FDG presentation
Question Codebook

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Scope

Our project aims to explores ways in which a question can be created with the following features:

1. Suitable for online instructions.
2. Compatible with **Canvas** or **Web-Assign** design.
3. Allows students to show their work.
4. Assigns grade according to complexity of the question.

Compatibility

Currently, The Department of Mathematical Sciences uses four on-line learning systems:

(1) **Aleks** is used for math placement test, MAT 101, and 102.

(2) **Canvas** for posting resource, syllabus, and other useful information for almost all courses.

(3) **Myopenmath** is used for MAT 120.

(4) **Web-Assign** is used for MAT 106, 110, 111, 114, 121, 213, 214, 341, and 342.

Aleks

Pros: Intuitive and easy to use. It comes with a vast ready to use question collection, textbook, and grade-book. System calculates grade of student assignments, tests, practice tests. Can be used for remote learning.

Cons: Questions cannot be modified and new questions cannot be created. Questions do not allow students to show their work. Manual grading is needed for partial credit.

Canvas

Canvas is a learning management system used for all courses to post lectures and other resources on the web. At present no math course uses Canvas for testing students.

Pros: Intuitive and easy to use. Question banks can be made and shared with other course sections. Open source material can be posted on course page. Assignments, tests, and practice tests can be made. Can be used for remote learning.

Cons: Not suitable for symbolic questions. Also does not make randomized multi-part questions. Manual grading is needed for partial credit.

Note: One of the features of the previous LMS Moodle allows multiple answers to a question which assigns different grades. This can be used to give partial credit.

Web-Assign

Web-Assign is a web based learning management system which is used for numerous math classes.

Pros: Intuitive and easy to use and has a vast ready to use question collection. Books along with PowerPoint and video lectures are available for major math courses. Assignments, tests, and practice tests can be created. Questions can be made and shared with other course sections. Instructor's resource can be posted on course page. Can be used for remote learning.

Cons: Requires some learning.

Questions

The following types of questions are used in math courses:

1. Numerical or computational.
2. Concept.
3. Symbolic.
4. Graphical.
5. Logical.
6. Combination of the above types.

Numerical questions

Question: Eva invested $\$\, P$ in a simple interest account for t years with $r\,\%$ rate of interest. Use the formula $I = P \cdot r \cdot t$ to answer the following questions:

(1) Identify the values of the letters used in the formula.

(2) Find the interest amount.

(3) Find the final balance.

Randomize values of P, t and r as follows:
P is an integer between 500 to 5000 with increment of 50.
t is an integer between 2 to 10 with increment of 1.
r is a number between 2 to 8 with increment of 0.25.

Canvas

To create a randomized question on canvas, the best way we found is randomized group questions. We first create a question bank with three identical questions with different numbers and let quiz select one from each group.

Question Banks in Canvas

To create a question bank, click Quiz in figure 1 and then click circled dots in figure 2, which will open a drop-down menu.

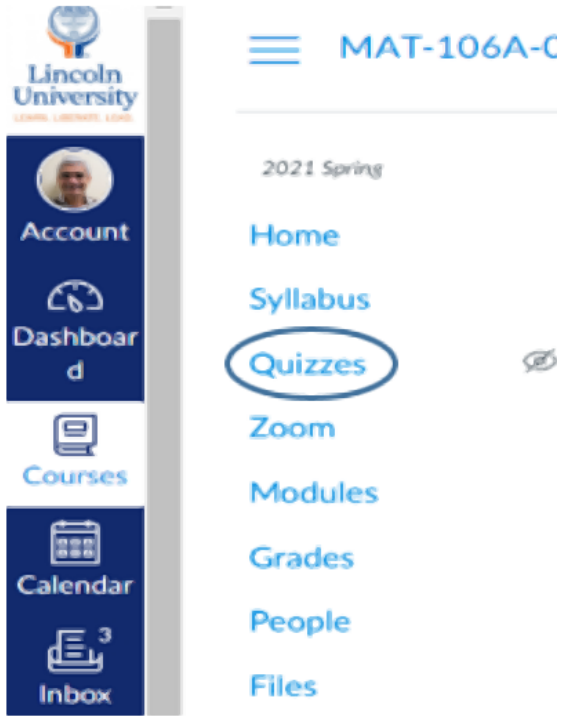


Figure: 1

Select 'manage question banks'.

