Multi Formula Questions**

Multi Formula questions accept a list of numbers or formulas, separated by semicolons. The response is graded correct if the list of formulas matches the list in the correct answer when ignoring the *ordering*. If the correct answer is $1;2;3$, then any of the 6 permutations of the formulas, for example, $2;1;3$, $3;2;1$, and $1;2;3$, is graded correct.

Options/Features

- *Algorithmic variables* can be created for use in the question statement, answer, hint, feedback, and solution fields.
- Accepts any combination of symbolic and numeric math expressions in answers.
- Use *MathML* to define math content for display.
- The system automatically grades *equivalent lists of expressions* correct, ignoring order.
- Note: The feedback for this question is dynamically generated (by algorithm), and includes HTML and MathML.

Question:

What are the roots of the quadratic equation $9x^2 + 17x + 8$? Enter only the expressions for the roots, omitting "x =".

Question 16: (2 points)**Matrix Questions**

Matrix questions accept numeric or formula responses entered in a rectangular array of entry boxes. These questions are designed to require responses in the form of a matrix, a common question structure found in Linear Algebra and applied in a variety of science and engineering fields.

Options/Features

- *Algorithmic variables* can be created for use in the question statement, answer, hint, feedback, and solution fields.
- Accepts any combination of symbolic and numeric math expressions in answers.
- Use *MathML* to define math content for display.
- The system automatically grades *equivalent expressions* correct.
- **Note:** Matrix questions must be created and edited in LaTeX.

Question:

Invert the matrix $\begin{pmatrix} 3 & -2 \\ -4 & -4 \end{pmatrix}$

Question 17: (3 points)**Maple Syntax Questions**

Using the Maple-graded question type, you have access to the computational power of Maple. It includes facilities for algebra, calculus, differential equations, discrete mathematics, graphics, numerical computation, and many other areas of mathematics. Both the **Maple-graded Formula** and **Maple Syntax** subtypes allow you to use Maple functions and expressions, for example, trigonometric functions, \log_{10} , \ln , abs , sqrt , Diff , Int , and $\text{LinearAlgebra}[\text{Determinant}]$.

Maple Syntax Features

You can use Maple functions and expressions when creating a question.

Students must respond using Maple commands and syntactically correct expressions.

This question type is useful when the answer is to be expressed as a:

- Definite integral, $\text{Int}(f(x), x=a..b)$
- Derivative, $\text{Diff}(f(x), x)$
- Limit, $\text{Limit}(f(x), x=0)$
- Differential equation, for example, $\text{Diff}(y(x,t), t, t) = c^2 * \text{Diff}(y(x,t), x, x)$
- Set, for example, $\{1, 4, 9\}$

Guidelines

- Complete each line of code with a semicolon.
 - The last line of your question code must evaluate to a Boolean value.
 - Use the long form for all package functions.
 - Use Maple code to evaluate a student response.
 - Optional: Enter Maple code to plot the students response.
-

Question:

What is the intersection of the sets $\{a,b,c\}$ and $\{b,c,d,e\}$?

Enclose your response in braces.

Question 18: (1 point)**Maple-graded Formula Questions**

Using the Maple-graded question type, you have access to the computational power of Maple. It includes facilities for algebra, calculus, differential equations, discrete mathematics, graphics, numerical computation, and many other areas of mathematics. Both the **Maple-graded Formula** and **Maple Syntax** questions allow you to use Maple functions and expressions, for example, trigonometric functions, \log_{10} , \ln , abs , sqrt , Diff , Int , and $\text{LinearAlgebra}[\text{Determinant}]$.

Maple-graded Formula Features

You can use Maple functions and expressions when creating a question. Students *cannot* use Maple commands and expressions in a response to a question generated using Maple-graded Formula.

Guidelines

- Complete each line of code with a semicolon.
- The last line of your question code must evaluate to a Boolean value.
- Use the long form for all package functions.
- Use Maple code to evaluate a student response.
- Optional: Enter Maple code to plot the students response.

