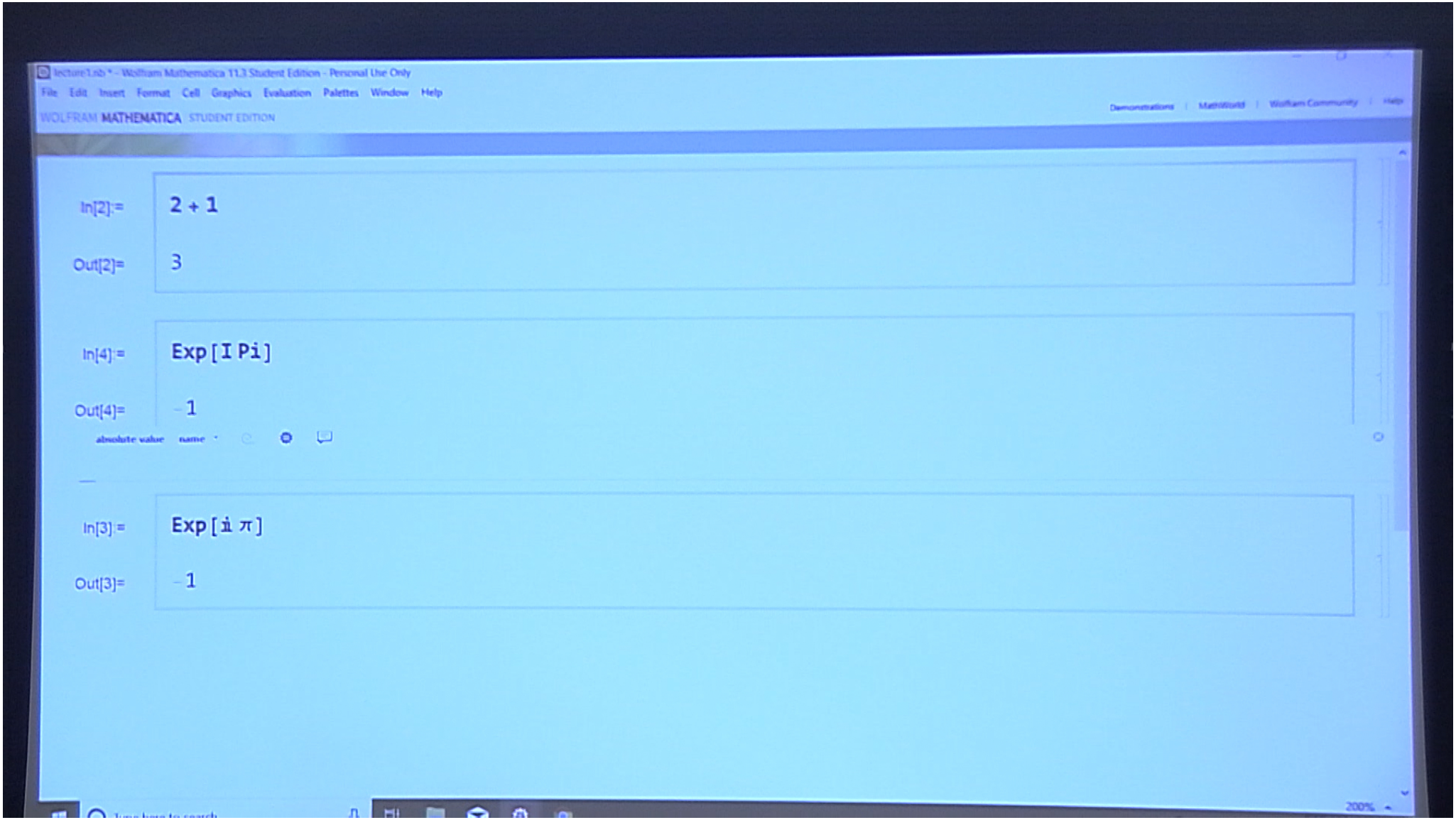
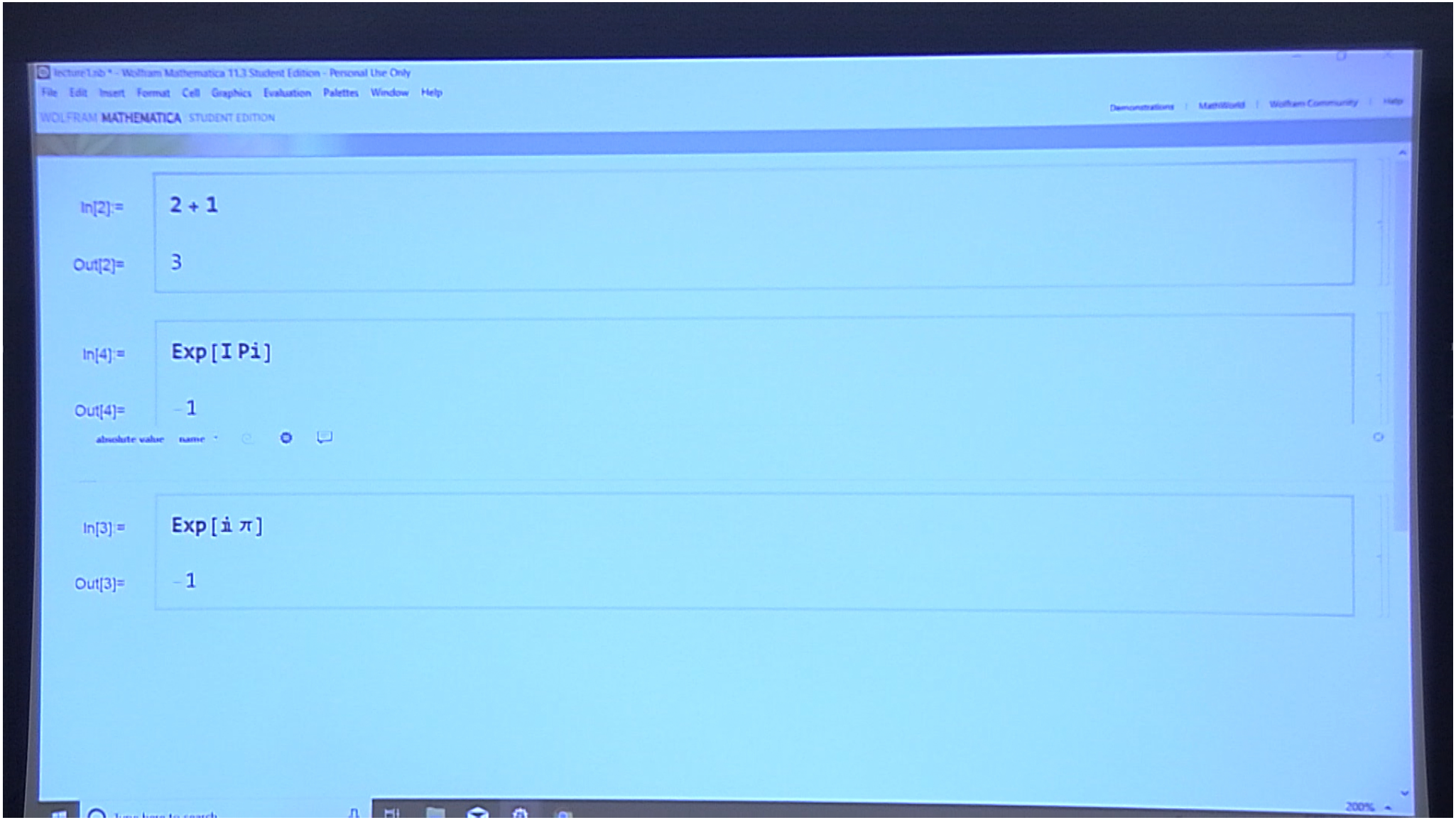
Title: PSI 2018/2019 - Introduction to Mathematica - Lecture 1

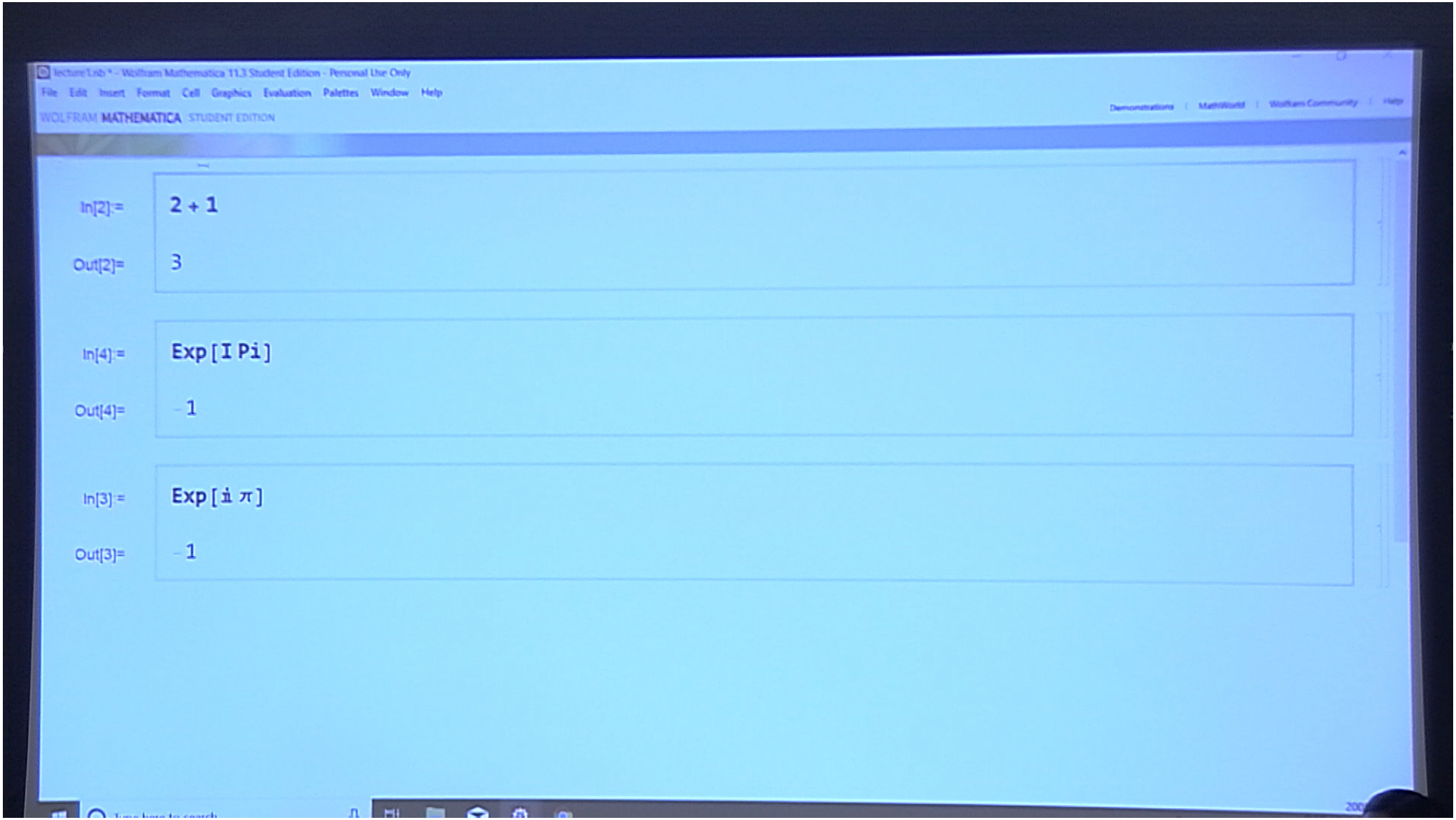
Date: Aug 27, 2018 09:00 AM

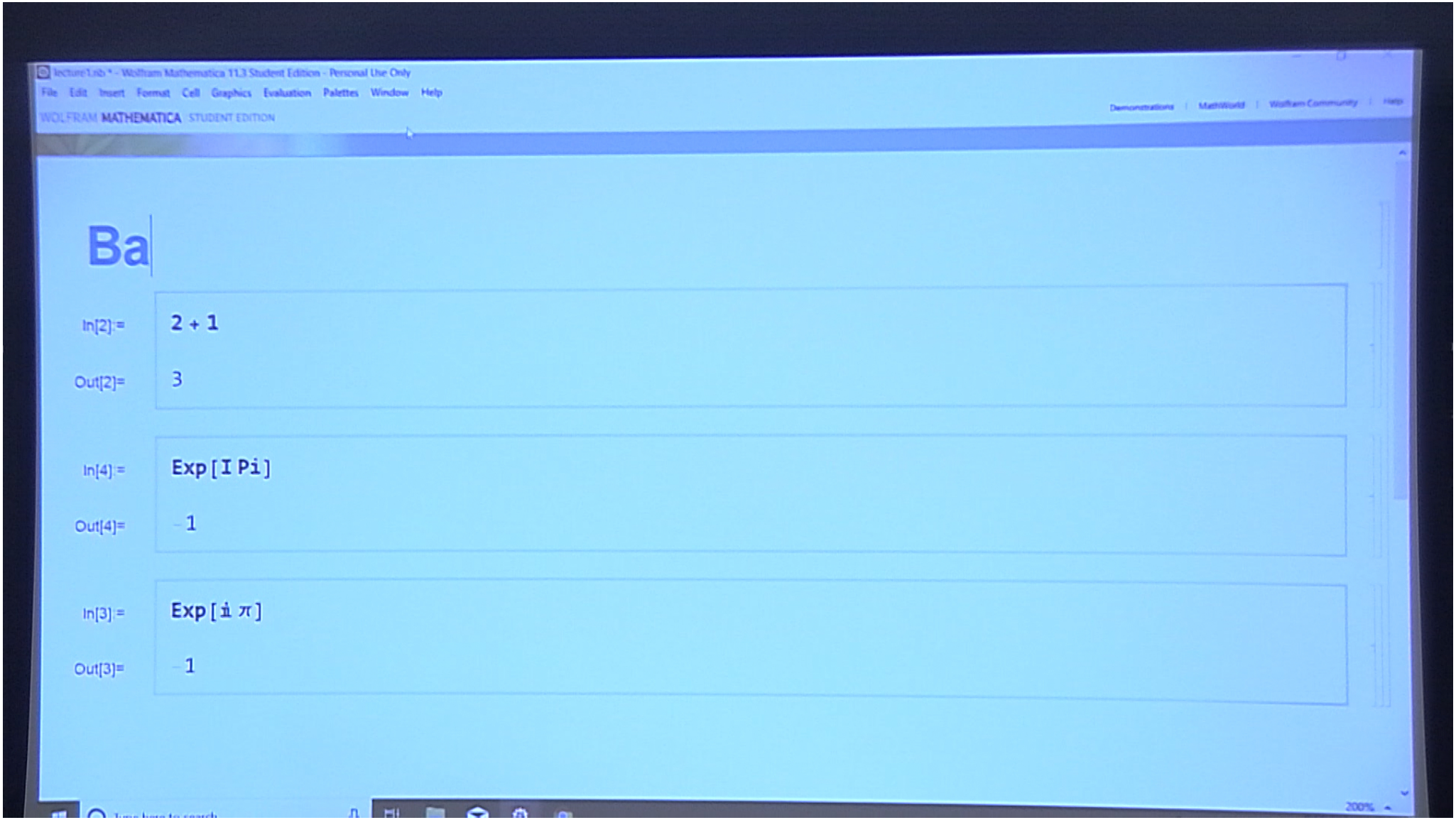
URL: http://pirsa.org/18080023

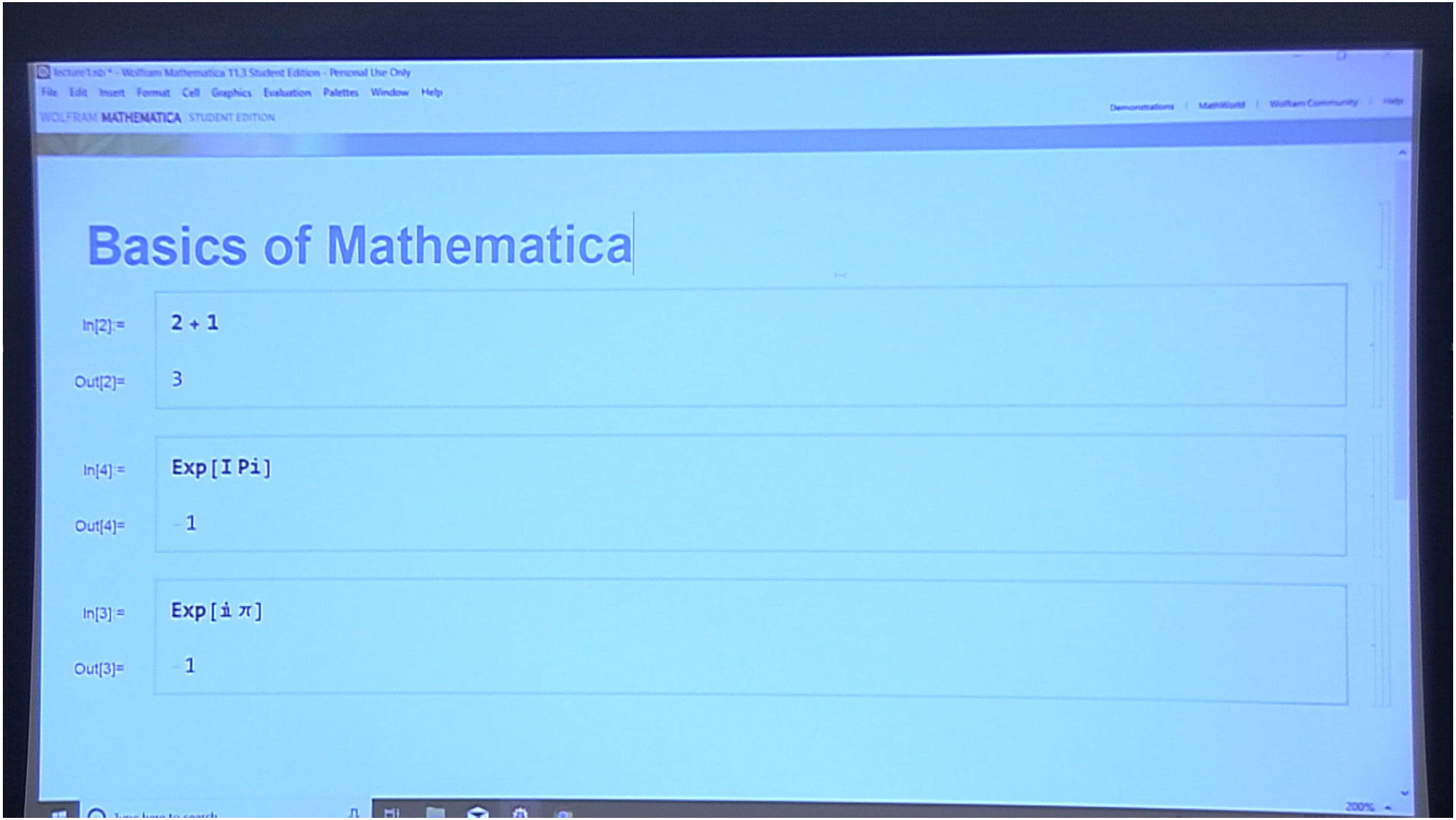
Abstract:

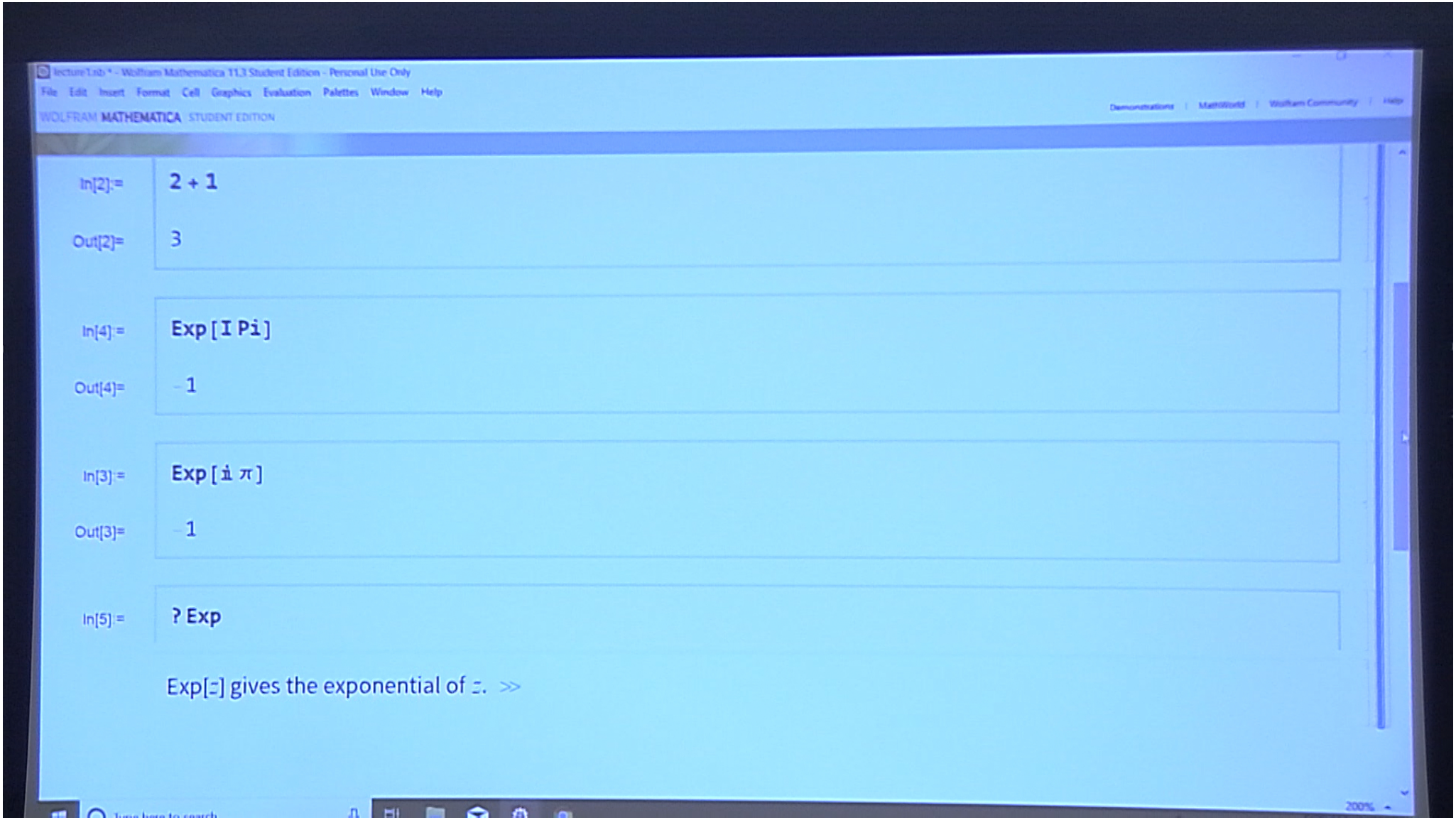

lecture1.nb * - Wolfram Mathematica 11.3 Student Edition - Personal Use Only
File Edit Insert Format Cell Graphics Evaluation Palettes Window Help
WOLFRAM MATHEMATICA STUDENT EDITION
In[2]:= 2 + 1
Out[2]= 3
In[4]:= Exp[I Pi]
Out[4]= -1
absolute value name
In[3]:= Exp[i π]
Out[3]= -1
200%

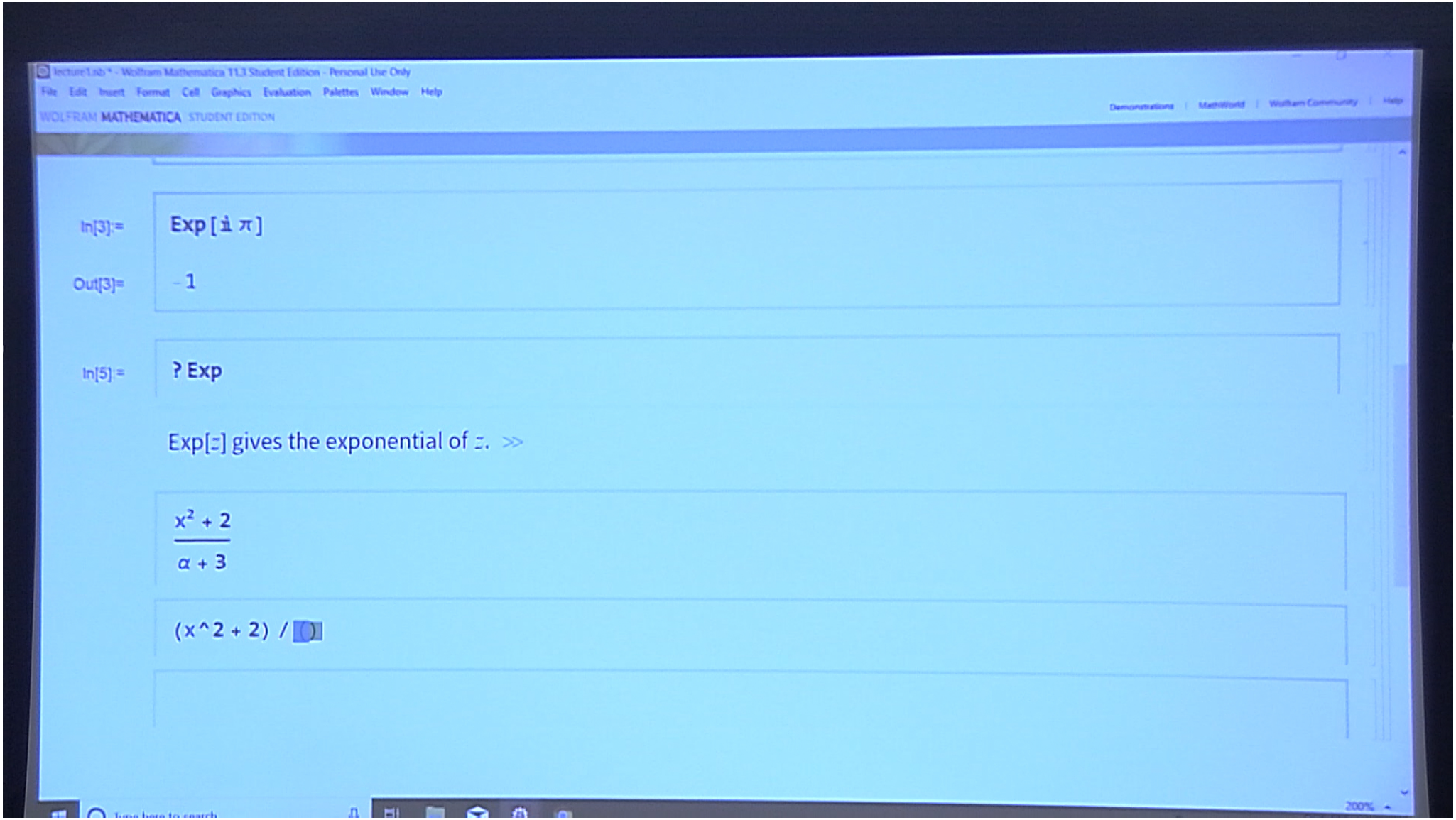

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WOLFRAM MATHEMATICA STUDENT EDITION
In[2]:= 2 + 1
Out[2]= 3
In[4]:= Exp[I Pi]
Out[4]= -1
absolute value name
In[3]:= Exp[i π]
Out[3]= -1
200%

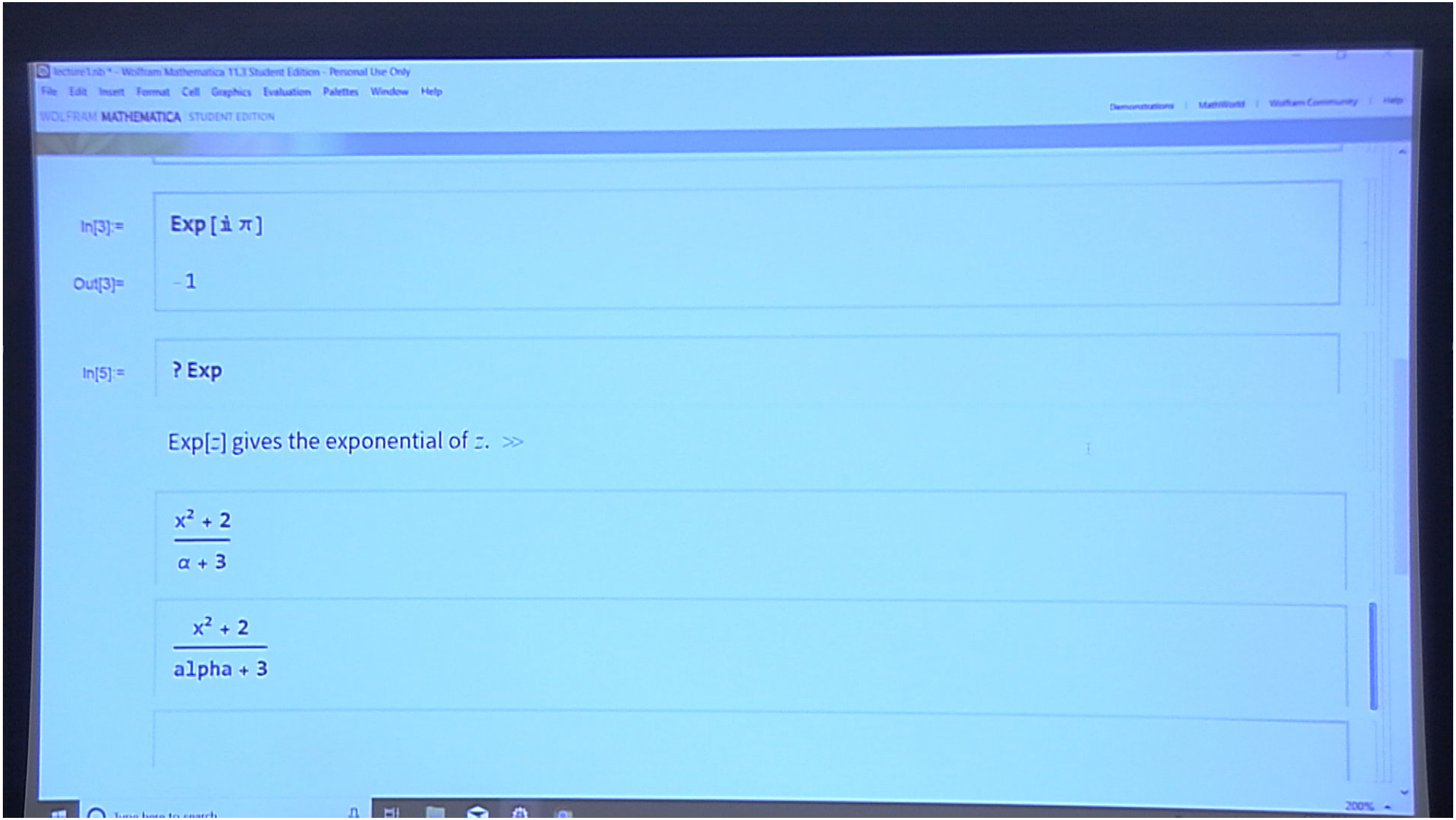

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WOLFRAM MATHEMATICA STUDENT EDITION
Demonstrations | MathWorld | Wolfram Community | Help
In[2]:= 2 + 1
Out[2]= 3
In[4]:= Exp[I Pi]
Out[4]= -1
In[3]:= Exp[i π]
Out[3]= -1

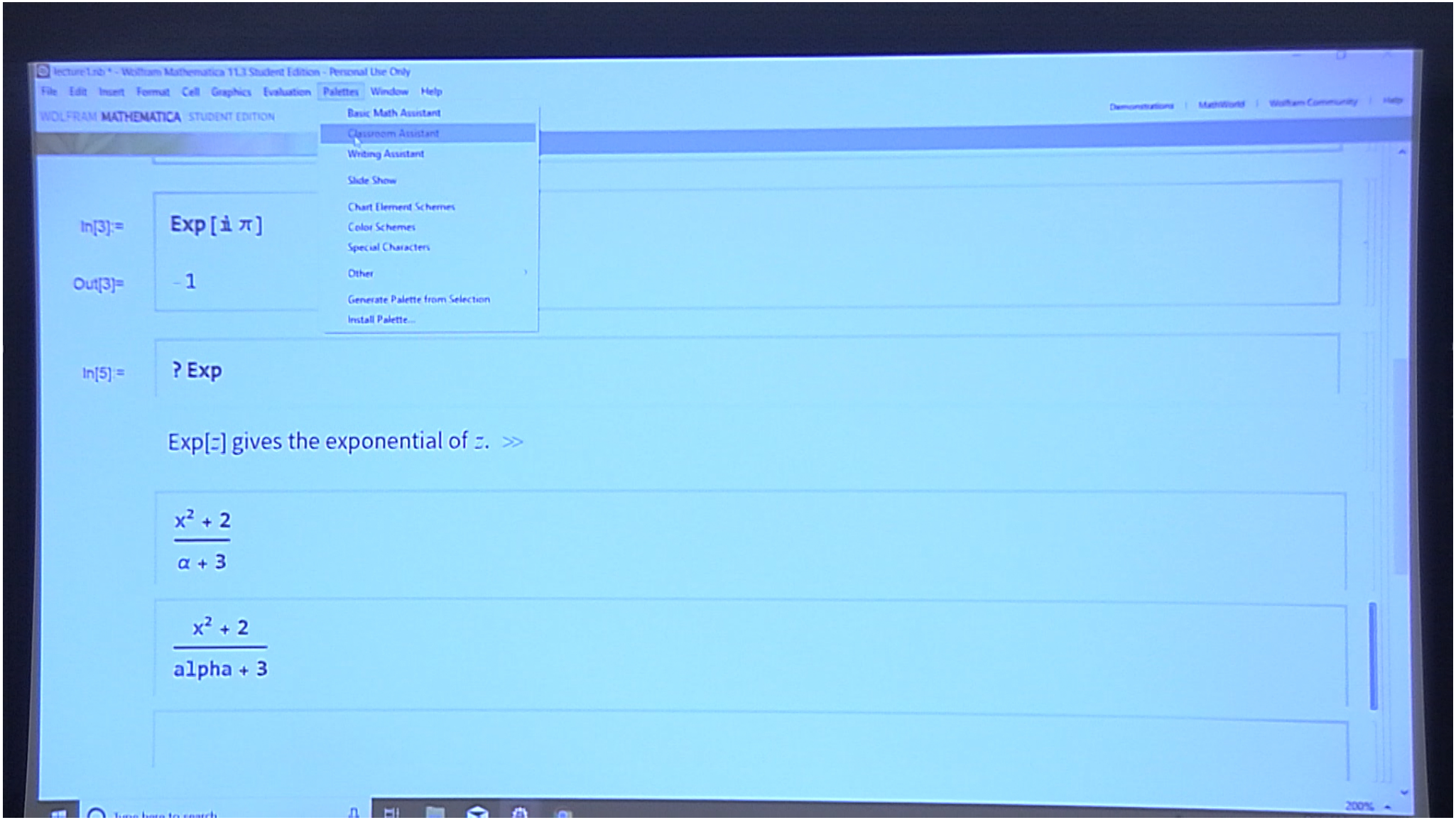

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WOLFRAM MATHEMATICA STUDENT EDITION
Demonstrations | MathWorld | Wolfram Community | Help
Ba
In[2]:= 2 + 1
Out[2]= 3
In[4]:= Exp[I Pi]
Out[4]= -1
In[3]:= Exp[i π]
Out[3]= -1
200%