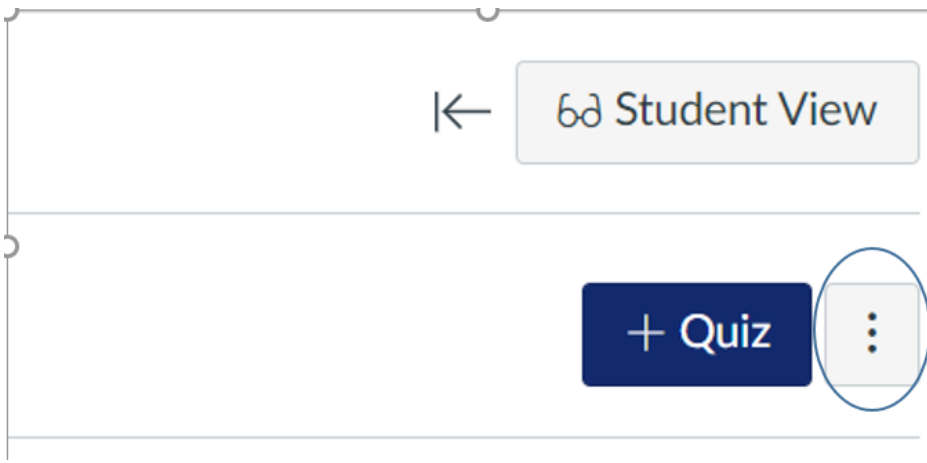


Figure: 2

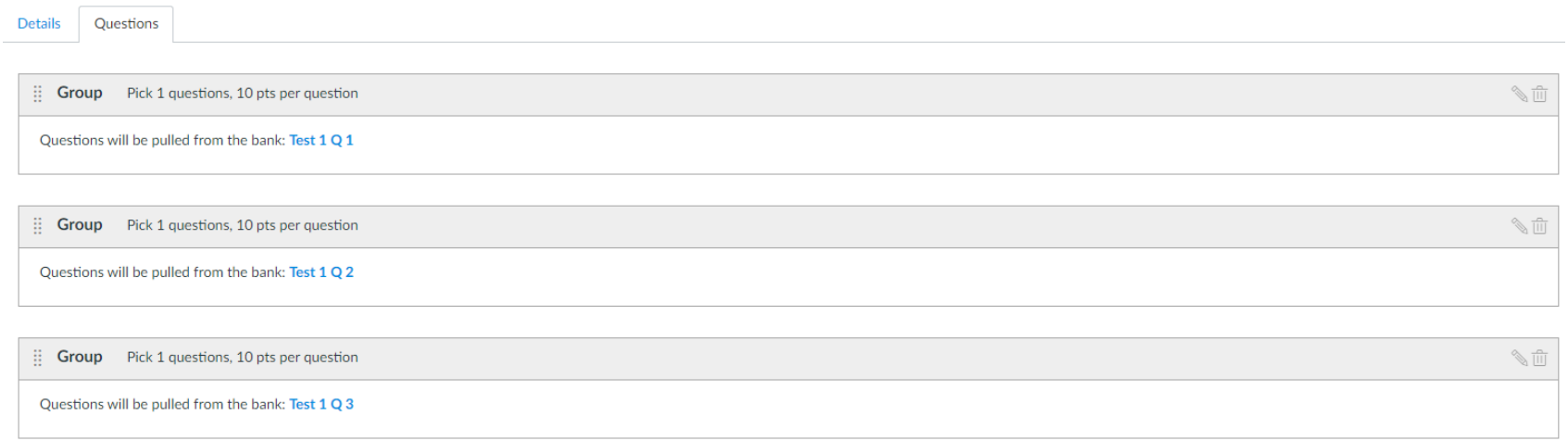
Question: Canvas

A question in Canvas has 3 parts.