Question:

What is the antiderivative of $\sin(x)$ with respect to x ? Test your response by clicking **Plot**, which plots the derivative of your response.

Question 19: (4 points)**Inline Questions**

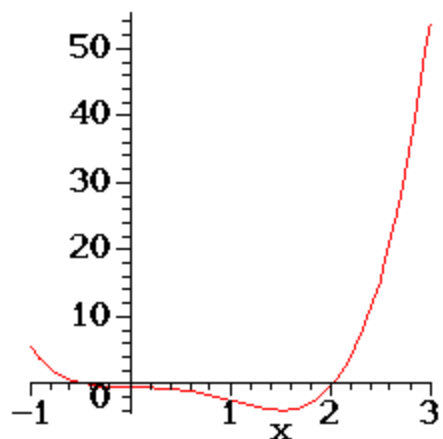
Inline questions offer a flexible and extensible form for free response questions. Inline Questions can contain multiple response cells with question types including formula, Maple-graded, numeric, multiple choice, multiple selection, essay, and list question types.

Options/Features

- *Algorithmic variables* can be created for use in the question statement, answer, hint, feedback, and solution fields.
- *Symbolic and numeric math operations* can be used in all parts of the question.
- Use *MathML* to define math content for display.

Question:

Use the function $2x^4 - 4x^3$ and the following plot of the function to answer the questions below.



1. Determine the first derivative of the function. _____
2. Identify the maximum point(s).
 - (a) [-1, 6]
 - (b) [3, 54]
 - (c) [1.5, -3.38]
3. Identify the interval on which the function is concave down. _____
4. Determine the integral of the function. _____

Question 20: (1 point)

Chemistry Question

Mathematical Formula questions accept responses in 9 modes: formula, formula without logs and trig, formula with physical units, formula that matches responses to within + C, equation, unordered list of formulas, ordered list of formulas, vectors of formulas, and chemical equation. With chemical equation expressions, students are required to enter a formula that matches the correct answer.

Options/Features

- Use *MathML* to define math content for display.

Question:

Enter the reaction of sodium hydroxide (NaOH) with hydrochloric acid (HCl).

Question 21: (3 points)**Dynamic Figure Labels in Engineering and Physics Questions**

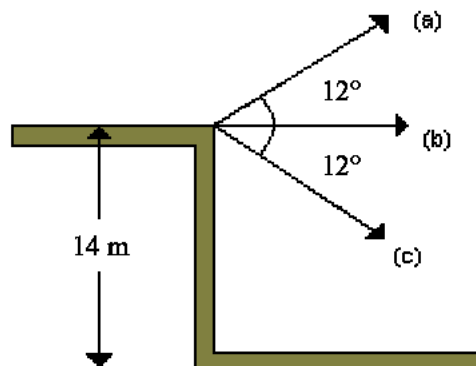
Questions that include related diagrams or figures can feature algorithmically-generated figure labels placed inside the graphic. In this question, the label data indicating the angles on the diagram are randomly-generated variables, creating multiple variants from the same problem.

Options/Features

- *Algorithmic variables* can be created for use in the question statement, answer, hint, feedback, and solution fields.
- Use *MathML* to define math content for display.
- Authoring these questions requires HTML and rudimentary image editing experience.

Question:

Suppose that you throw a rock from the top of a 14 m cliff with a velocity of 12 m/s in the three directions shown. Neglecting aerodynamic drag, use the principle of work and energy to determine the velocity of the rock as it hits the ground in the upward, horizontal, and downward angles, respectively.



