

Development of methods for interactive classes using KeTLMS

Koji Nishiura, Setsuo Takato

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Contents of this talk

- Purpose of this research

Contents of this talk

- Purpose of this research
- KeTLMS

Contents of this talk

- Purpose of this research
- KeTLMS
- Making teaching materials by KeTLMS

Contents of this talk

- Purpose of this research
- KeTLMS
- Making teaching materials by KeTLMS
- Teaching materials

Contents of this talk

- Purpose of this research
- KeTLMS
- Making teaching materials by KeTLMS
- Teaching materials
- Concluding remarks

Purpose of this research

We are developing an LMS called KeTLMS. Using KeTLMS, we will create teaching methods that allow us to objectively assess students' levels of understanding while conducting the class, based on verification of its educational effectiveness.

KeTLMS

KeTLMS is a system designed to streamline the process of teachers creating and distributing questions, while students receive the questions and submit their answers. Additionally, it allows teachers to collect and grade the answers efficiently.

KeTTask01-1

1 Q01-3 [2] Find the cubic approximation of $f(x)$ at $x=0$.

Q01 Let $f(x) = \log(1+x)$. Answer the questions.

• [2] Find the cubic approximation of $f(x)$ at $x=0$.

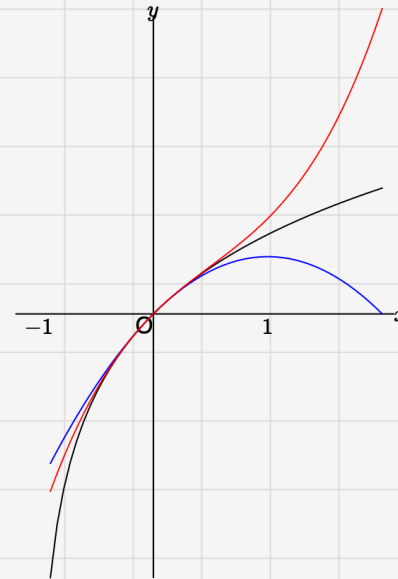
• [2] $= x - \frac{1}{2}x^2 + \frac{1}{3}x^3$

AC ← → DL OK Nxt Pg=3 Pre Un AC PS PL

2 • [2]=x-fr(1,2)x^(2)+fr(1,3)x^(3)

Cap	a	b	c	sin	sq	)	7	8	9	+	Cal	
Gre	x	y	z	cos	fr	,	4	5	6	-	Lin	Rsel
Txt	r	s	t	tan	tfr	(	1	2	3	*	St=01AA	
Vec	w	_	=	log	ln	^	0	.	sp	/	OK	
	°	@	[	]	|	d	e	f	g	lim	pi	Play
	×	!	{	}	≠	h	i	j	k	int	∞	Pau
	dot	:	;	≤	≥	l	m	n	o	'	cs	Rev
Rec	\	±	∓	<	>	p	q	u	v	sum	tx	Stop

1;;12024120526907;;Q01---;;[1]=x-fr(1,2)x^(2);;[2]=x-fr



$$f(x) = \sum_{n=0}^{\infty} \frac{f^{(n)}(0)}{n!} x^n$$

$$= f(0) + f'(0)x + \frac{f''(0)}{2!}x^2 + \frac{f^{(3)}(0)}{3!}x^3 + \dots$$

An important feature of the system is that both questions and answers are formatted as a single line of text.

Making teaching materials by KeTLMS

1. Create a question file, 'question01-1.txt'.

```
1 Q↓
2 Let f(x)=log(1+x). Answer the questions.↓
3 [1] Find the quadratic approximation of f(x) at x=0.↓
4 [2] Find the cubic approximation of f(x) at x=0.↓
5 Sheet↓
6 [1]=? ::5↓
7 [2]=? ::5↓
8 Ans↓
9 [1] x-fr(1,2)x^(2)↓
10 [2] x-fr(1,2)x^(2)+fr(1,3)x^(3)
```

Making teaching materials by KeTLMS

2. Create a question file, 'kettaskv01-1E.html' by pressing buttons '1.taskline' and '2.Kettask' in 'toolketmathE.cdy'.

Go	Rset	data	2024
0:Mxans(option)			0:Generate mxans with Maxima
1.taskline			1,2:Generate kettask.html *Copy all answers to 2anssheetall
2.Kettask			3:Divide anssheetall
3.Ansheet each			4,5:Generate ketscore.html
4.scoreline+anschart			6:Score with Maxima *Add results to 4scoresheetall
5.ketscore			7:Generate each 4scoresheet
6.Maxima(option)			8:Generate summaries
7.scoresheet			9:Generate results
8.Summary			10:Copy results to students' folder
9.Result each St			
10.Return to St			