- **Mode** determines the question style such as 'Multiple choice, 'True/False question' and so on. It also contains a short user guide of the style selected and a tool menu. Block is static, except single drop down menu to select a style of a question.
- **Question** where user can write a statement of a question.
- **Answers** which has boxes to store answers.

Randomize question

Questions of a quiz can be selected from a question bank. In a Canvas classic quiz, we can randomly chose one or more questions from a specific question bank, which is called a 'group'. In this figure, a quiz has three questions, each one is randomly selected from different groups.



Randomized question: Canvas

To create a randomized question, best way we found is to make a random selection of a question from different groups. We recommend at least three similar questions in each groups.

If a quiz has 6 questions, and each group has three questions, then we can create $3^6 = 729$ different tests. Thus if a class has 25 students, no two students will get identical tests.

Canvas method

Questions are created in the question editor as shown.

Question 1

Q. 1.1	Fill in multiple blanks	10 pts

Enter your question, specifying where each blank should go. Then define the possible correct answer for each blank. Students must type correct answers into text boxes at each blank.

Question:

In the box below, every place you want to show an answer box, type a reference word (no spaces) surrounded by brackets (i.e. "Roses are [color1], violets are [color2]")

Edit View Insert Format Tool Table

Eva deposits \$12000 at 5.2% APR in a simple interest account for 3 years.

(a) Select a formula that finds the final balance or interest.

*Formulas: $(1)I = Prt$ $(2)A = P(1 + rt)$ $(3)A = (1 + i)^N$

$(4)A = \frac{d[(1+i)^N - 1]}{i}$ $(5)\ d = \frac{Pi}{[1-(1+i)^{-N}]}$

Answer (insert the formula number only) = [response1]

(b) Find the medicated values:

P = \$[response2], r = [response3] (in decimals) and t = [response4] years.

(c) Find the interest. I= \$ [response5]

Answers:

Canvas method

Students view of the question is given below:

Question 1 10 pts

Eva deposits $12000 at 5.2% APR in a simple interest account for 3 years.

(a) Select a formula that finds the final balance or interest.

$Formulas (1) I = Prt, (2) A = P(1 + rt), (3) A = P(1 + i)^N$

$(4) A = \frac{d[(1+i)^N - 1]}{i} (5) d = \frac{P \cdot i}{[1-(1+i)^{-N}]}$

Answer (insert the formula number only) = [ ]

(b) Find the medicated values:

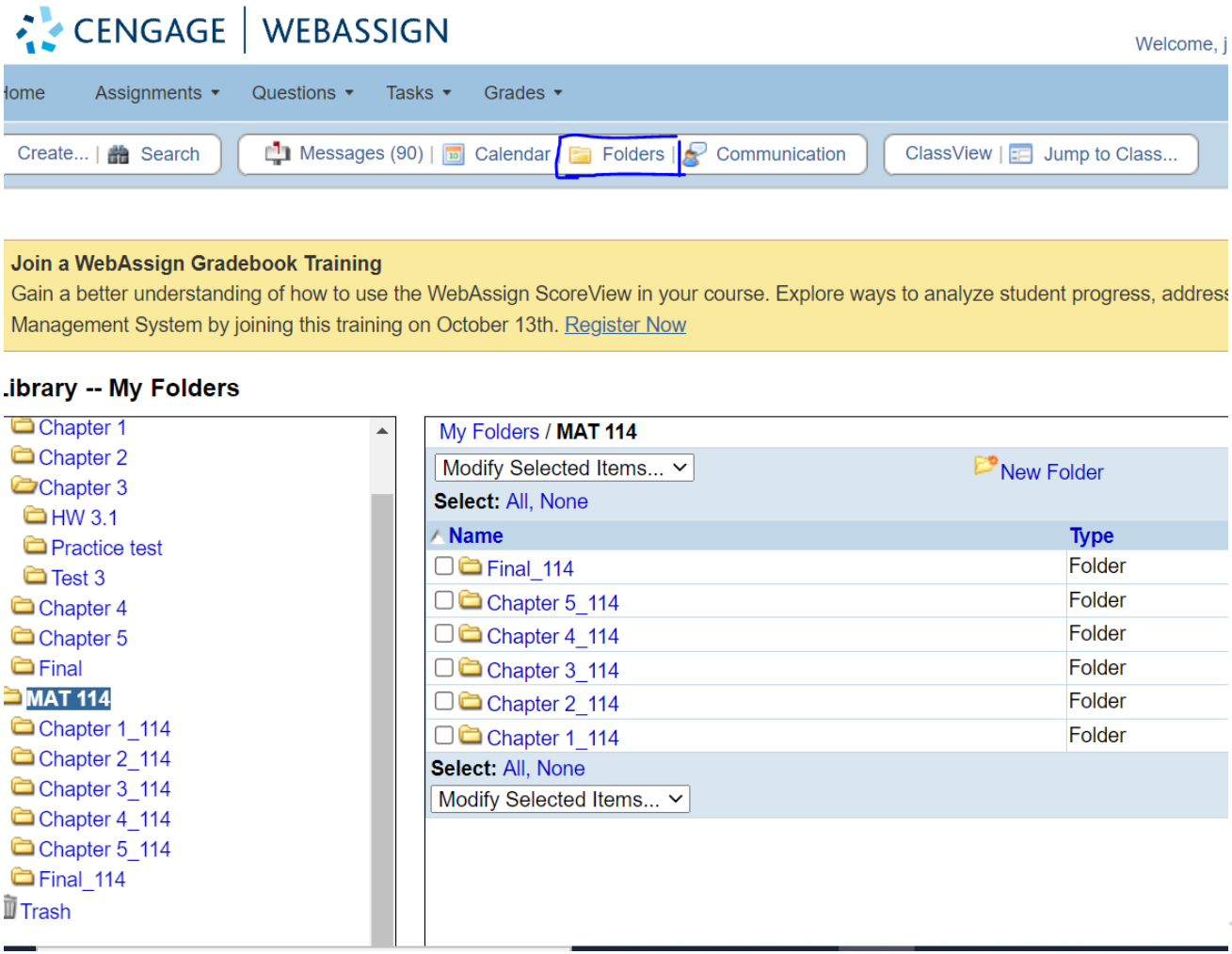
P = $ [ ] , r = [ ] (in decimals) and t = [ ] years.

(c) Find the interest. I= $ [ ]

(d) Find the final balance. A=$ [ ]

Folders: Web-Assign

We can store files, images, or a question in a folder. Assignments can pull any material from any folder you wish. Here is a picture of a folder:



Web-Assign

To generate randomized integer values within a specified range, the Web-Assign 'randnum()'function can be used in the questions code. For example, the code

$$\$n = \text{randnum(5,500,5);}$$

will replace $< eqn\ \$n >$ with any random number from the list $5, 10, 15, \ldots, 500$. A single modification in the above code can generate random decimal numbers. For example, the code

$$\$r = \text{randnum(5,500,5)/10;}$$

will replace $< eqn\ \$r >$ with any random number from the list $0.5, 1, 1.5, \ldots, 50$.