Question 22: (3 points)**Dynamic figure labels in an economics problem**

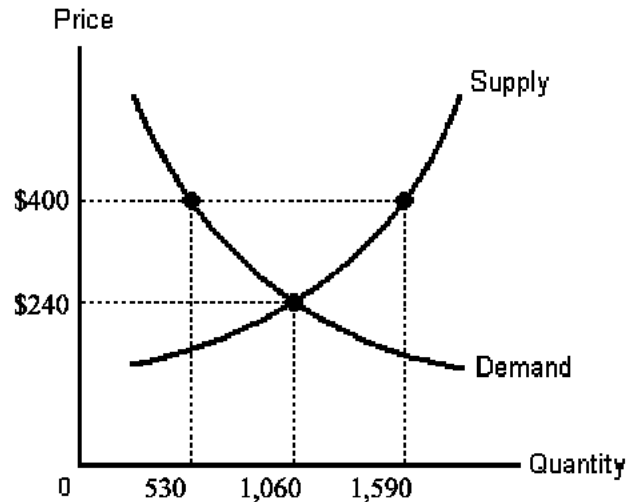
This is another case illustrating the system's capabilities to produce many problem variations from the combination of a graphic image and algorithmically-generated figure labels.

Options/Features

- Each time the labels on the axis change, students are confronted with a *slightly* different problem.
- *Algorithmic variables* can be created for use in the question statement, answer, hint, feedback, and solution fields.
- Authoring these questions requires HTML and rudimentary image editing experience.

Question:

Assume that the equilibrium price of corn is \$240 as shown in the graph below.



(a) If a law is passed that forces the sales price of corn to be \$400, how many units will be sold?

(b) What will be the total revenue generated by the sale of corn after the price increase? Do not include the dollar sign (\$) in your response.

Question 23: (1 point)

Dynamically Generated Function Plot Questions

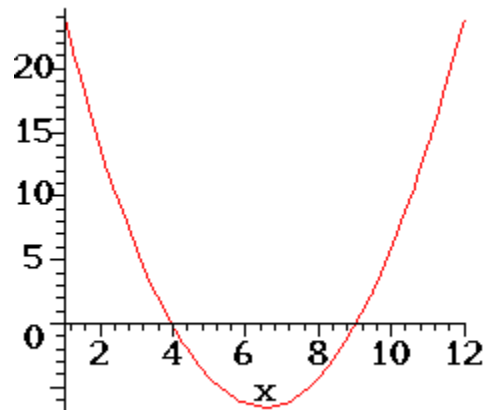
The integrated Maple T.A. plotting capabilities enable you to create Maple-generated graphics.

Options/Features

- *Algorithmic variable data* is used to define the Maple plot.
- *Algorithmic variables* can be used in the question statement, answer, hints, feedback, and solution fields.
- Use *MathML* to define math content for display.

Question:

Give a formula for the quadratic function in the graph below.



Enter only the expression for the equation, omitting "y =".

Question 24: (3 points)

Dynamically Generated Function Plot and Symbolic Algebraic Content in a Question

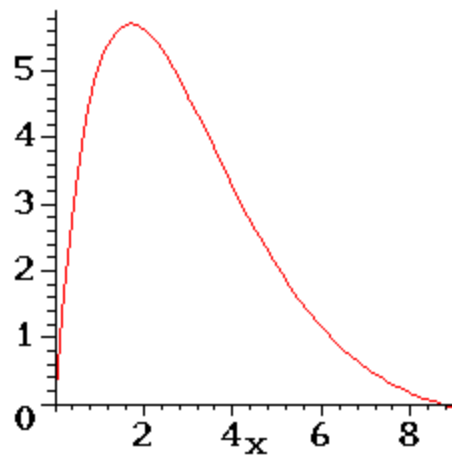
In this example, Maple is used to produce a related graph.

Options/Features

- *Algorithmic variable data* is used to define Maple plots.
- *Algorithmic variables* can be used in the question statement, answer, hints, feedback, and solution fields.
- Use *MathML* to define math content for display.

Question:

The graph below shows the function $f(x) = x(9 - x)e^{-0.45x}$



Use Riemann sums on the graph to estimate $\int_0^9 f(x) dx$