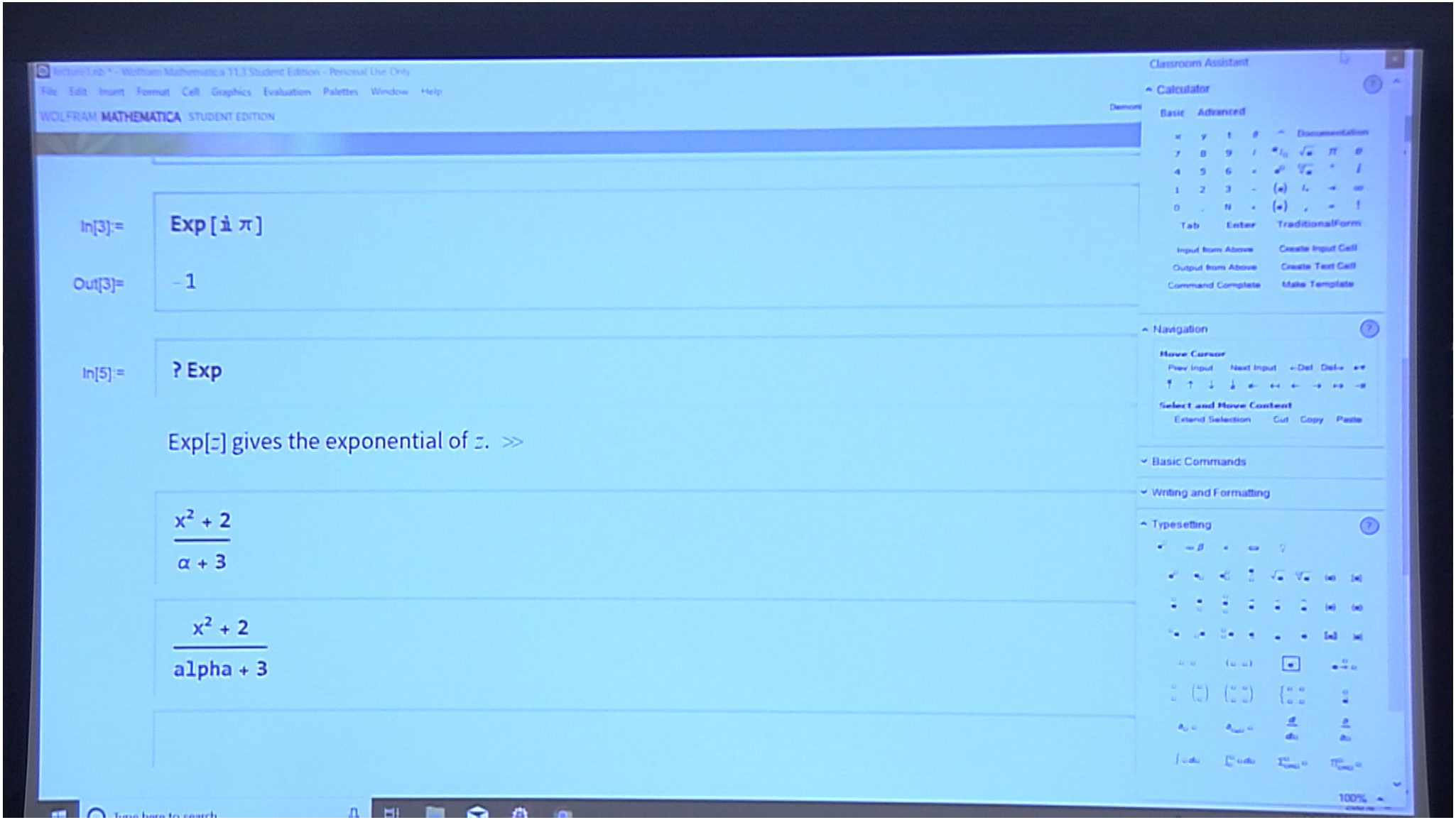

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WOLFRAM MATHEMATICA STUDENT EDITION
Demonstrations | MathWorld | Wolfram Community | Help
Basics of Mathematica
In[2]:= 2 + 1
Out[2]= 3
In[4]:= Exp[I Pi]
Out[4]= -1
In[3]:= Exp[i π]
Out[3]= -1
200%

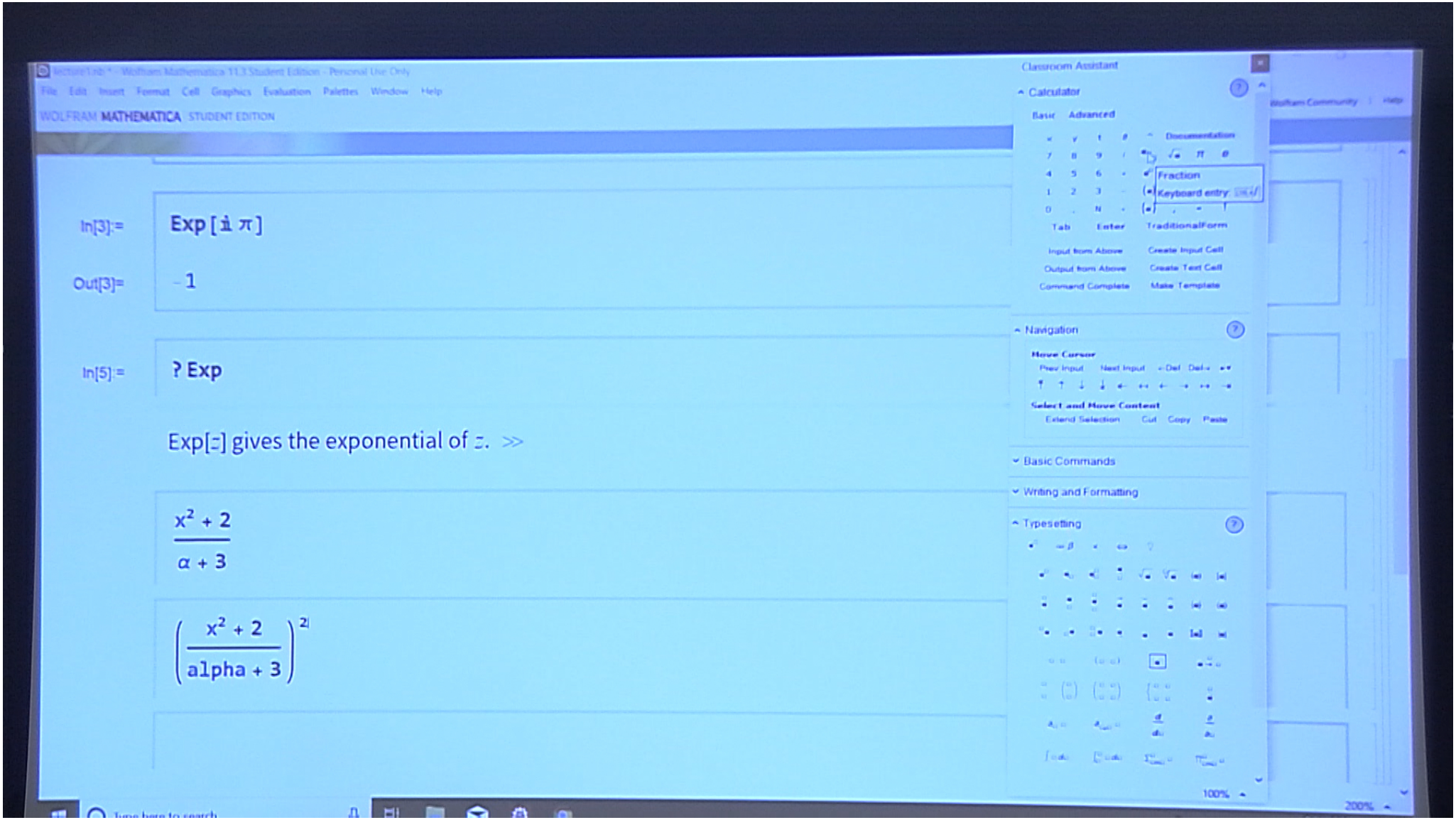

File Edit Insert Format Cell Graphics Evaluation Palettes Window Help
WOLFRAM MATHEMATICA STUDENT EDITION
In[2]:= 2 + 1
Out[2]= 3
In[4]:= Exp[I Pi]
Out[4]= -1
In[3]:= Exp[i π]
Out[3]= -1
In[5]:= ? Exp
Exp[□] gives the exponential of □. >>

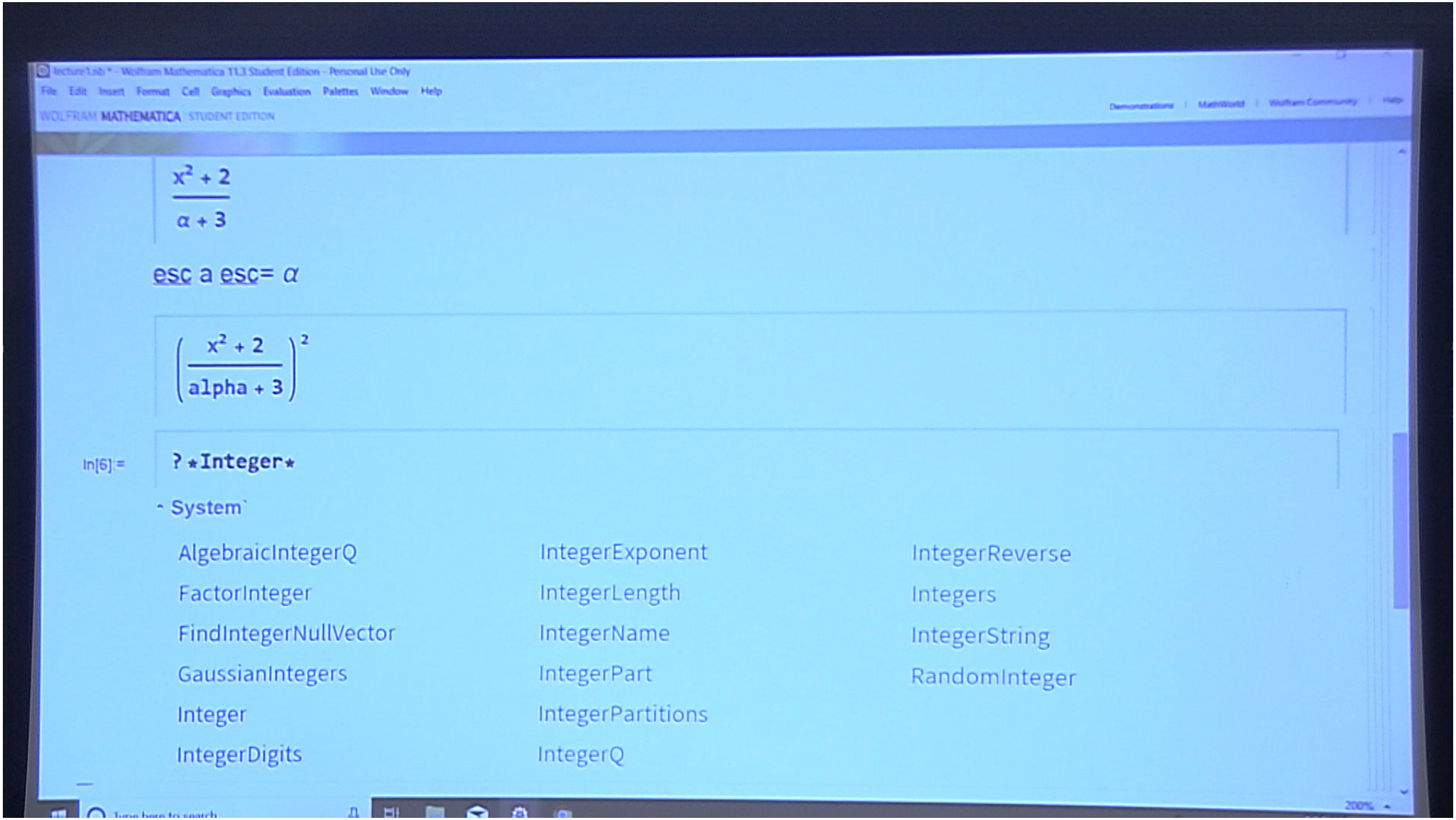

Lecture1.nb * - Wolfram Mathematica 11.3 Student Edition - Personal Use Only
File Edit Insert Format Cell Graphics Evaluation Palettes Window Help
WOLFRAM MATHEMATICA STUDENT EDITION
Demonstrations | MathWorld | Wolfram Community | Help
In[3]:= Exp[i π]
Out[3]= -1
In[5]:= ? Exp
Exp[z] gives the exponential of z. >>
x^2 + 2
α + 3
(x^2 + 2) /
200%

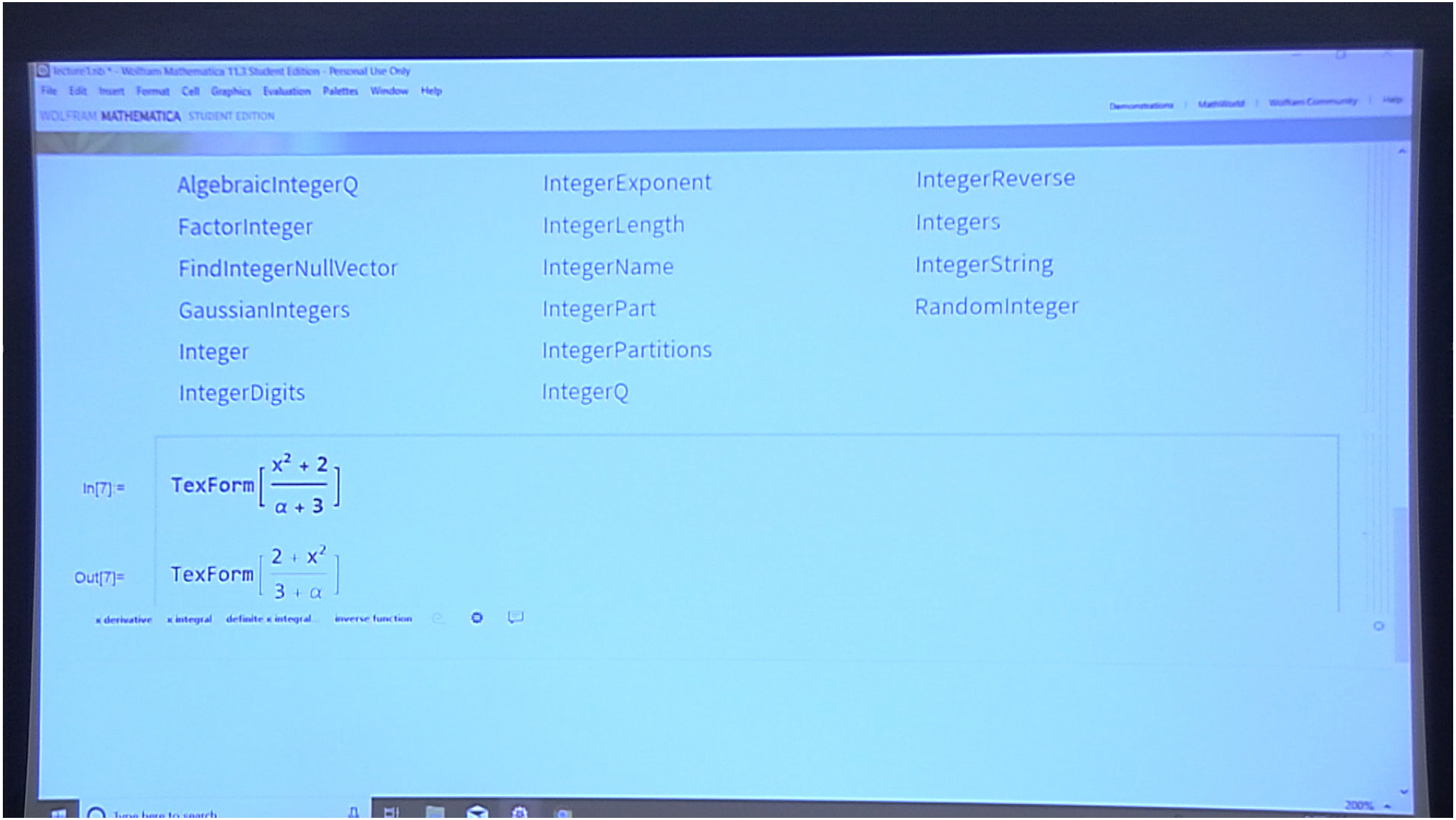

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WOLFRAM MATHEMATICA STUDENT EDITION
In[3]:= Exp[i π]
Out[3]= -1
In[5]:= ? Exp
Exp[z] gives the exponential of z. >>
x^2 + 2 / α + 3
x^2 + 2 / alpha + 3

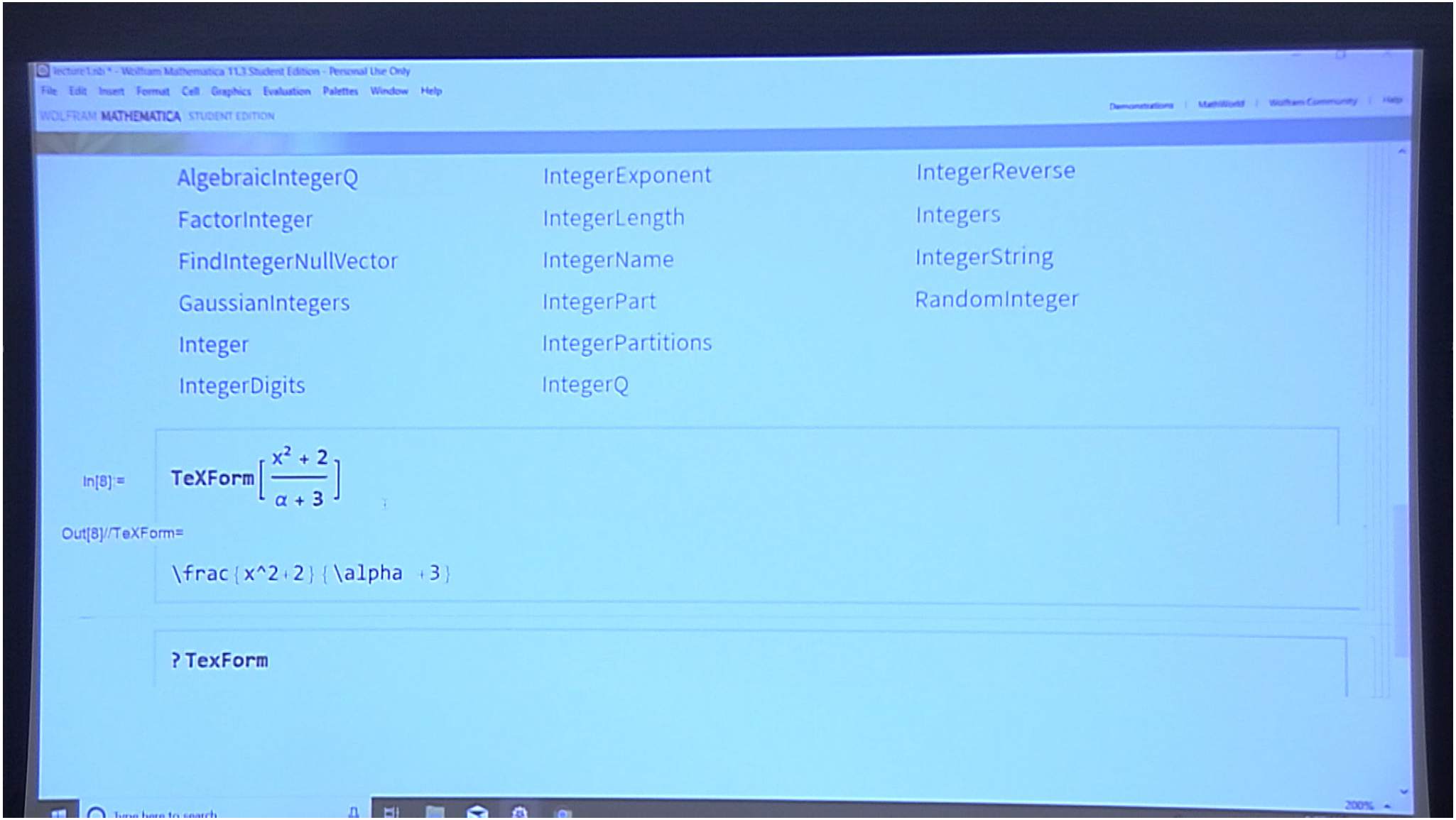

lecture1.nb * - Wolfram Mathematica 11.3 Student Edition - Personal Use Only
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WOLFRAM MATHEMATICA STUDENT EDITION
Basic Math Assistant
Classroom Assistant
Writing Assistant
Slide Show
Chart Element Schemes
Color Schemes
Special Characters
Other
Generate Palette from Selection
Install Palette...
In[3]:= Exp[i π]
Out[3]= -1
In[5]:= ? Exp
Exp[z] gives the exponential of z. >>
x^2 + 2 / α + 3
x^2 + 2 / alpha + 3