Question: Web-Assign

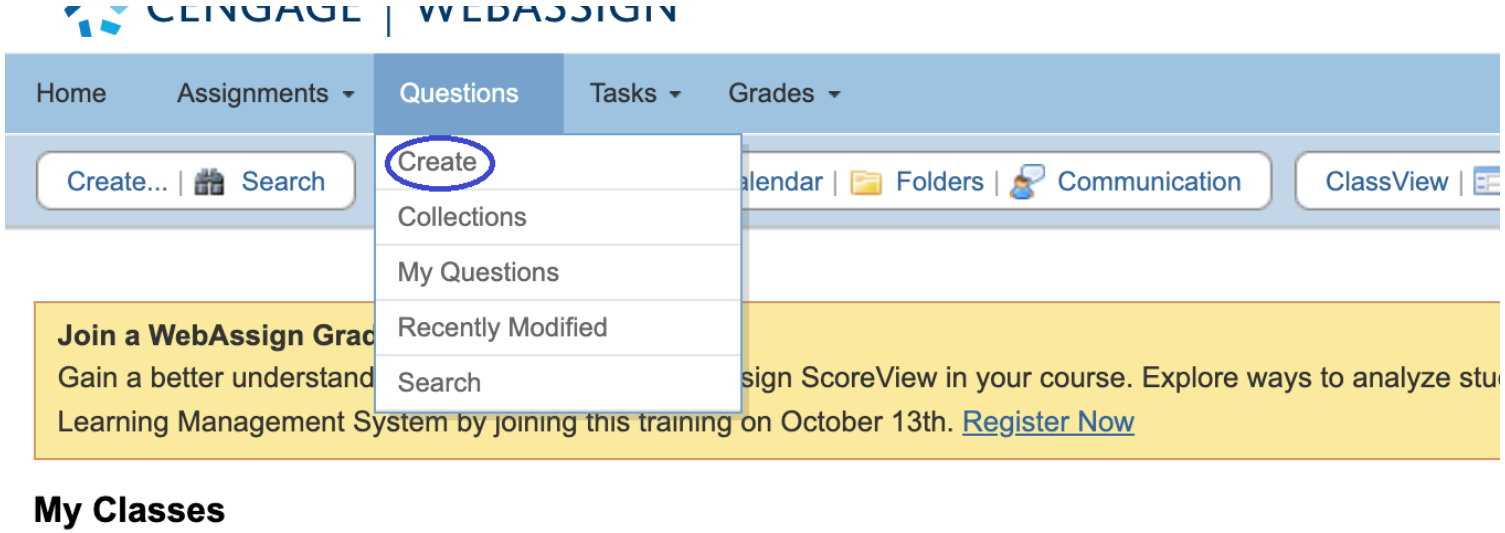
A question in Web-Assign has 5 parts.

- **Mode** determines the question patterns such as 'Multiple choice, Symbolic' etc.
- **Preamble** is a 'Pearl' code.
- **Question** is a statement of question.
- **Answers** is a series of answers written in a single column.
- **Solution** is optional and contains step by step solution.