< >

Making teaching materials by KeTLMS

3. Create a file to embed in 'kettaskv01-1E.html',
'001-1draw.txt'.

```
1 if(ketlibflg==1,↓
2   str2="?";↓
3   ketlibflg=0;↓
4   flgp2=1;Defvar(["flgp2",flgp2]);↓
5   flgp3=1;Defvar(["flgp3",flgp3]);↓
6 );↓
7 Setwindow([-1.2,2.1],[-2.3,2.6]);↓
8 if(nqu>1,↓
9   Expr(Mvpt(-1.5,-2.7),"e",↓
10      Totexform("f(x)=sum(n=0,{\infty},!fr(f^((n))(0),n!)x^n)"));
11   Expr(Mvpt(-1.5,-3.3),"e",↓
12      Totexform("\phantom{f(x)}=f(0)+f'(0)x+fr(f''(0),2!)x^2↓
13      +fr(f^((3))(0),3!)x^3+\cdots "));↓
14 );↓
15 Mvplotdata("1","log(1+x)","x=[-0.9,2]");↓
16 Expr(Mvpt(1,0),"s1","1");↓
17 Expr(Mvpt(-1,0),"s1","-1");↓
18 Mvdrwxy();↓
```

Making teaching materials by KeTLMS

4. Create an embedded file, 'kettaskv01-1Ed.html', using 'toolembded.cdy'.

The screenshot displays the KeTLMS interface with a top toolbar containing buttons: Draw, Embed, OK, Rep, Reset, data, 2024, Ketjson, and Ketjsoff. The main workspace is divided into two sections.

Section 1: Labeled with a green '1' in a box. It features a text input field containing '01-1Edraw.txt'. To the left, there are four colored dots labeled T1 (black), T2 (yellow), T3 (black), and T4 (yellow). Below these is a horizontal blue line with a red dot labeled 's'. A toolbar below the line includes buttons: PS, PL, AC, CL, BS, and navigation arrows (<<, <, >, >>).

Section 2: Labeled with a green '2' in a box. It features a text input field containing '[2]='. Below this is a large keypad with various mathematical symbols and functions. The keypad is organized as follows:

Cap	a	b	c	sin	sq	)	7	8	9	+	Cal
Gre	x	y	z	cos	fr	,	4	5	6	-	Lin
Bld	r	s	t	tan	tfr	(	1	2	3	*	St=
Vec	w	_	=	log	ln	^	0	.	sp	/	OK
	°	@	[	]	|	d	e	f	g	lim	pi
	×	!	{	}	≠	h	i	j	k	int	∞
	dot	:	;	≤	≥	l	m	n	o	'	cs
Rec	\	±	∓	<	>	p	q	u	v	sum	tx

To the right of the keypad is a red 'Rset' button and a green 'OK' button. Below the keypad is a vertical stack of buttons: Play, Pau, Rev, and Stop.

Graphing Area: On the right side, there is a coordinate system with x and y axes. A curve is plotted, passing through the origin (0,0). The x-axis is labeled with -1 and 1. Below the graph, the Taylor series expansion for f(x) is shown:

$$f(x) = \sum_{n=0}^{\infty} \frac{f^{(n)}(0)}{n!} x^n$$
$$f(x) = f(0) + f'(0)x + \frac{f''(0)}{2!}x^2 + \frac{f^{(3)}(0)}{3!}x^3 + \dots$$

Teaching materials

We have created teaching materials on the differential coefficient, titled `kettaskv001-1Ed.html` and `kettaskv001-2Ed.html`.

These materials consist of explanations and questions.

Teaching materials

kettaskv001-1Ed.html, kettaskv001-2Ed.html



Teaching materials

File of answers : anschart001-1.csv

CA	2024	1		Q01---	[1]1	—	[2]4	5	[3]a+b	5
1	01C	1209	17:49:21	Q01---	[1]=1		[2]=4		[3]=a+b	
2	02C	1209	17:51:0	Q01---	[1]=1		[2]=4		[3]=a-b	
3	03C	1209	17:51:51	Q01---	[1]=1		[2]=4		[3]=a+b	
4	04C	1209	17:52:39	Q01---	[1]=1		[2]=4		[3]=a+b	
5	05C	1209	17:54:15	Q01---	[1]=0		[2]=3		[3]=b^(2) -a^(2)	

Teaching materials

File of answers : anschart001-1.csv

CA	2024	1		Q01---	[1]1	—	[2]4	5	[3]a+b	5
1	01C	1209	17:49:21	Q01---	[1]=1		[2]=4		[3]=a+b	
2	02C	1209	17:51:0	Q01---	[1]=1		[2]=4		[3]=a-b	
3	03C	1209	17:51:51	Q01---	[1]=1		[2]=4		[3]=a+b	
4	04C	1209	17:52:39	Q01---	[1]=1		[2]=4		[3]=a+b	
5	05C	1209	17:54:15	Q01---	[1]=0		[2]=3		[3]=b^(2) -a^(2)	

The teacher will check the answers given by the students and then move on to the next explanation.

Concluding remark

We can easily create interactive teaching materials with KeTLMS, and we will assess their effectiveness from now on.