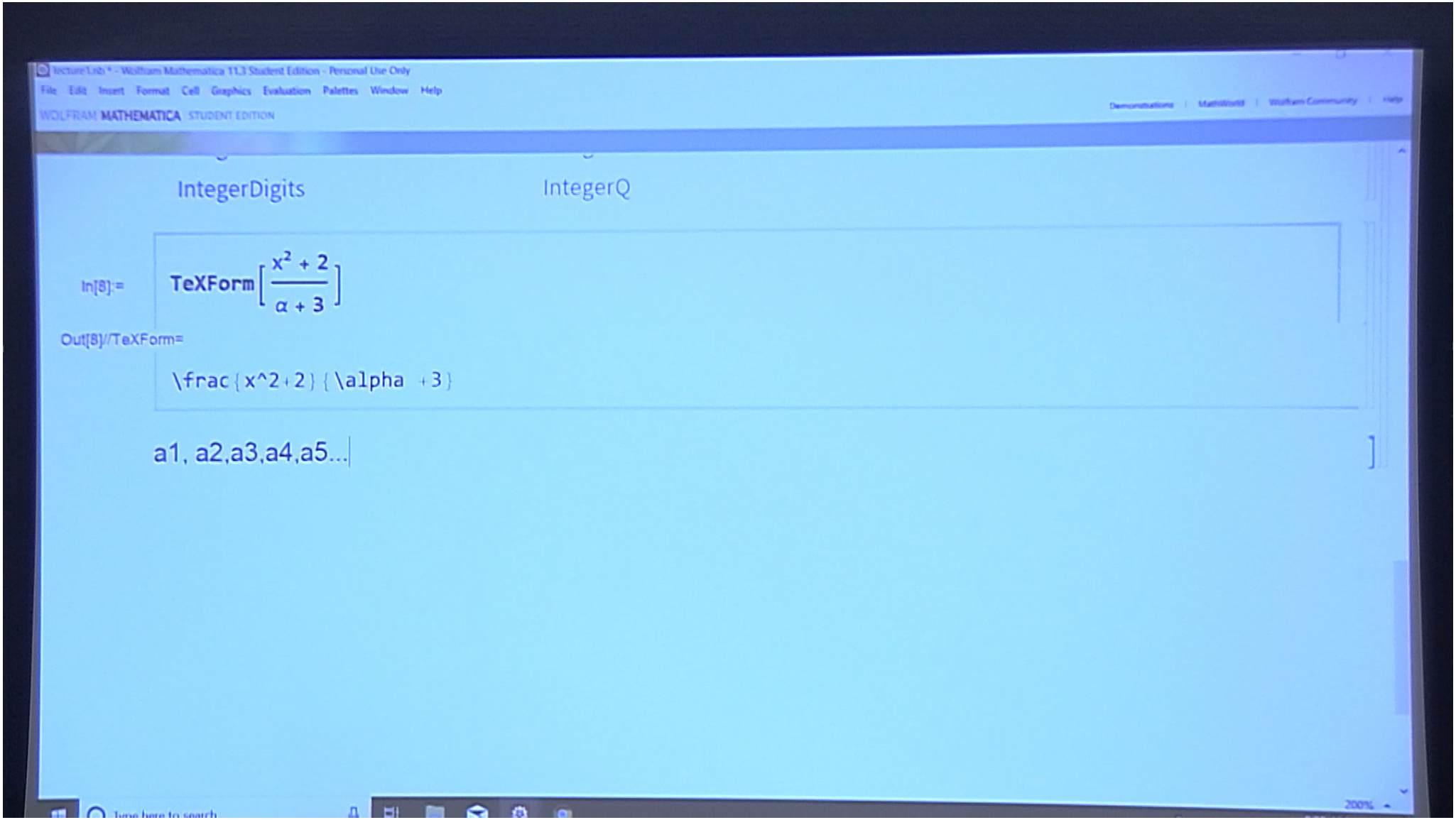

File Edit Insert Format Cell Graphics Evaluation Palettes Window Help
WOLFRAM MATHEMATICA STUDENT EDITION
In[3]:= Exp[i π]
Out[3]= -1
In[5]:= ? Exp
Exp[z] gives the exponential of z. >>
(x^2 + 2)/(α + 3)
(x^2 + 2)/(alpha + 3)
Classroom Assistant
Calculator
Basic Advanced
Navigation
Move Cursor
Select and Move Content
Basic Commands
Writing and Formatting
Typesetting

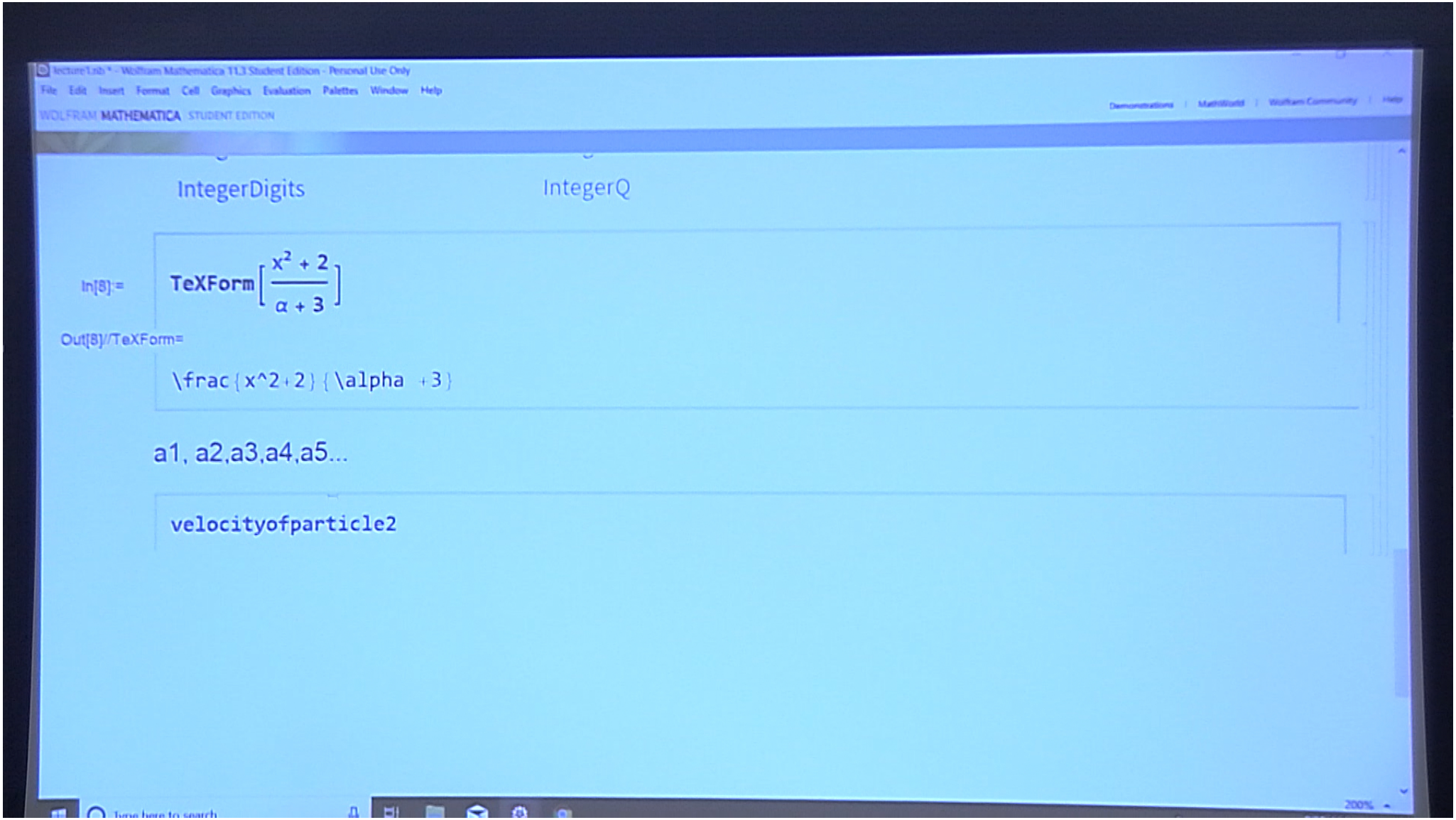

File Edit Insert Format Cell Graphics Evaluation Palettes Window Help
WOLFRAM MATHEMATICA STUDENT EDITION
In[3]:= Exp[i π]
Out[3]= -1
In[5]:= ? Exp
Exp[z] gives the exponential of z. >>
(x^2 + 2)/(α + 3)
((x^2 + 2)/(alpha + 3))^2
Classroom Assistant
Calculator
Basic Advanced
Fraction
Keyboard entry
Navigation
Basic Commands
Writing and Formatting
Typesetting

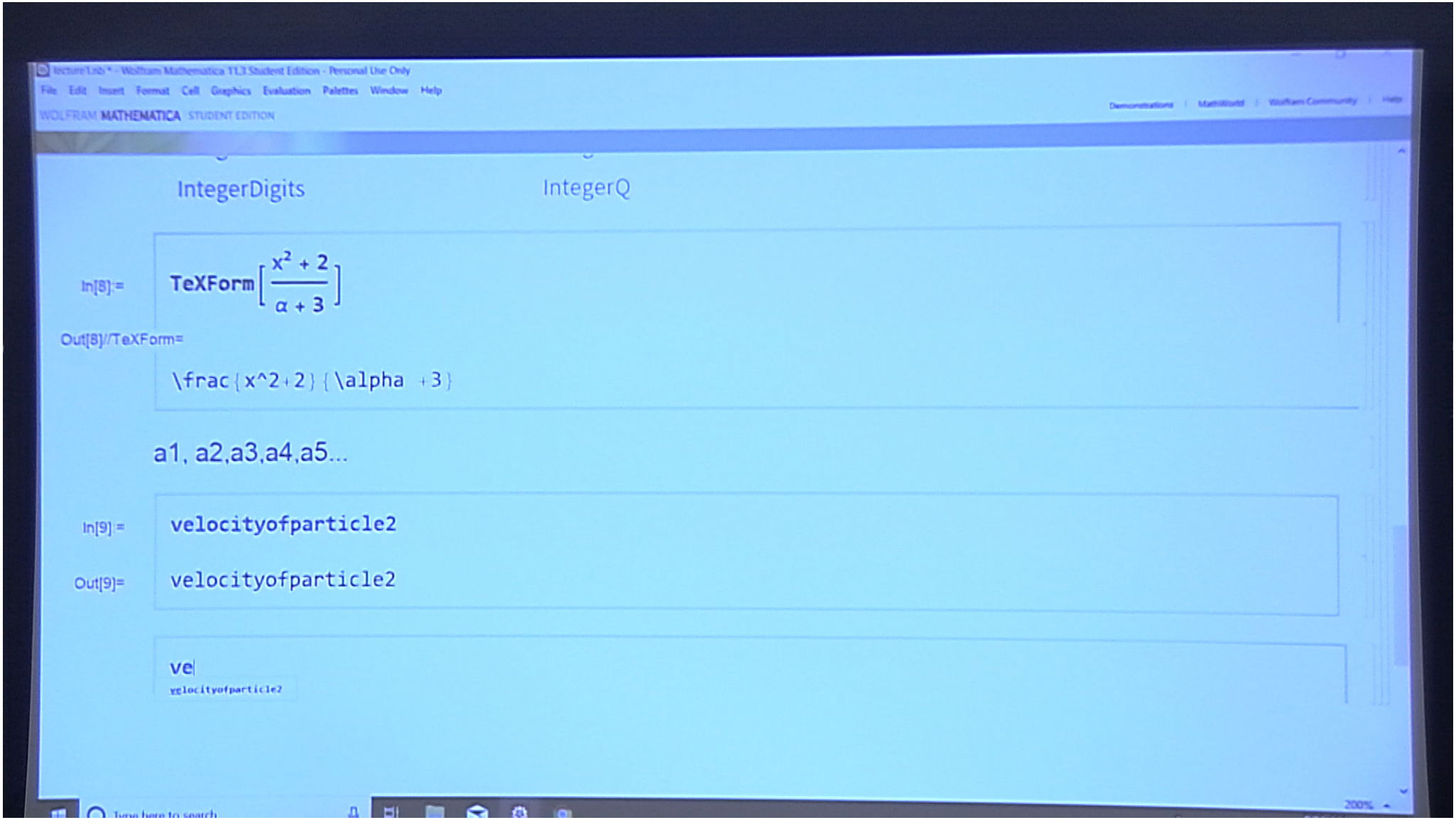

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File Edit Insert Format Cell Graphics Evaluation Palettes Window Help
WOLFRAM MATHEMATICA STUDENT EDITION
$\frac{x^2 + 2}{\alpha + 3}$
esc a esc= α
$\left(\frac{x^2 + 2}{\text{alpha} + 3}\right)^2$
In[6]:= ?*Integer*
System`
AlgebraicIntegerQ
FactorInteger
FindIntegerNullVector
GaussianIntegers
Integer
IntegerDigits
IntegerExponent
IntegerLength
IntegerName
IntegerPart
IntegerPartitions
IntegerQ
IntegerReverse
Integers
IntegerString
RandomInteger

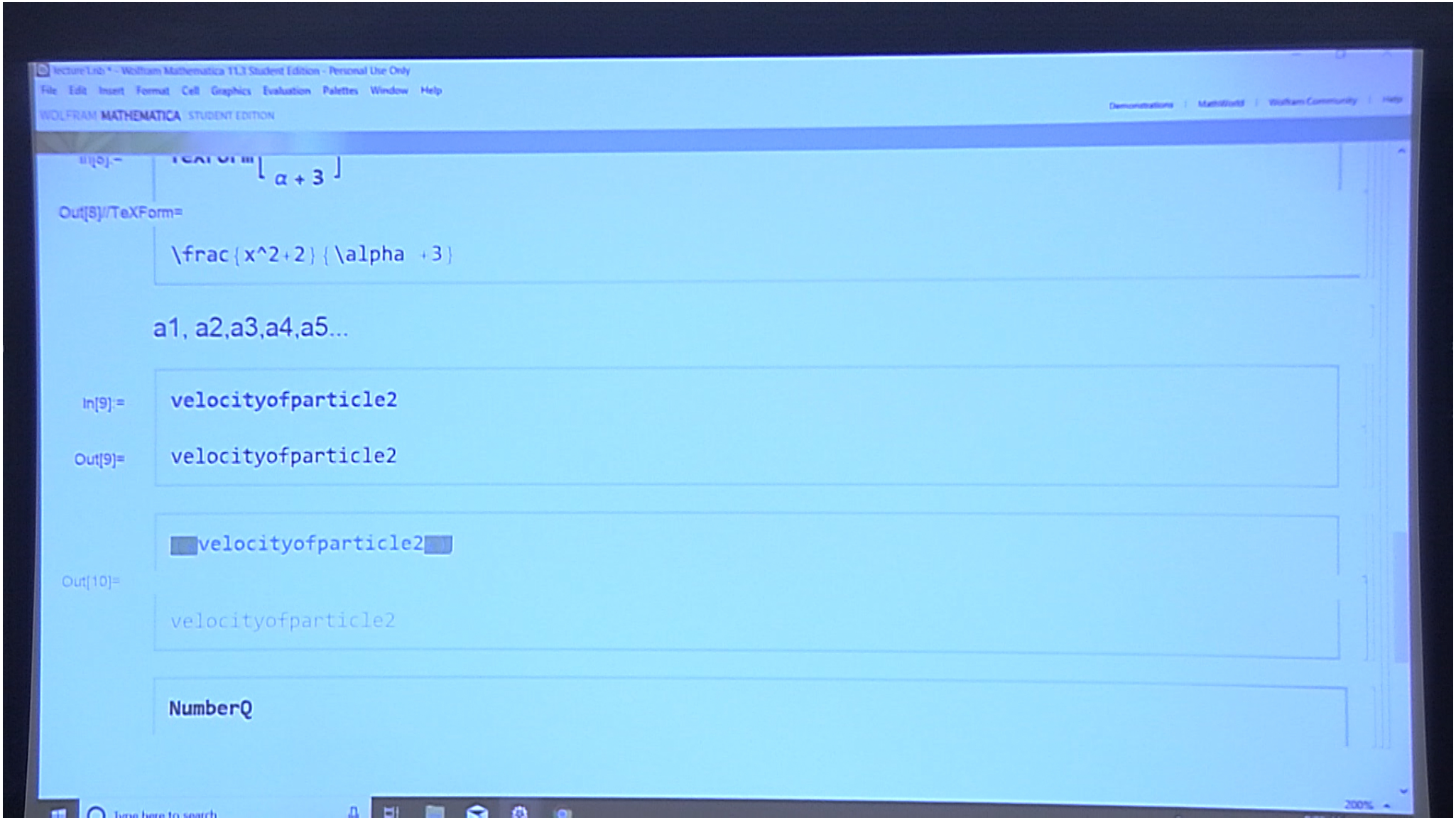

Lecture1.nb * - Wolfram Mathematica 11.3 Student Edition - Personal Use Only
File Edit Insert Format Cell Graphics Evaluation Palettes Window Help
WOLFRAM MATHEMATICA STUDENT EDITION
AlgebraicIntegerQ
FactorInteger
FindIntegerNullVector
GaussianIntegers
Integer
IntegerDigits
IntegerExponent
IntegerLength
IntegerName
IntegerPart
IntegerPartitions
IntegerQ
IntegerReverse
Integers
IntegerString
RandomInteger
In[7]:= TexForm[(x^2 + 2)/(α + 3)]
Out[7]= TexForm[(2 + x^2)/(3 + α)]
x derivative
x integral
definite x integral...
inverse function
200%