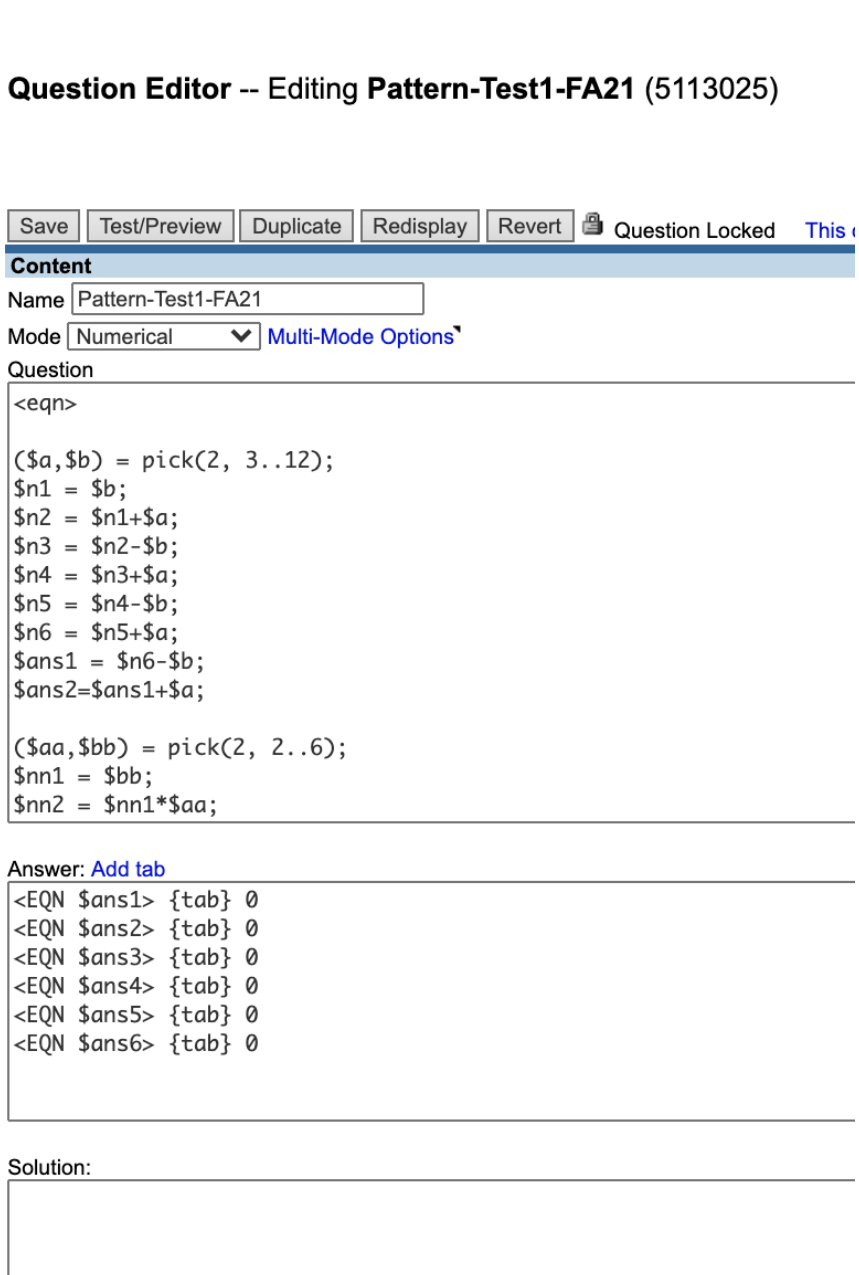
Creating a question: Web-Assign

To create or edit questions in Web-Assign, the Question Editor is used.

① Click **Questions** > **Create**. The Question Editor opens.



Creating a question in Web-Assign



(2) in **Name**, type a name for the question.

(3) In **Mode**, select one of the question modes to define the basic behaviors of the question.

(4) In **Question**, type the question that the students are asked to answer.

(5) In **Answer**, specify the answer key for the question.

Numerical question in Web-Assign

A numerical question on Web-Assign is given here:

Name SI_FDG_1

Mode Numerical Multi-Mode Options

Question

```
<eqn> #Pearl code begins here
$P = randnum(1000,5000,100);
$r = randnum(3,9,1);
$t = randnum(3,10,1);
$I=decform($r*$P*$t/100,2);
$A=decform($P+$I,2);

''
</eqn>
```

Question body:

```
</eqn>

Eva invested $<eqn $P> in a simple interest for <eqn $t> years
with <eqn $r>% rate of<br>
interest. Use the formula <watex> \[ I=P r t\] </watex>
to answer the following questions:<br>

1. Identify the values of the letters used in the formula.<br>
P = <_>, r = <_> <br>
and t = <_>. <br>
2. Find the interest amount. Answer I = <_><br>
3. Find the final balance. Answer A = <_><br>
```

Student's view in Web-Assign

Eva invested $1100 in a simple interest for 7 years with 3% rate of interest. Use the formula $I=P\,r\,t$ to answer the following questions:

1. Identify the values of the letters used in the formula.

P = [ ] 1100 , r = [ ] 0.03

and t = [ ] 7 .

2. Find the interest amount. Answer I = [ ] 231

3. Find the final balance. Answer A = [ ] 1330

Concept question

Determine whether the statement is true or false.

$$\frac{d}{dx}[f(x) + g(x)] = f'(x) + g'(x)$$

- True.
- False.

Concept question

Canvas

Question 1 1 pts

Determine whether the statement is true or false.

