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Extending the Exerquiz Package
Math Fillin Questions

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1. Math Fill-In Question

The current version of exerquiz included only multiple choice questions. That's all well and good, but instructors would occasionally like to ask questions that would require the student to fill in the answer, whether it be numerical or symbolic.

This new question type, the Math Fill-in, can be used in either the shortquiz or quiz environment. In the former case, there is immediate feedback as to right or wrong; in the latter case, correction is delayed until the quiz is completed and the user requests to be corrected.

In either case, you can choose to include the correct answer, which can be obtained by the click of a button.

The next section outlines the syntax for the user to enter the answer.

1.1. Instructions

When responding to a Math Fill-in question, you answer by typing in your answer. Use the following notation to enter your answers.

- Use `*` to indicate multiplication: Type `4*x` for $4x$;
- Use `^` to indicate powers: Type `4*x^3` for $4x^3$; `12*x^-6` for $12x^{-6}$.
- Use parentheses to delimit the argument of a function; i.e., type `sin(x)` rather than `sin x`.
- Use parentheses to define the *scope* of an operation: For example, type `4*x*(x^2+1)^3` for $4x(x^2+1)^3$; `4^(2*x+1)` for 4^{2x+1}; `(sin(x))^2` for $(\sin(x))^2$. *Do not* type `sin^2(x)` for $\sin^2(x)$, type `(sin(x))^2` instead.
- You can also use brackets `[ ]` or braces $\{\ \}$, to delimit a mathematics expression.
- Functions you may use:
  - Trig: `sin`, `cos`, `tan`, `cot`, `sec`, `csc`;
  - Inverse Trig: `asin`, `acos`, `atan`;
  - Log: `ln` (natural log), or use `log`; e.g. `ln(x)`;
  - Exponential: The natural exponential function, e^x, can be entered as `exp(x)` or as `e^x`.

- The absolute function, `abs(·)` can also be written in the usual way `|·|`; thus, you can type either `abs(x)` or `|x|`.
- Misc.: `sqrt`, usage `sqrt(x)` for $\sqrt{x}$ (or, use exponential notation: `x^(1/2)`).

When you enter your response, some attempt will be made to determine whether the response is a valid mathematical expression. For example, if you say `san(x)`, the function '`san`' will not be recognized as a valid mathematical function; an error message is generated, and the user is not penalized for a possible typing error. The JavaScript routines will also check for unbalanced parentheses; thus, `((x^4+1) + sin(x)^2` will be flagged as a syntax error.

Important: When you enter a function of a single variable—the only type currently supported—use as the independent variable implied by the statement of the problem. If the problem statement involves the variable x, use `x` as the independent variable; if the problem statement uses t, use `t` in your answer. To enter a function of t when a function of x is expected will, no doubt, result in missed problem.

1.2. Answers and Solutions

For fill-in questions, if the document author so wishes, answers and (optionally) solutions can be provided. The author provides an “Ans” button. This button is visible for a `shortquiz` and hidden for a `quiz`.

For a `shortquiz`, the “Ans” button can be clicked at anytime. In the case of a `quiz`, after a `quiz` has been completed, the hidden “Ans” buttons appear. Click on the button to get an answer to the problem.

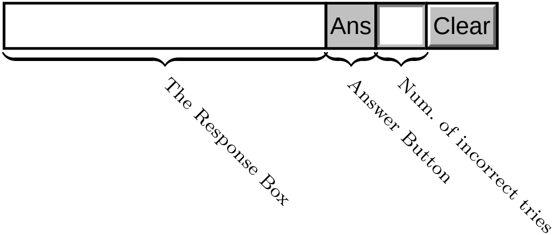
Concerning solutions. If the “Ans” button has a green boundary, that means that question has a solution. Performing a `Shift-Click` on the “Ans” button causes the viewer to jump to the solution. For multiple choice questions, the boundary for the correct answer is colored green as well. Click on the answer field to jump to the solution.

Solutions to a `quiz` can be protected from prying eyes with the `\NoPeeking` command. See the Section 1.5 for an example and a brief discussion.

1.3. Practice Example

Example: Consider the following sample question. Practice by typing in the answer: `2*x^3*(x^4+1)^(-1/2)`

$$\frac{\mathrm{d}}{\mathrm{d}x}(x^4+1)^{1/2} =$$



When a correct answer is input into the response box, the color of the border surrounding the response box changes to green. The answer can also be expressed correctly using the `sqrt` operator, try modifying the answer using `sqrt`.

1.4. Short Quiz Environment

Problem #2 illustrates how to define a problem with a variable other than the default x. Click on the "Ans" button to get answers, shift-click on "Ans" buttons that have a green boundary to get a solution.

Quiz Answer each of the following. Passing is 100%.

1. If f is differentiable, then f is continuous.

   True False

2. $\dfrac{\mathrm{d}}{\mathrm{d}t} 4t^{-1/2} =$ Ans

3. $\dfrac{\mathrm{d}}{\mathrm{d}x} e^{x^2} =$ Ans

4. $\displaystyle\int_0^{\pi} \sin(x)\, dx =$ Ans

Clear

1.5. Quiz Environment

The example below illustrates multiple choice questions and objective math questions in the `quiz` environment and is protected by the `\NoPeeking` command. First, browse the solutions at the end of the file, when you encounter a solution protected by `\NoPeeking`, see what happens. Click on the "Ans" button to get answers, shift-click on "Ans" buttons that have a green boundary to get a solution.

Begin Quiz Answer each of the following. Passing is 100%.

1. If $\lim_{x\to a} f(x) = f(a)$, then we say that f is...

(a) differentiable (b) continuous (c) integrable

2. $\cos(\pi) =$ [ ]

3. $\dfrac{\mathrm{d}}{\mathrm{d}x} e^{x^2} =$ [ ]

End Quiz Score: Correct

Answers: [ ]

Solutions to Quizzes

Solution to Quiz: Yes, differentiability at a point implies continuity at that point. ∎

Solution to Quiz: We use the power rule:

$$4t^{-1/2} = 4(-1/2)t^{-3/2} = \boxed{-2t^{-3/2}}$$

Or, in the syntax of this quiz: `-2*t^(-3/2)`.

Solution to Quiz: A function f is said to be continuous at $x = a$ if $x \in \mathrm{Dom}(f)$, $\lim_{x \to a} f(x)$ exists and $\lim_{x \to a} f(x) = f(a)$. ■

Solution to Quiz: Of course, everyone knows that $\cos(\pi) = -1$. ■

Solution to Quiz: First apply the rule for differentiating an the natural exponential, then apply the power rule:

$$\begin{aligned}\frac{d}{dx}\,e^{x^2} &= e^{x^2}\,\frac{d}{dx}\,x^2\\ &= e^{x^2}\,(2x)\\ &= 2xe^{x^2}\end{aligned}$$

In the syntax of this document, `2*x*e^(x^2)`. ∎