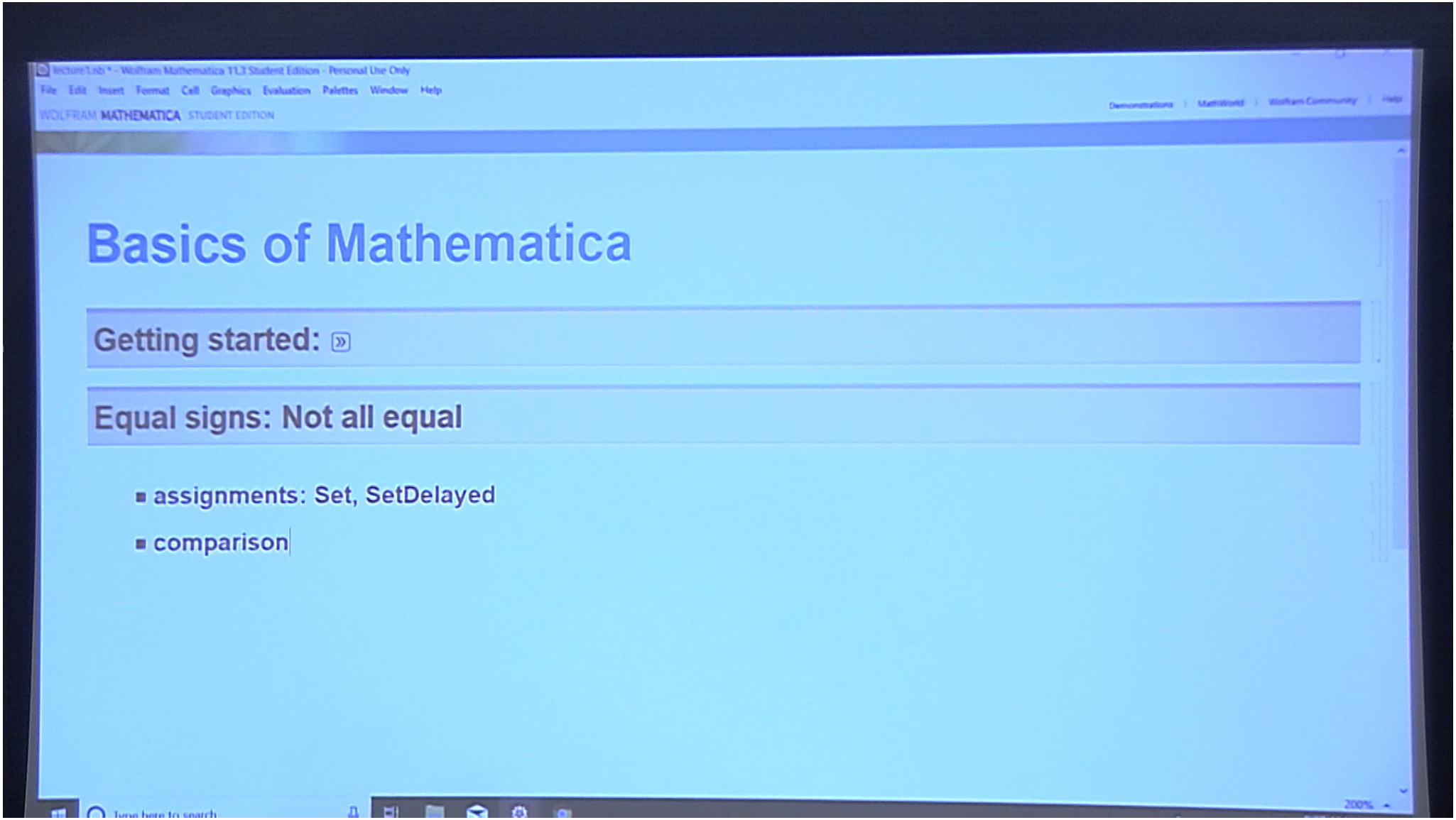

lecture1.nb * - Wolfram Mathematica 11.3 Student Edition - Personal Use Only
File Edit Insert Format Cell Graphics Evaluation Palettes Window Help
WOLFRAM MATHEMATICA STUDENT EDITION
AlgebraicIntegerQ
FactorInteger
FindIntegerNullVector
GaussianIntegers
Integer
IntegerDigits
IntegerExponent
IntegerLength
IntegerName
IntegerPart
IntegerPartitions
IntegerQ
IntegerReverse
Integers
IntegerString
RandomInteger
In[8]:= TeXForm[(x^2 + 2)/(α + 3)]
Out[8]//TeXForm=
\frac{x^2+2}{\alpha +3}
?TexForm

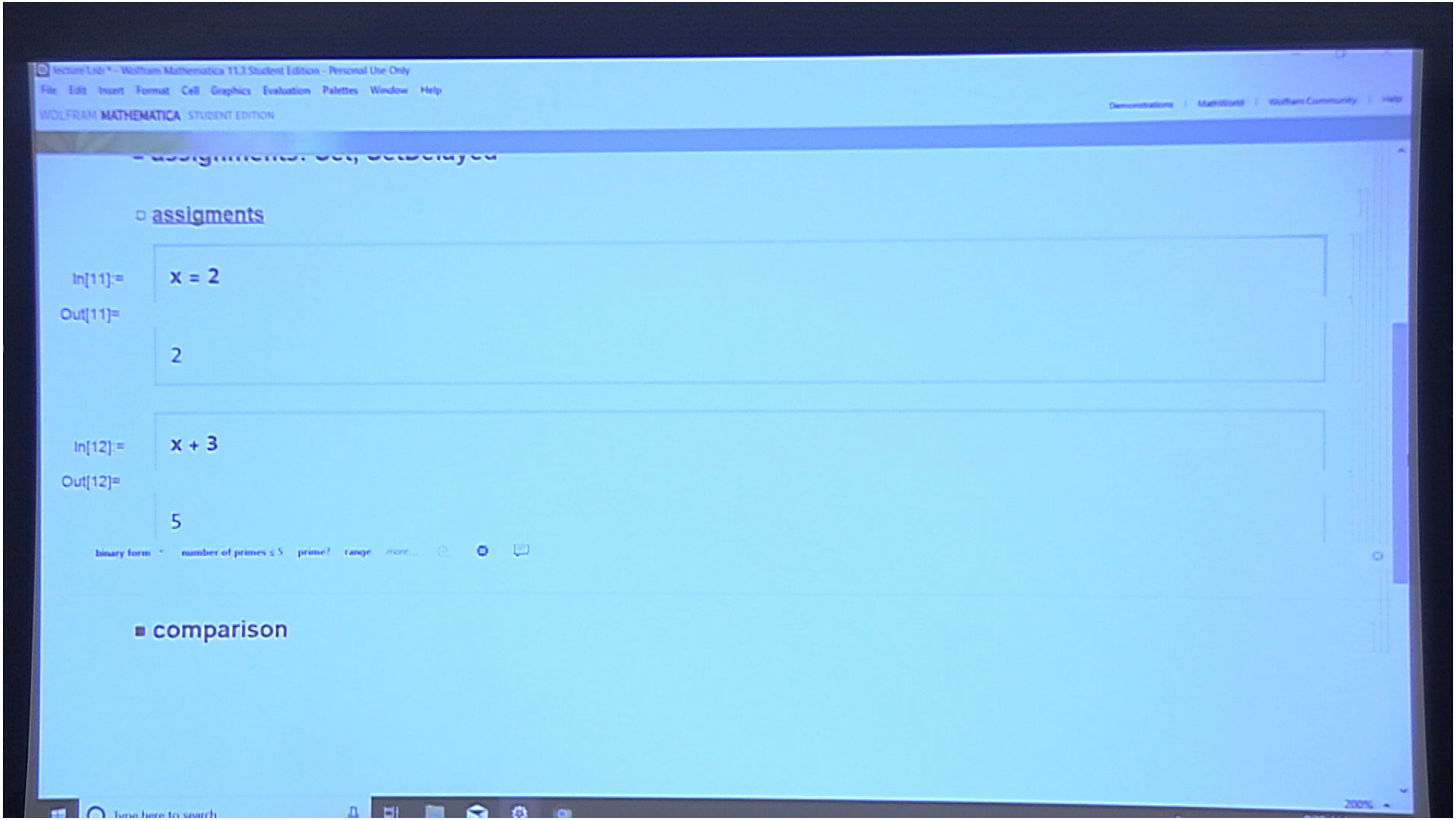

IntegerDigits
IntegerQ
In[8]:=
TeXForm[(x^2 + 2)/(α + 3)]
Out[8]//TeXForm=
\frac{x^2+2}{\alpha +3}
a1, a2,a3,a4,a5...

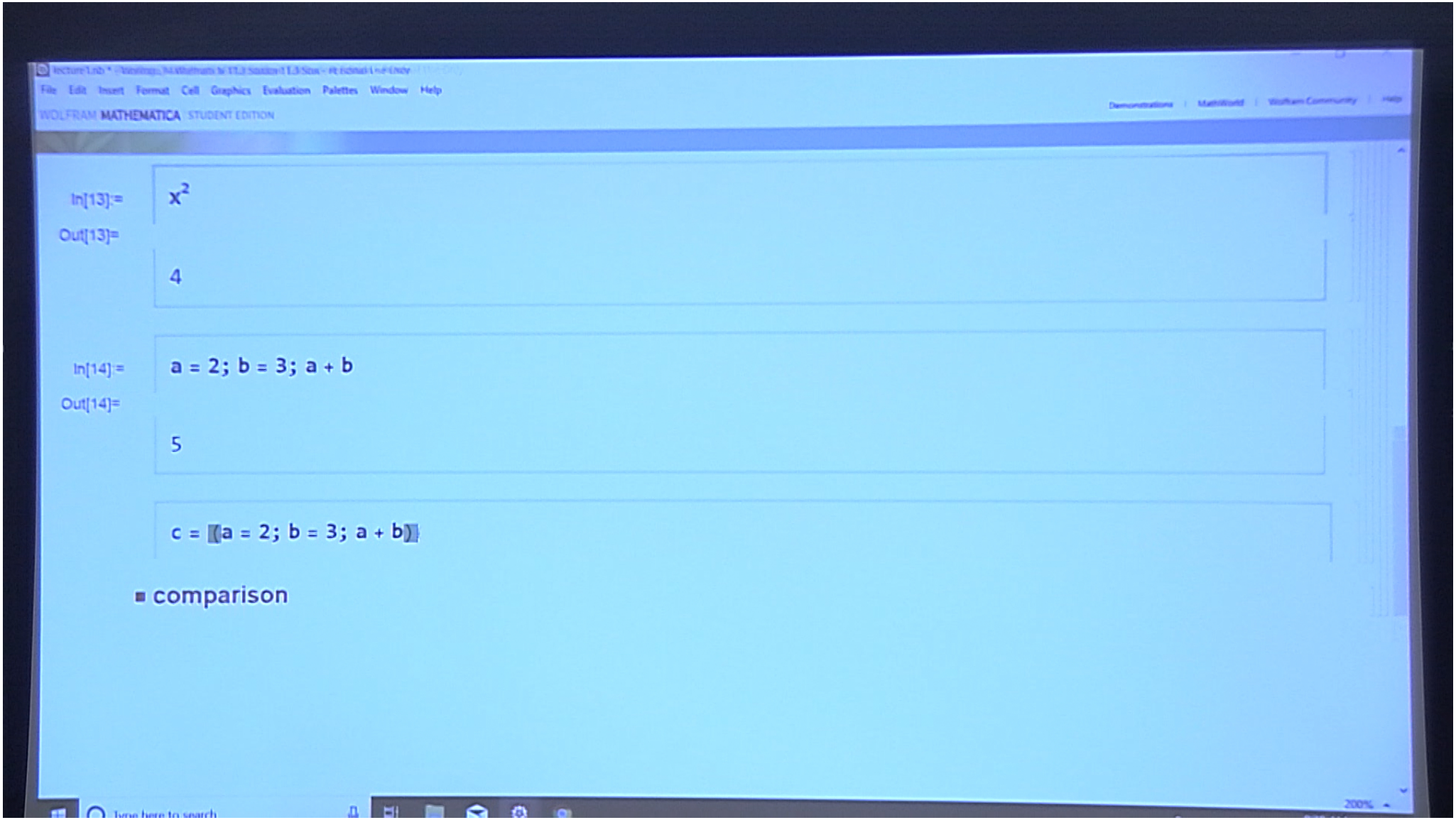

lecture1.nb * - Wolfram Mathematica 11.3 Student Edition - Personal Use Only
File Edit Insert Format Cell Graphics Evaluation Palettes Window Help
WOLFRAM MATHEMATICA STUDENT EDITION
IntegerDigits
IntegerQ
In[8]:=
TeXForm[(x^2 + 2)/(α + 3)]
Out[8]//TeXForm=
\frac{x^2+2}{\alpha +3}
a1, a2,a3,a4,a5...
velocityofparticle2

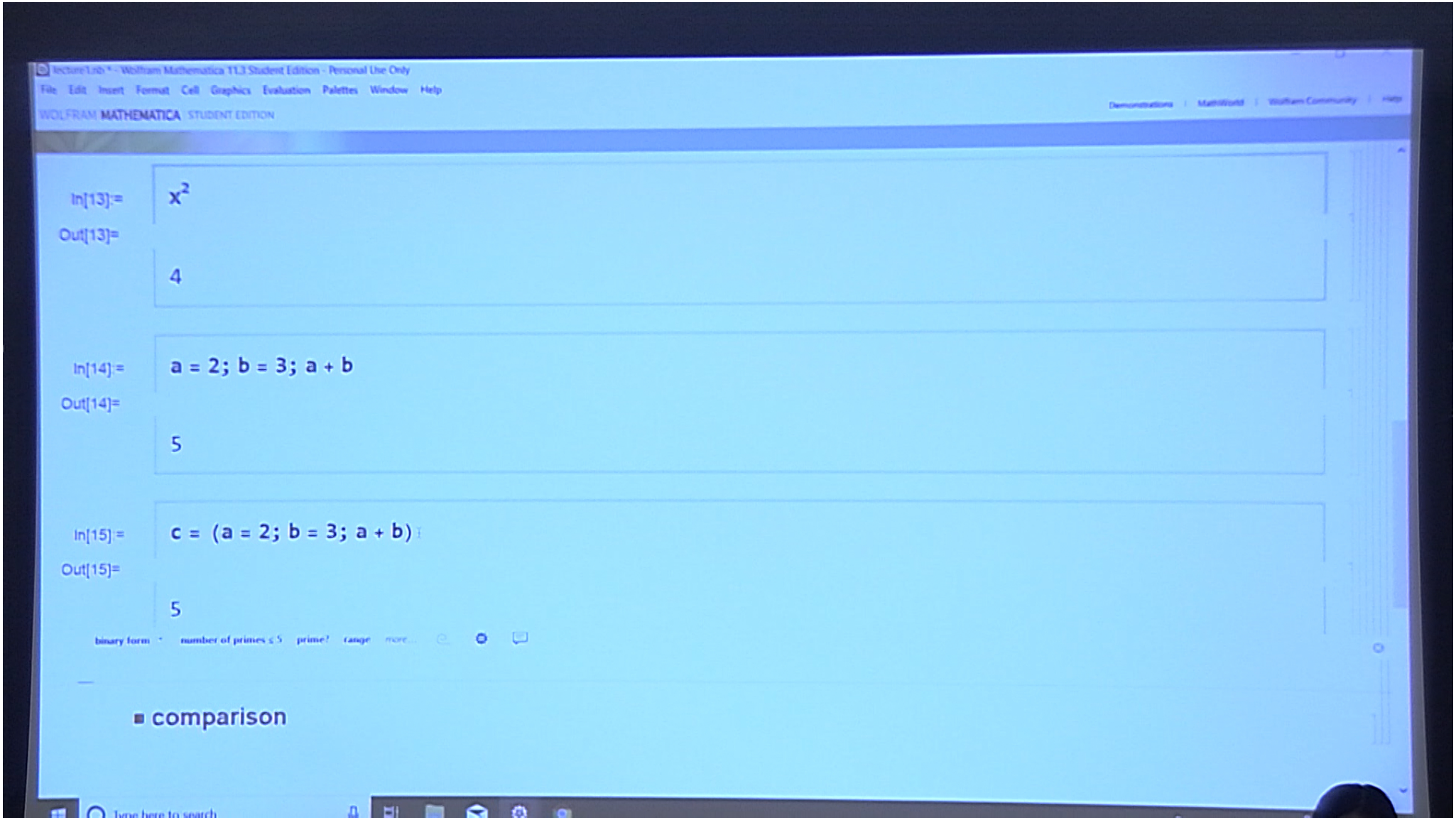

IntegerDigits
IntegerQ
In[8]:=
TeXForm[(x^2 + 2)/(α + 3)]
Out[8]//TeXForm=
\frac{x^2+2}{\alpha +3}
a1, a2,a3,a4,a5...
In[9]:=
velocityofparticle2
Out[9]=
velocityofparticle2
ve
velocityofparticle2