If f and g are differentiable, then
$\frac{d}{dx}[f(x) + g(x)] = f'(x) + g'(x)$.

- ○ True
- ○ False

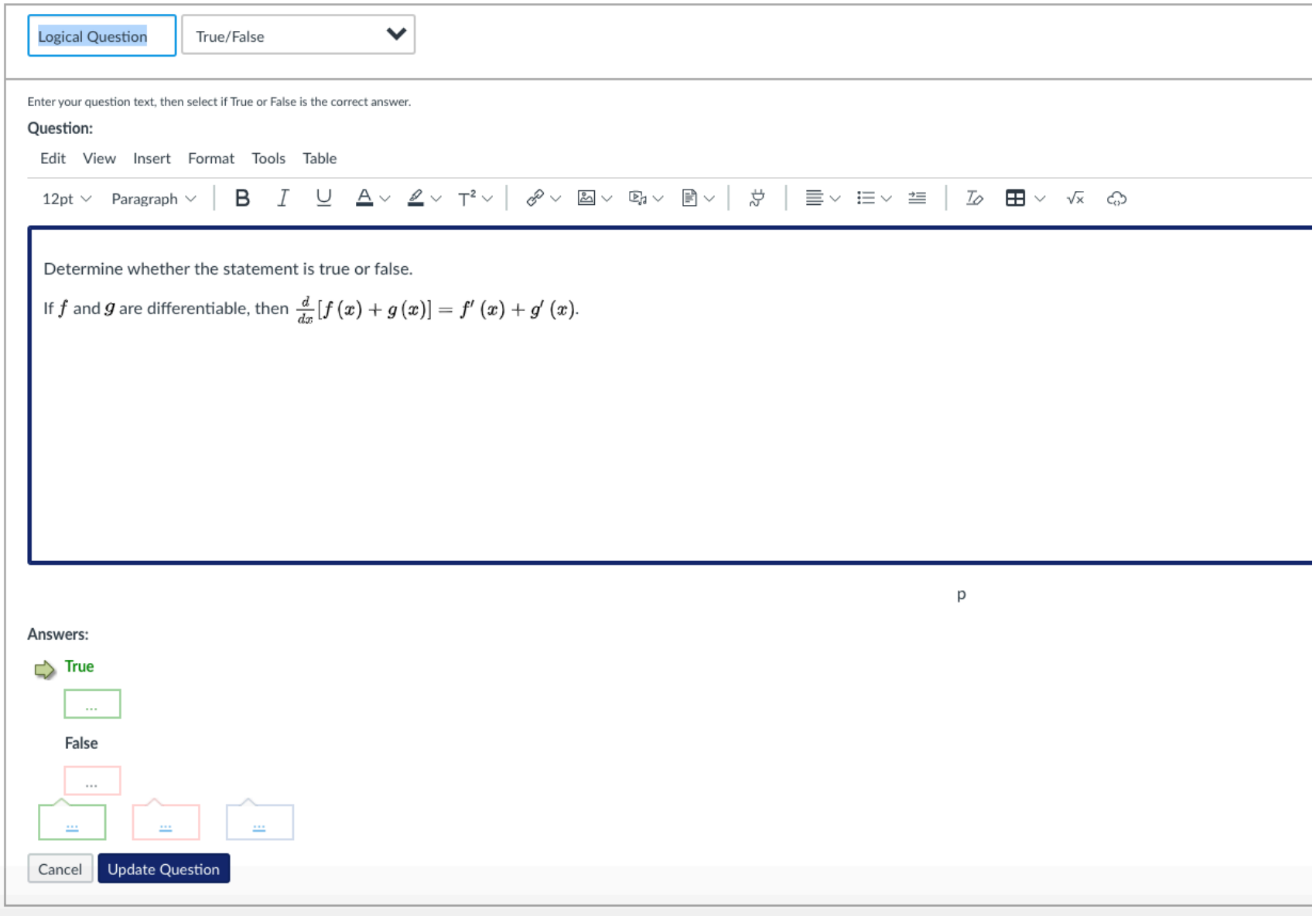
Web-Assign

Determine whether the statement is true or false.