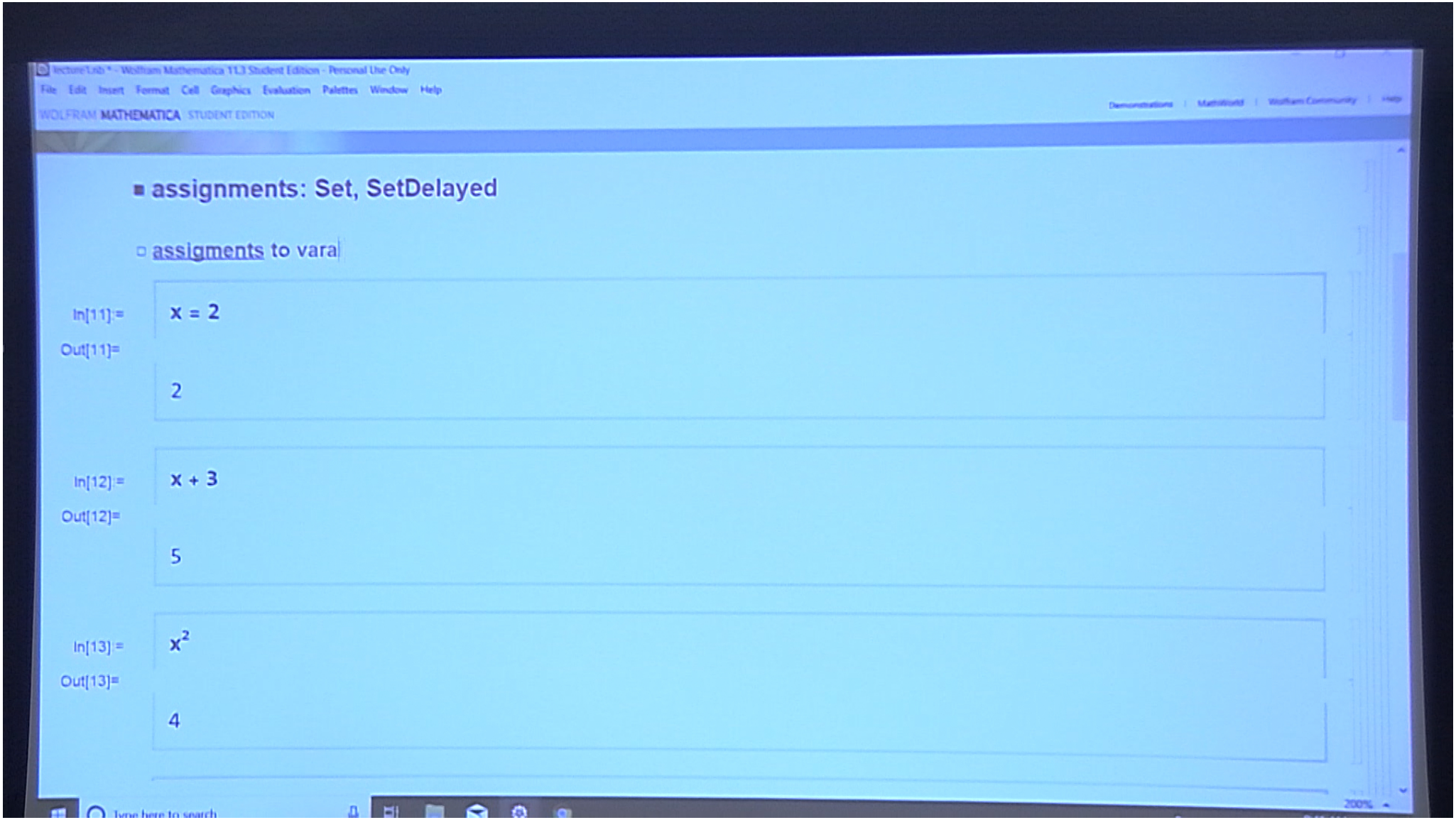

File Edit Insert Format Cell Graphics Evaluation Palettes Window Help
WOLFRAM MATHEMATICA STUDENT EDITION
Out[5]//TeXForm=
\frac{x^2+2}{\alpha +3}
a1, a2,a3,a4,a5...
In[9]:=
velocityofparticle2
Out[9]=
velocityofparticle2
velocityofparticle2
Out[10]=
velocityofparticle2
NumberQ

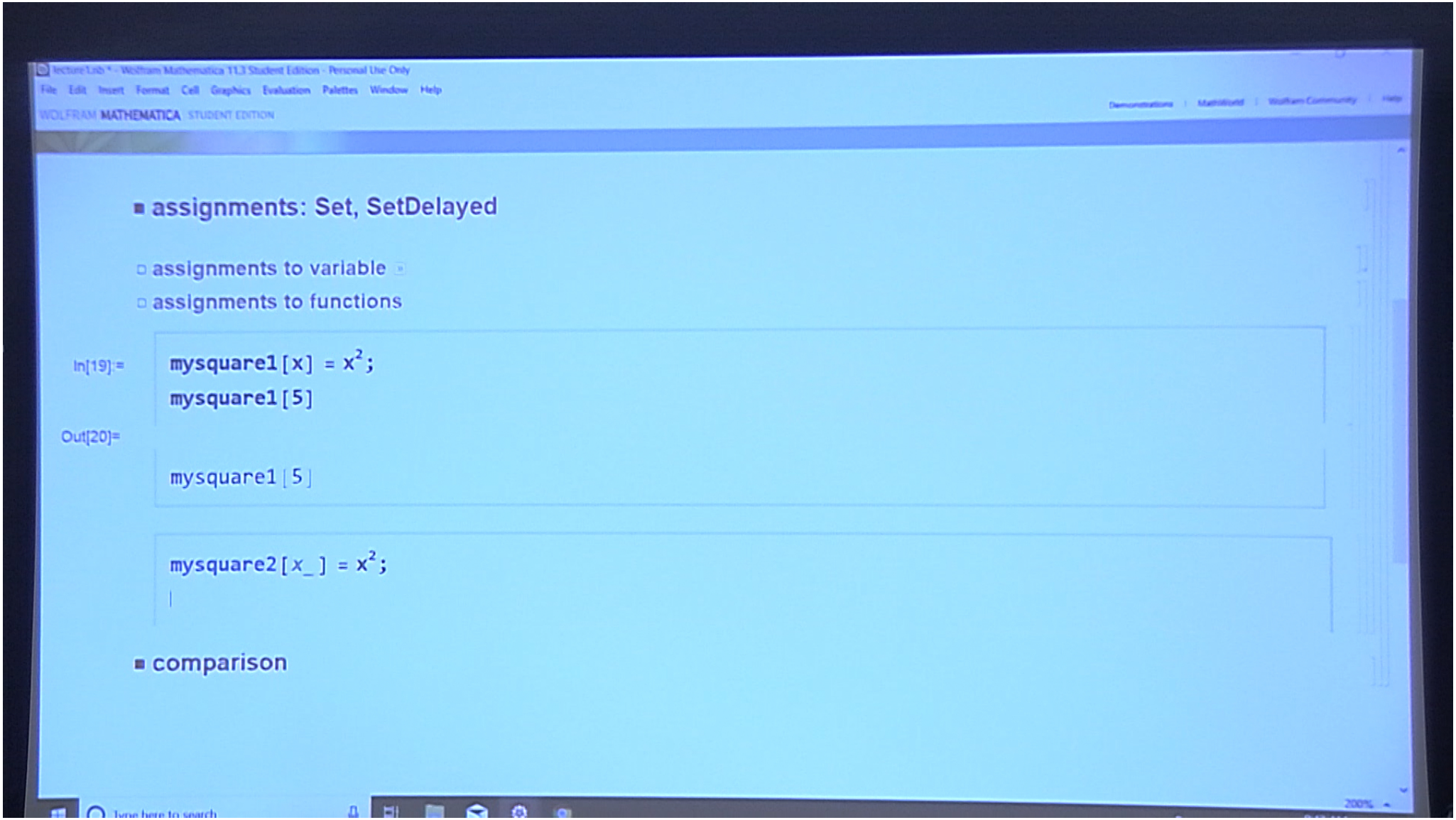

File Edit Insert Format Cell Graphics Evaluation Palettes Window Help
WOLFRAM MATHEMATICA STUDENT EDITION
Basics of Mathematica
Getting started:
Equal signs: Not all equal
assignments: Set, SetDelayed
comparison

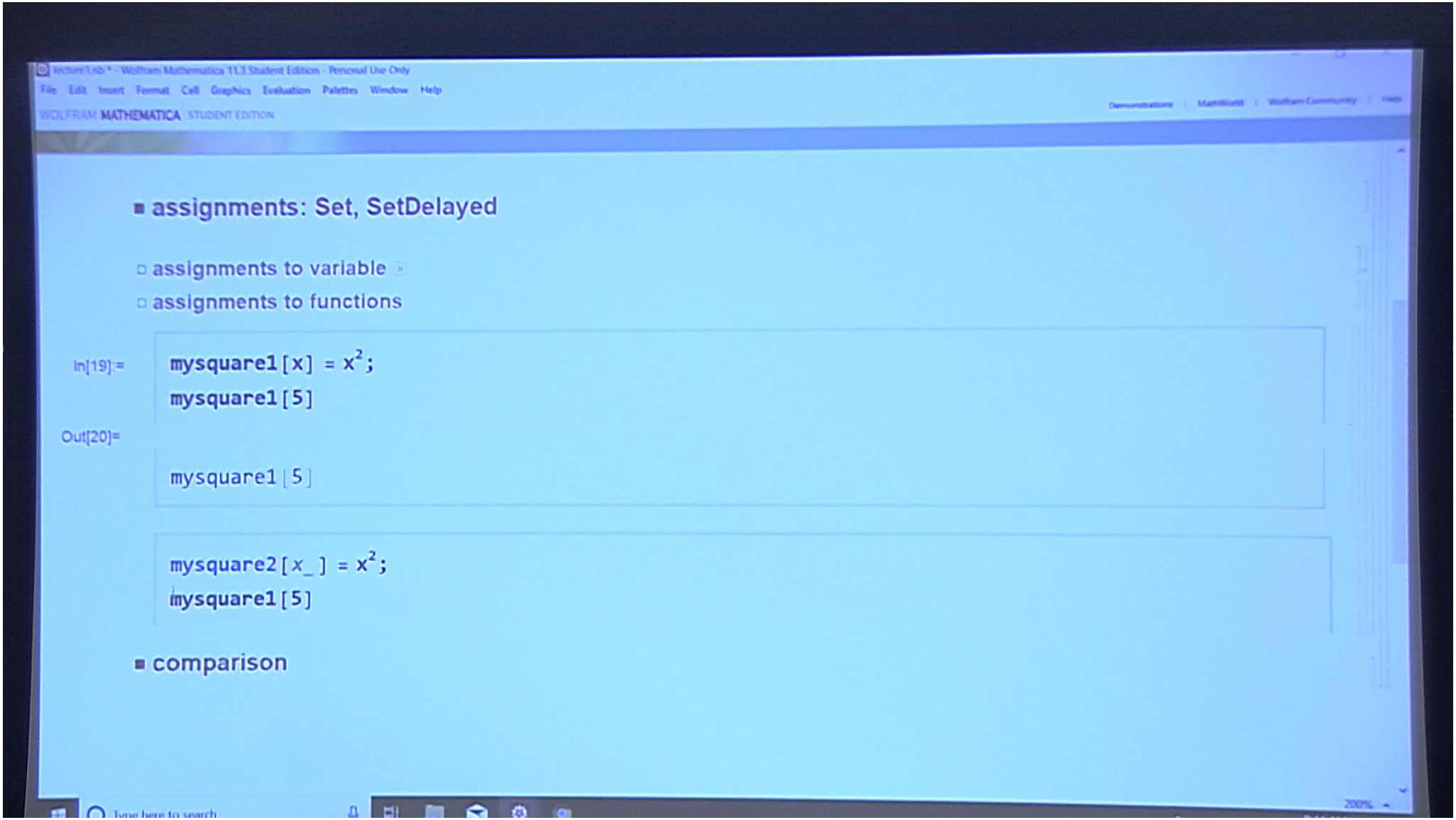

lectureUnb* - Wolfram Mathematica 11.3 Student Edition - Personal Use Only
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WOLFRAM MATHEMATICA STUDENT EDITION
assigments
In[11]:= x = 2
Out[11]= 2
In[12]:= x + 3
Out[12]= 5
binary form number of primes ≤ 5 prime? range more...
comparison

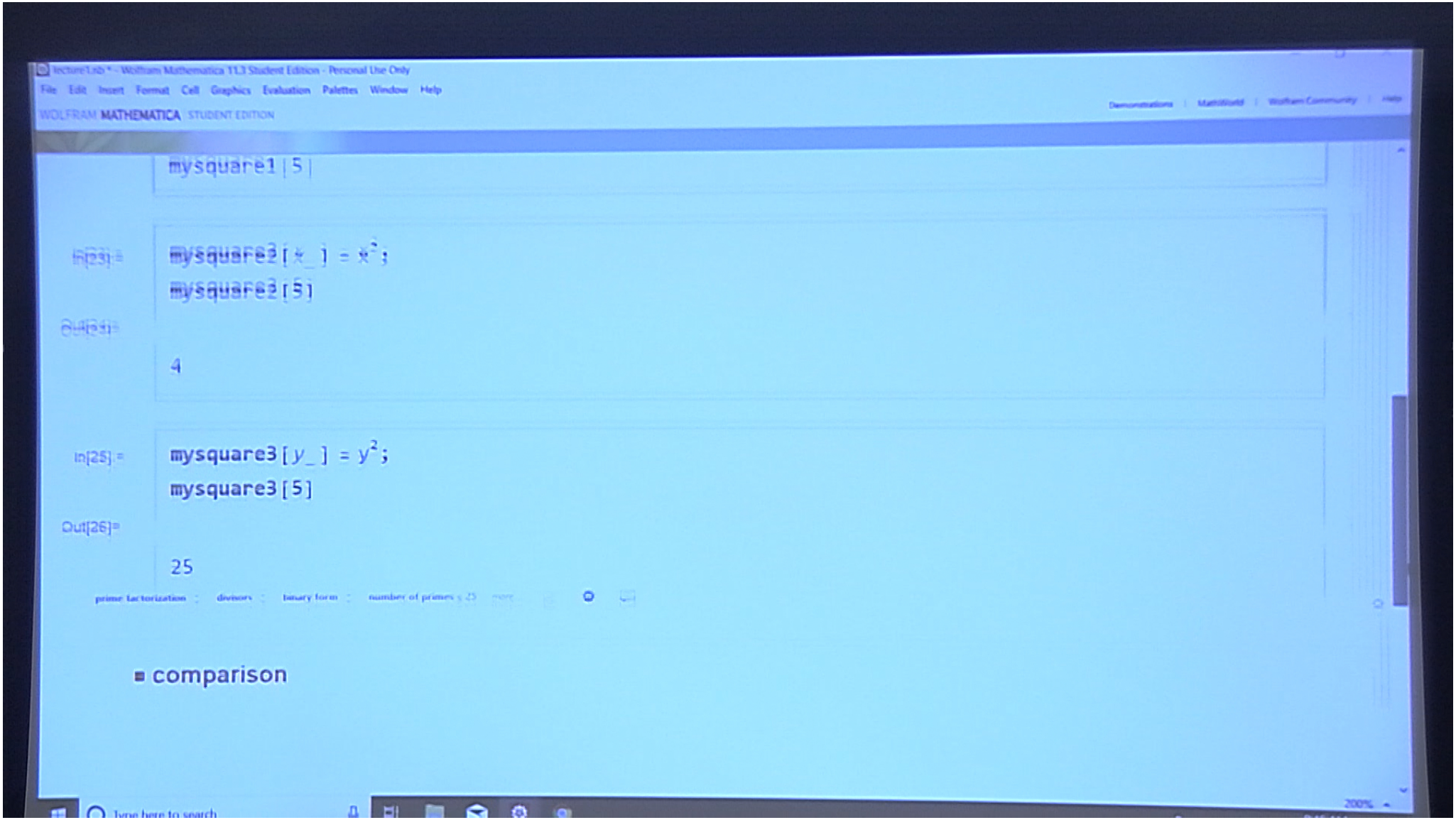

File Edit Insert Format Cell Graphics Evaluation Palettes Window Help
WOLFRAM MATHEMATICA STUDENT EDITION
In[13]:= x^2
Out[13]=
4
In[14]:= a = 2; b = 3; a + b
Out[14]=
5
c = [[a = 2; b = 3; a + b]]
■ comparison