If f and g are differentiable, then $\frac{d}{dx}[f(x) + g(x)] = f'(x) + g'(x)$.

- ○ True
- ○ False

Concept question-Canvas Question Editor



Concept question-WebAssign Question Editor

Save | Test/Preview | Duplicate | Redisplay | Revert | This question has been scheduled

Content

Name: TrueFalse-Sum Rule-MAT121

Mode: Multiple-Choice | Multi-Mode Options

Question

```
<div class="index">
    Determine whether the statement is true or false.
</div>
<div class="index">
    If <em>f</em> and <em>g</em> are differentiable, then <watex>\
[\frac{d}{dx} [f(x) + g(x)] = f<s:thinsp>'(x) + g'(x).\]</watex>
</div>
<div class="index">
    <_>
</div>
```

Answer: Add tab

```
<eqn $ORDERED=1;''>True
False
```

If...then...code

We present here a code that only works on Web-Assign.

$< EQN >$

$a1 = randnum(5,9,1);

$a2 = randnum(1,4,1);

($b1,$b2) = pick(2, 'Sunday', 'Monday', 'Tuesday', 'Wednesday', 'Thursday', 'Friday', 'Saturday');

$c1 = randnum(20,90,10);

$c2 = randnum(20,90,10);

$d1 = randnum(11,80,1)/100;

($e1) = pick(1, 'number card', 'face card');

if ($e1 = 'face card') $e2 = 12 else $e2 = 36;

"

$< /EQN >$

Question body

Find the indicated probabilities:$< br >$
(1) A number is selected randomly from 1 through $< eqn\ \$a1 >$ integers. Probability of getting $< eqn\ \$a2 >$ is $<$ _ $>$ (enter a fraction). $< br >$
(2) You meet a stranger. Probability that he/she is born on $< eqn\ \$b1 >$ or $< eqn\ \$b2 >$ is $<$ _ $>$ (enter a fraction).$< br >$
(3) In a survey, $< eqn\ \$c1 >$ use gas driven cars and $< eqn\ \$c2 >$ use electric. A person is randomly selected. Probability that the person uses electric is $<$ _ $>$ (enter a fraction). $< br >$
(4) A bag contains blue and yellow chips. Probability that a randomly picked chip is blue is $< eqn\ \$d1 >$. Then the probability of randomly selecting a yellow chip is $<$ _ $>$ (enter a decimal number). $< br >$
(5) A card is selected from a deck of 52 playing cards. The probability of getting a $< eqn\ \$e1 >$ (Ace is not a $< eqn\ \$e1 >$) is $<$ _ $>$ (enter a fraction).$< br >$

Answers

$< EQN\$FRACTION = 1; fraction(1, \$a1) >$
$< EQN\$FRACTION = 1; fraction(2, 7) >$
$< EQN\$FRACTION = 1; fraction(\$c2, \$c1 + \$c2) >$
$< EQN 1 - \$d1 >$
$< EQN\ \$FRACTION = 1; fraction(\$e2, 52) >$

Display

Find the indicated probabilities:
(1) A number is selected randomly from 1 through 8 integers. Probability of getting 4 is [ ] 1/8 (enter a fraction).
(2) You meet a stranger. Probability that he/she is born on Thursday or Monday is [ ] 2/7 (enter a fraction).
(3) In a survey, 20 use gas driven cars and 70 use electric. A person is randomly selected. Probability that the person uses electric is [ ] 7/9 (enter a fraction).
(4) A bag contains blue and yellow chips. Probability that a randomly picked chip is blue is 0.27. Then the probability of randomly selecting a yellow chip is [ ] 0.73 (enter a decimal number).
(5) A card is selected from a deck of 52 playing cards. The probability of getting a face card (Ace is not a face card is [ ] 3/13 (enter a fraction).

Acknowledgments

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