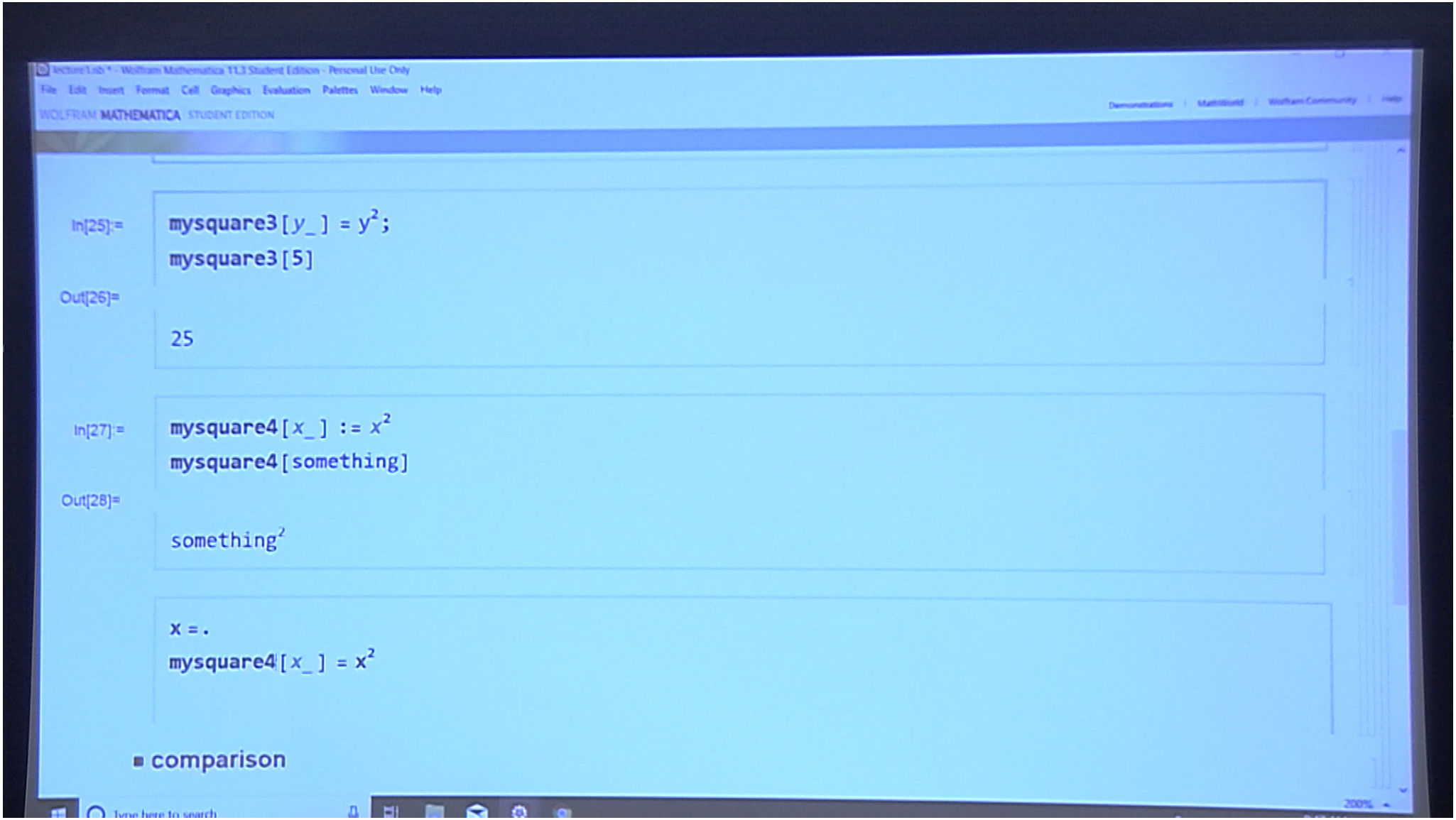

File Edit Insert Format Cell Graphics Evaluation Palettes Window Help
WOLFRAM MATHEMATICA STUDENT EDITION
In[13]:= x^2
Out[13]=
4
In[14]:= a = 2; b = 3; a + b
Out[14]=
5
In[15]:= c = (a = 2; b = 3; a + b)
Out[15]=
5
comparison

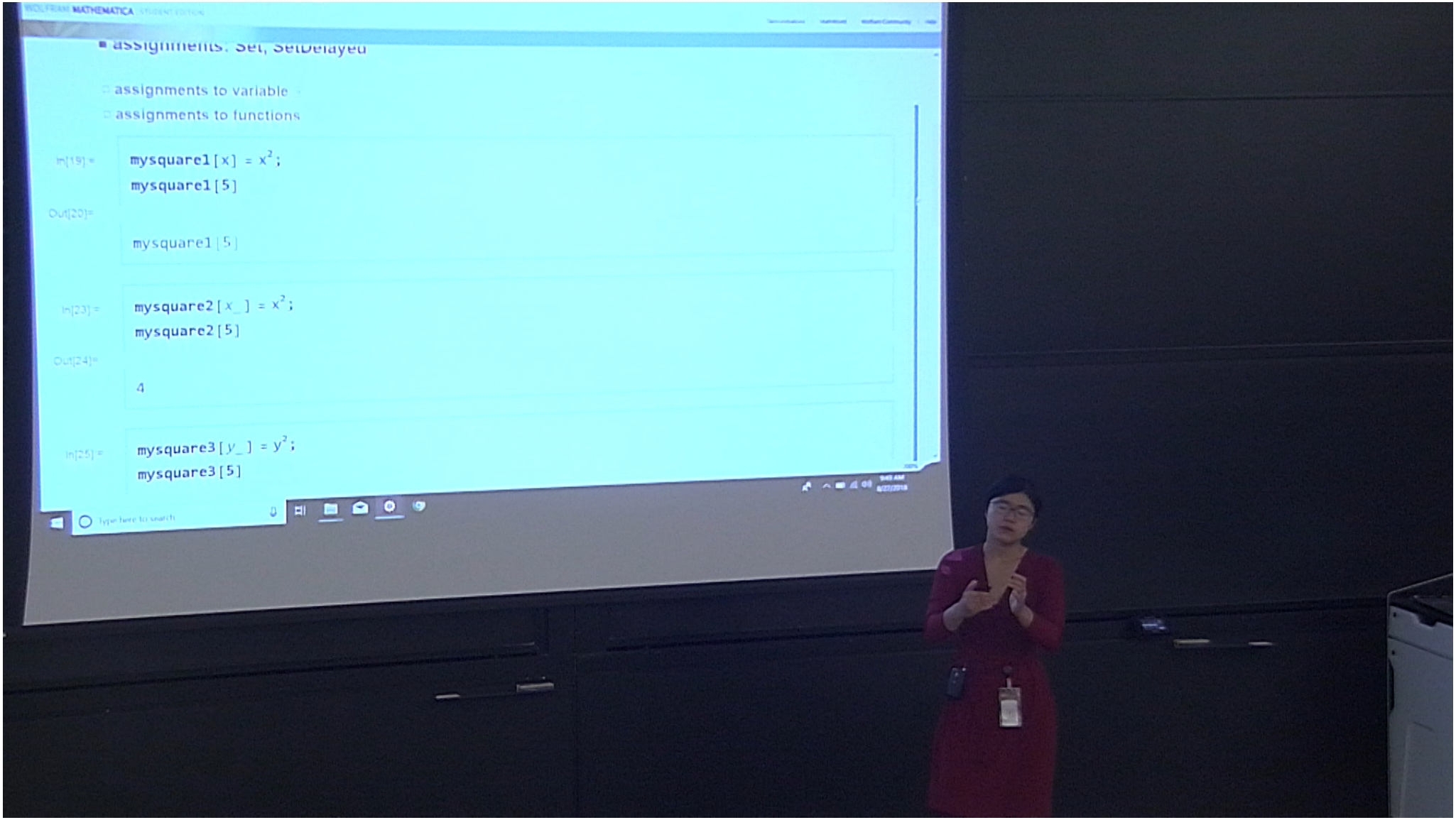

LectureUnit9 * - Wolfram Mathematica 11.3 Student Edition - Personal Use Only
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WOLFRAM MATHEMATICA STUDENT EDITION
Demonstrations | MathWorld | Wolfram Community | Help
assignments: Set, SetDelayed
assigments to vara
In[11]:= x = 2
Out[11]= 2
In[12]:= x + 3
Out[12]= 5
In[13]:= x^2
Out[13]= 4
Type here to search
200%

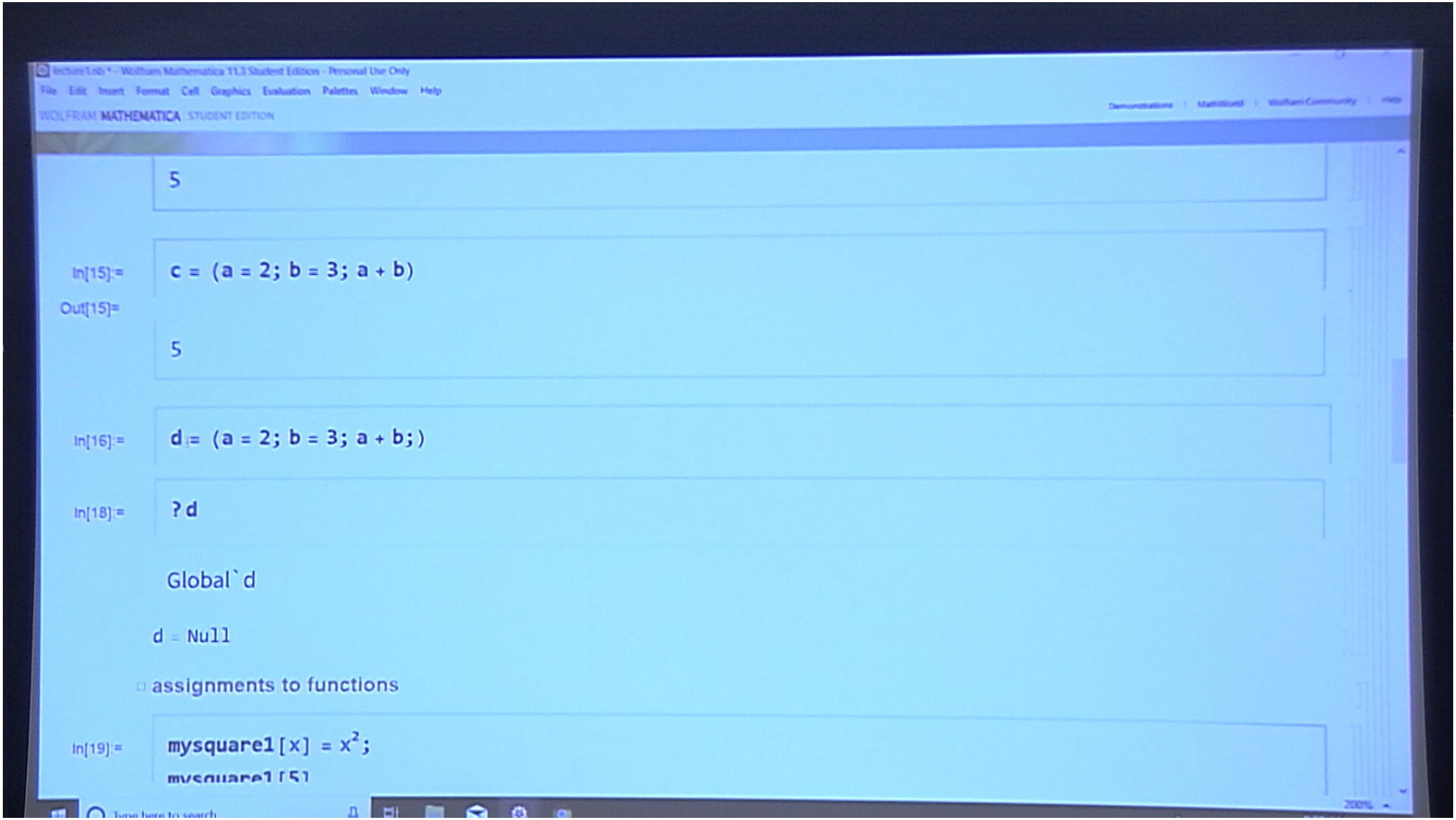

lectureUsb * - Wolfram Mathematica 11.3 Student Edition - Personal Use Only
File Edit Insert Format Cell Graphics Evaluation Palettes Window Help
WOLFRAM MATHEMATICA STUDENT EDITION
assignments: Set, SetDelayed
assignments to variable
assignments to functions
In[19]:=
mysquare1[x] = x^2;
mysquare1[5]
Out[20]=
mysquare1[5]
mysquare2[x_] = x^2;
comparison

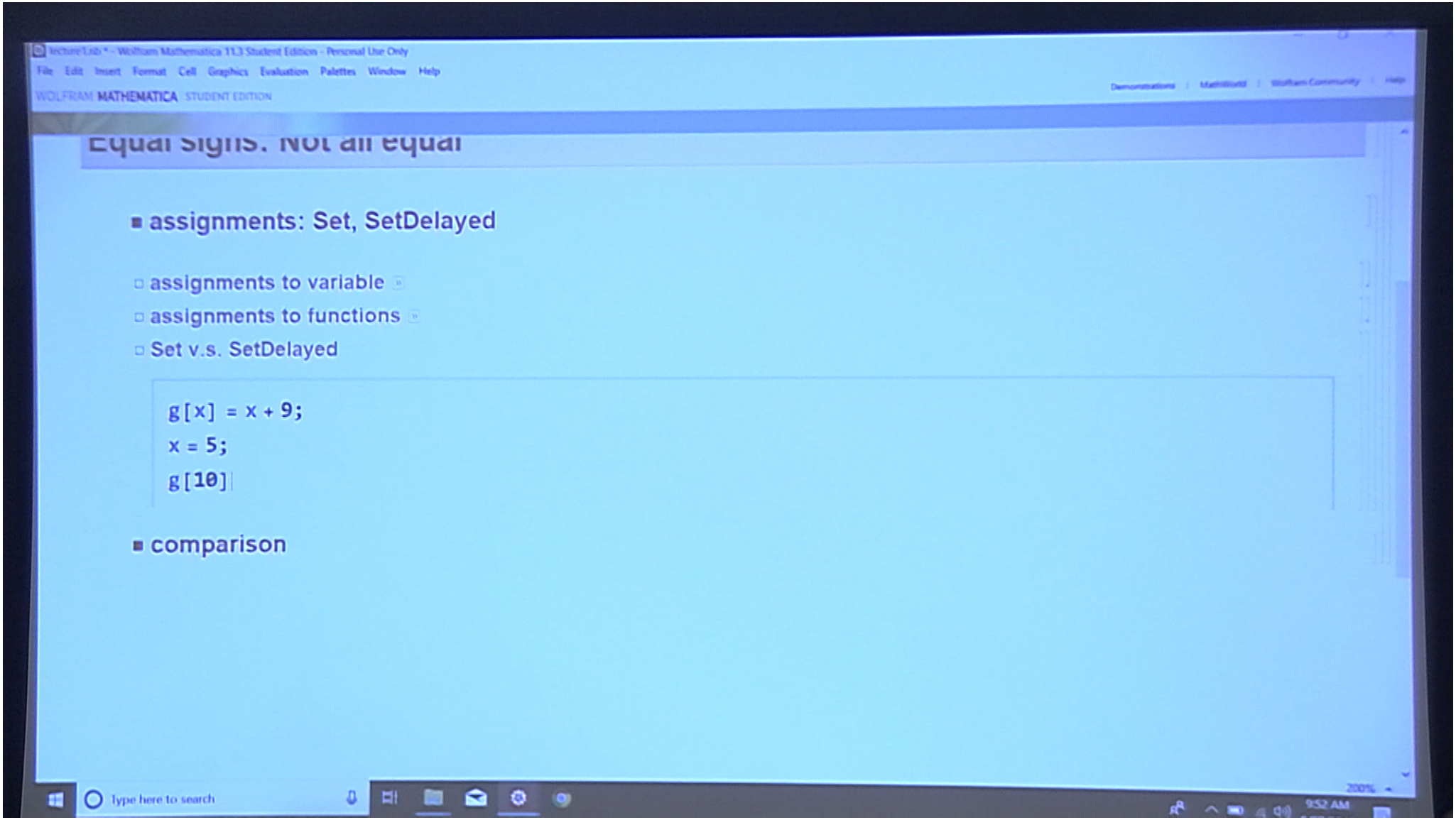

File Edit Insert Format Cell Graphics Evaluation Palettes Window Help
WOLFRAM MATHEMATICA STUDENT EDITION
assignments: Set, SetDelayed
assignments to variable
assignments to functions
In[19]:=
mysquare1[x] = x^2;
mysquare1[5]
Out[20]=
mysquare1[5]
mysquare2[x_] = x^2;
mysquare1[5]
comparison

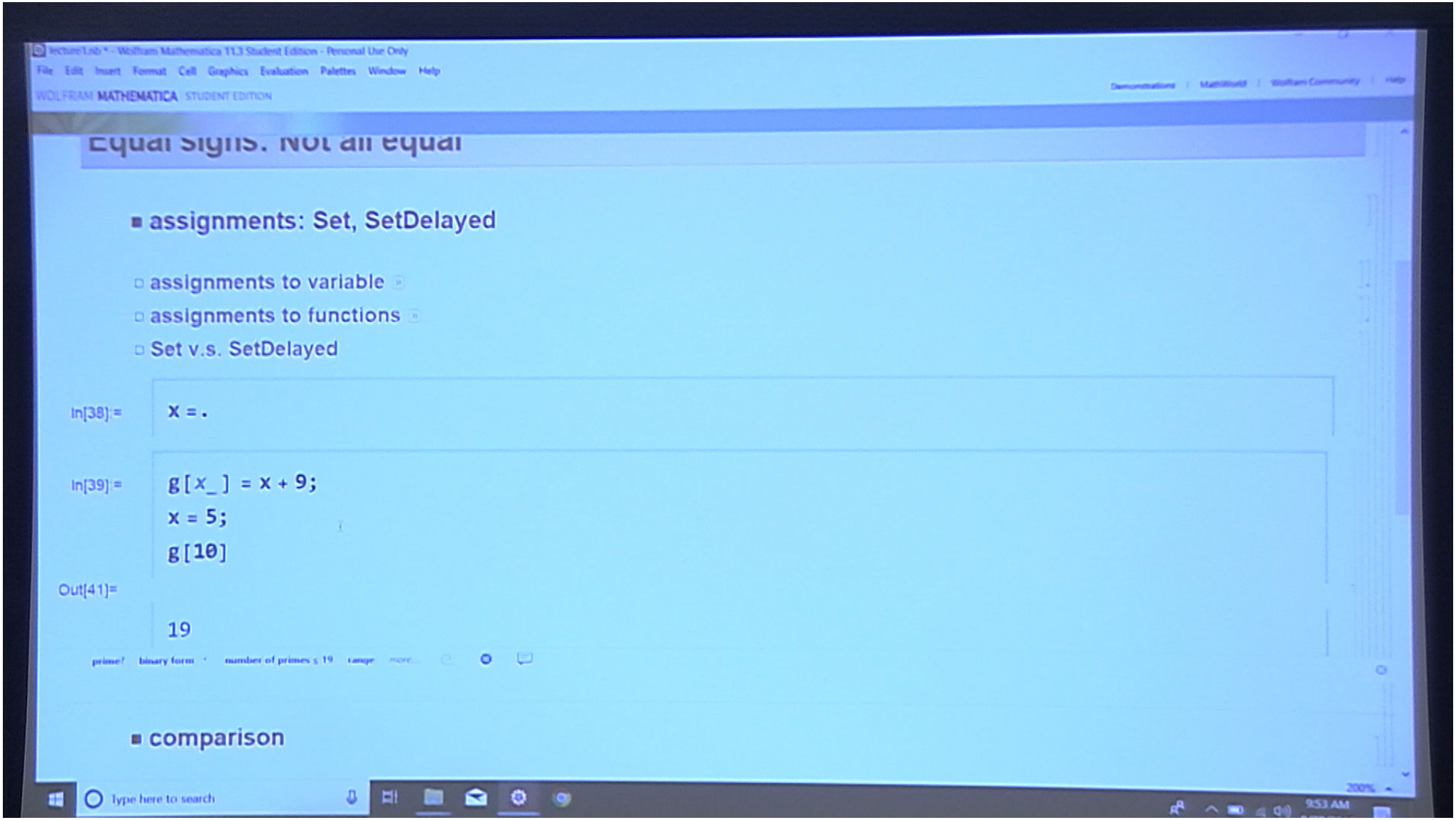

File Edit Insert Format Cell Graphics Evaluation Palettes Window Help
WOLFRAM MATHEMATICA STUDENT EDITION
mysquare1[5]
In[23]:=
mysquare2[x_] = x^2;
mysquare2[5]
Out[24]=
4
In[25]:=
mysquare3[y_] = y^2;
mysquare3[5]
Out[26]=
25
comparison

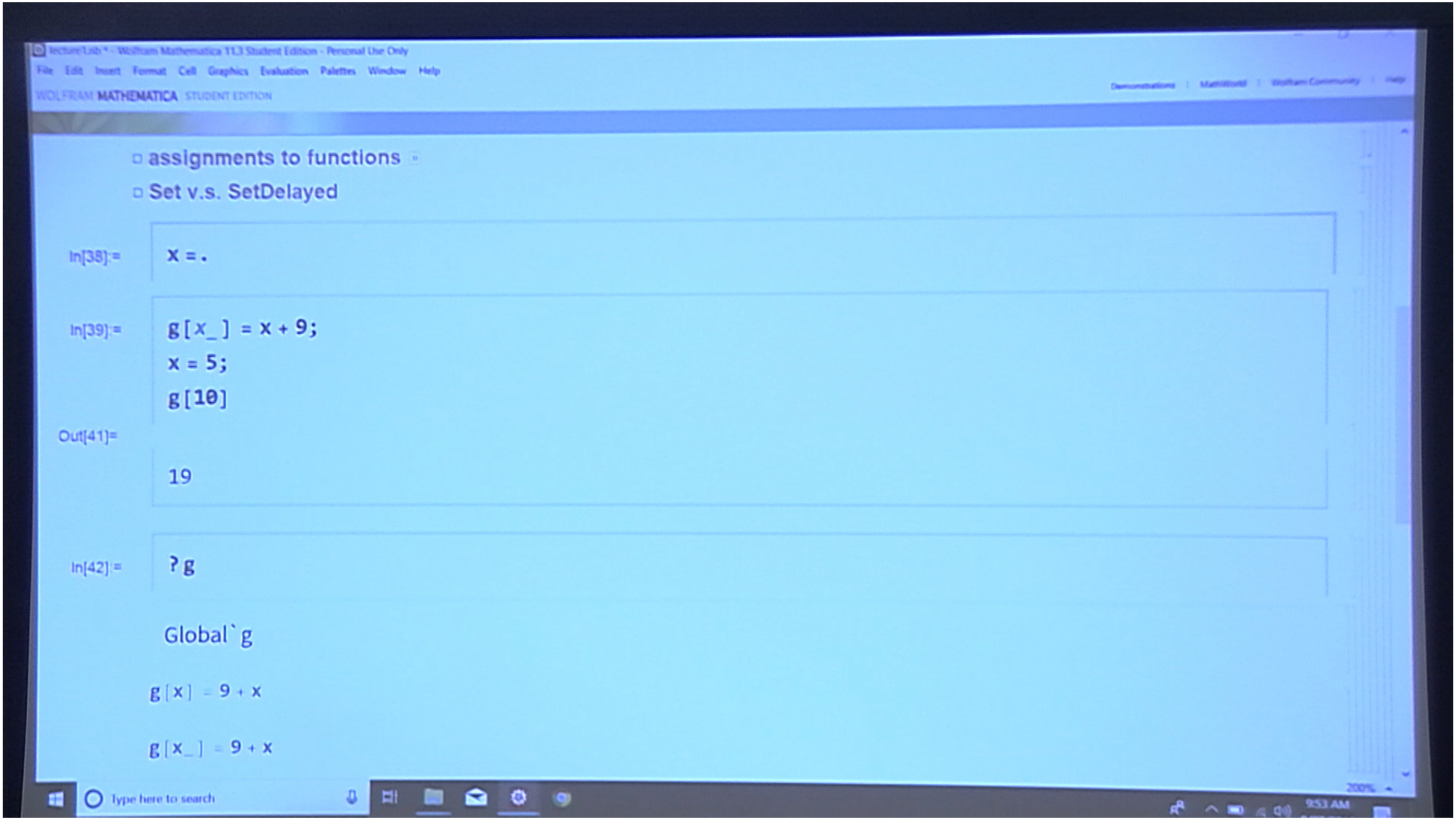

lecture1.nb * - Wolfram Mathematica TL3 Student Edition - Personal Use Only
File Edit Insert Format Cell Graphics Evaluation Palettes Window Help
WOLFRAM MATHEMATICA STUDENT EDITION
In[25]:=
mysquare3[y_] = y^2;
mysquare3[5]
Out[26]=
25
In[27]:=
mysquare4[x_] := x^2
mysquare4[something]
Out[28]=
something^2
x = .
mysquare4[x_] = x^2
comparison

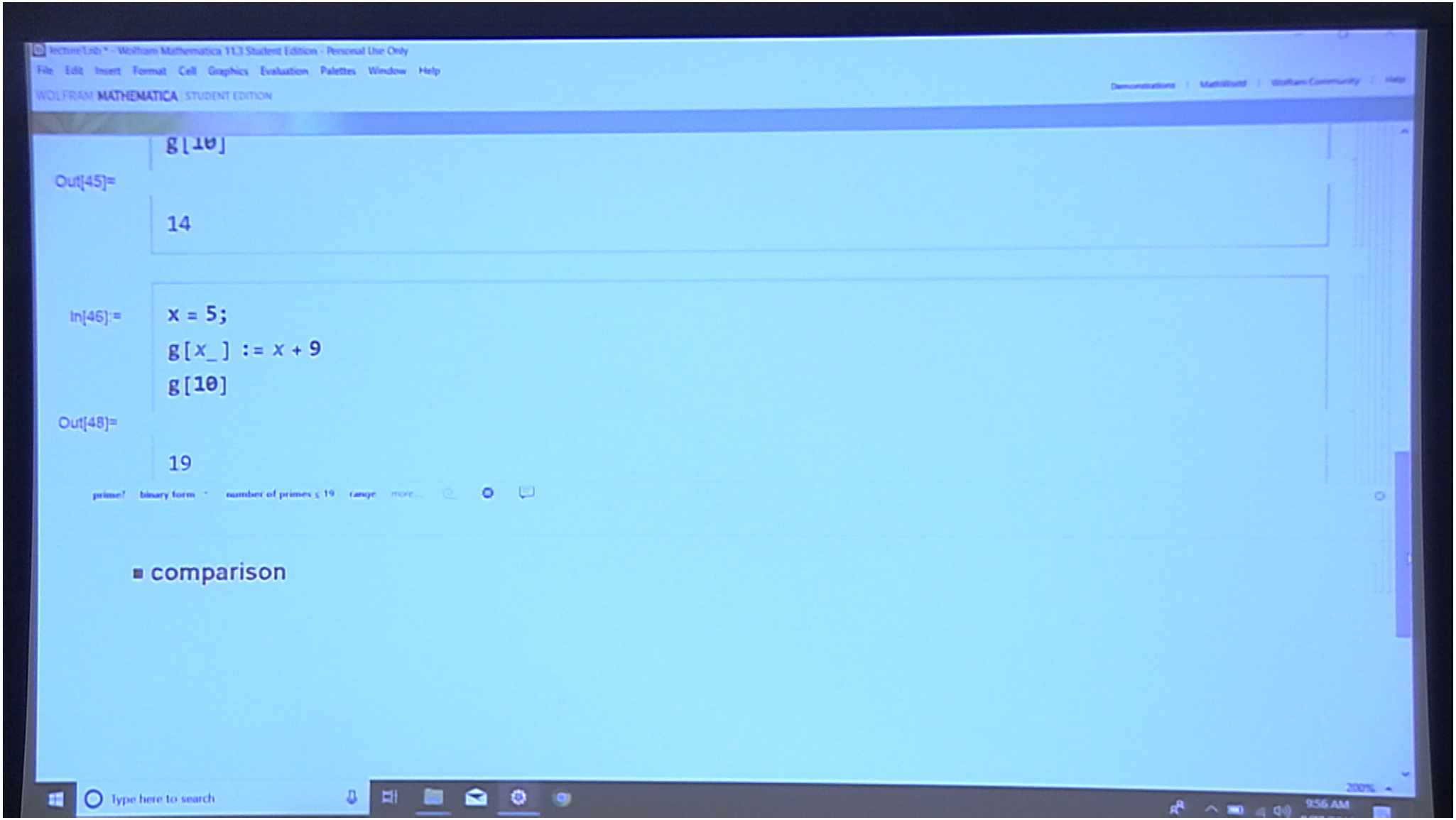

WOLFRAM MATHEMATICA STUDENT EDITION
assignments: Set, SetDelayed
assignments to variable
assignments to functions
In[19]:=
mysquare1[x] = x^2;
mysquare1[5]
Out[20]=
mysquare1[5]
In[23]:=
mysquare2[x_] = x^2;
mysquare2[5]
Out[24]=
4
In[25]:=
mysquare3[y_] = y^2;
mysquare3[5]
Type here to search

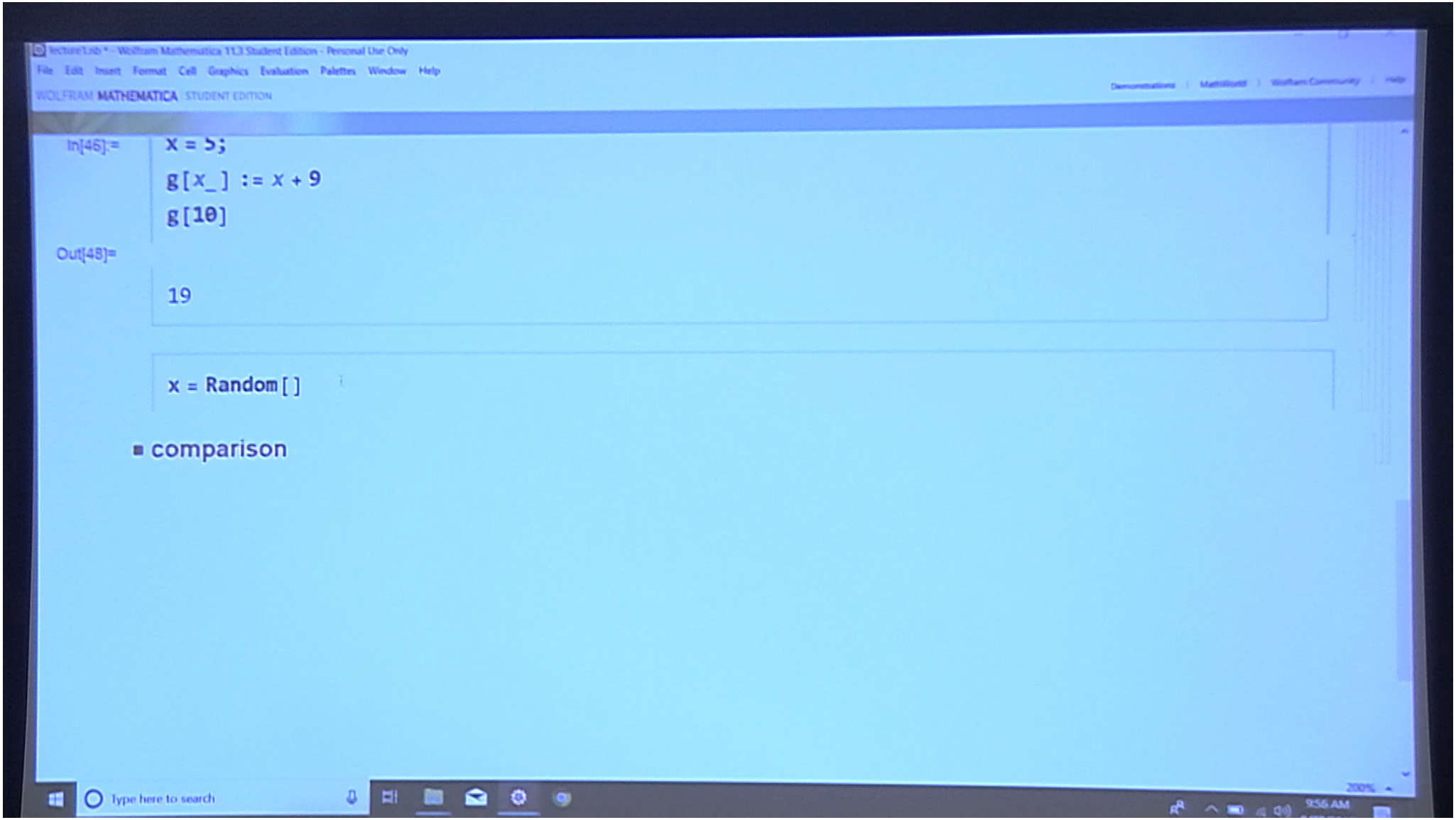

Lecture1.nb * - Wolfram Mathematica 11.3 Student Edition - Personal Use Only
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WOLFRAM MATHEMATICA STUDENT EDITION
5
In[15]:= c = (a = 2; b = 3; a + b)
Out[15]= 5
In[16]:= d = (a = 2; b = 3; a + b;)
In[18]:= ?d
Global`d
d = Null
assignments to functions
In[19]:= mysquare1[x] = x^2;

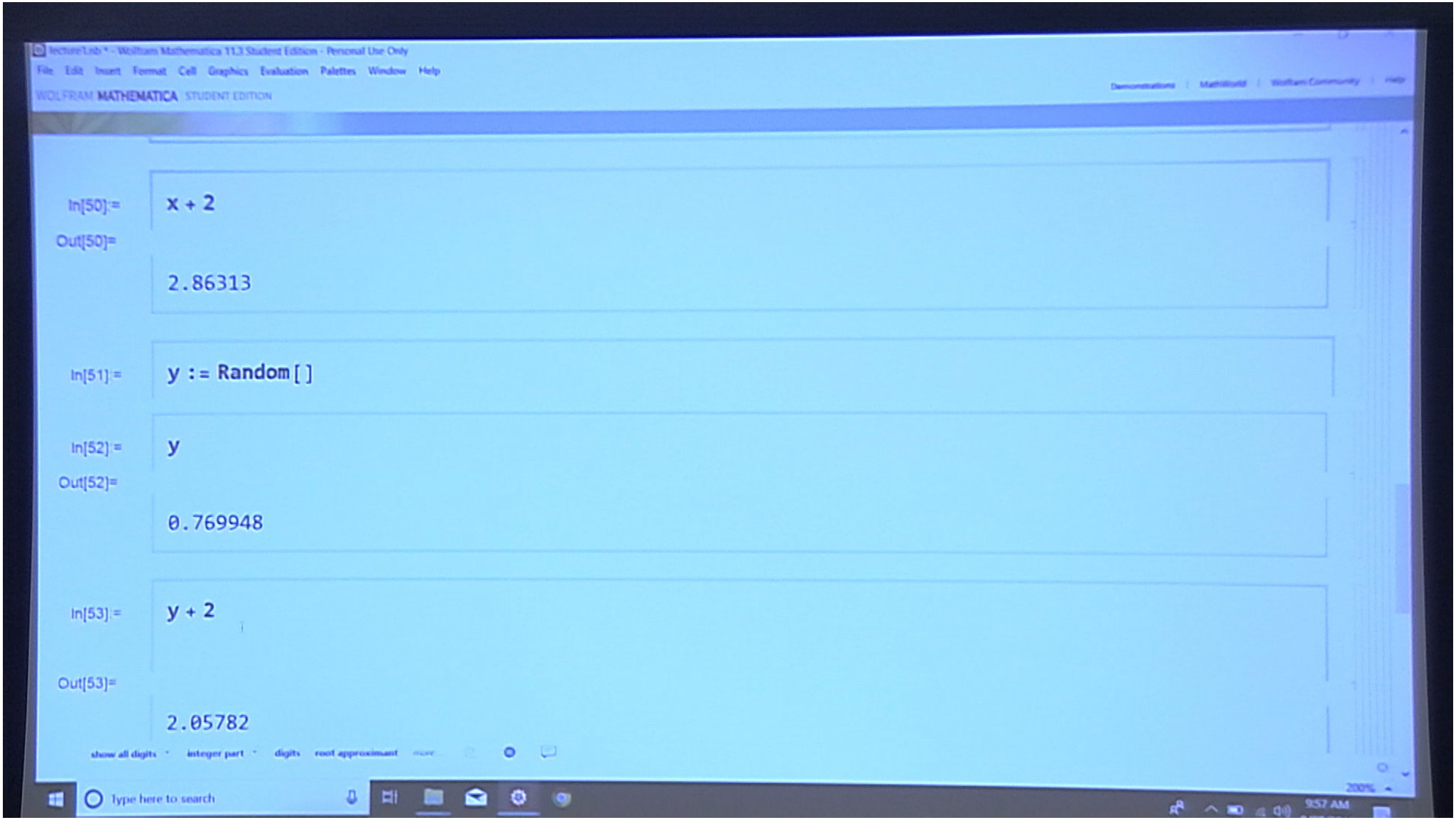

File Edit Insert Format Cell Graphics Evaluation Palettes Window Help
WOLFRAM MATHEMATICA STUDENT EDITION
Equal Signs: Not all equal
assignments: Set, SetDelayed
assignments to variable
assignments to functions
Set v.s. SetDelayed
g[x] = x + 9;
x = 5;
g[10]
comparison
Type here to search
9:52 AM

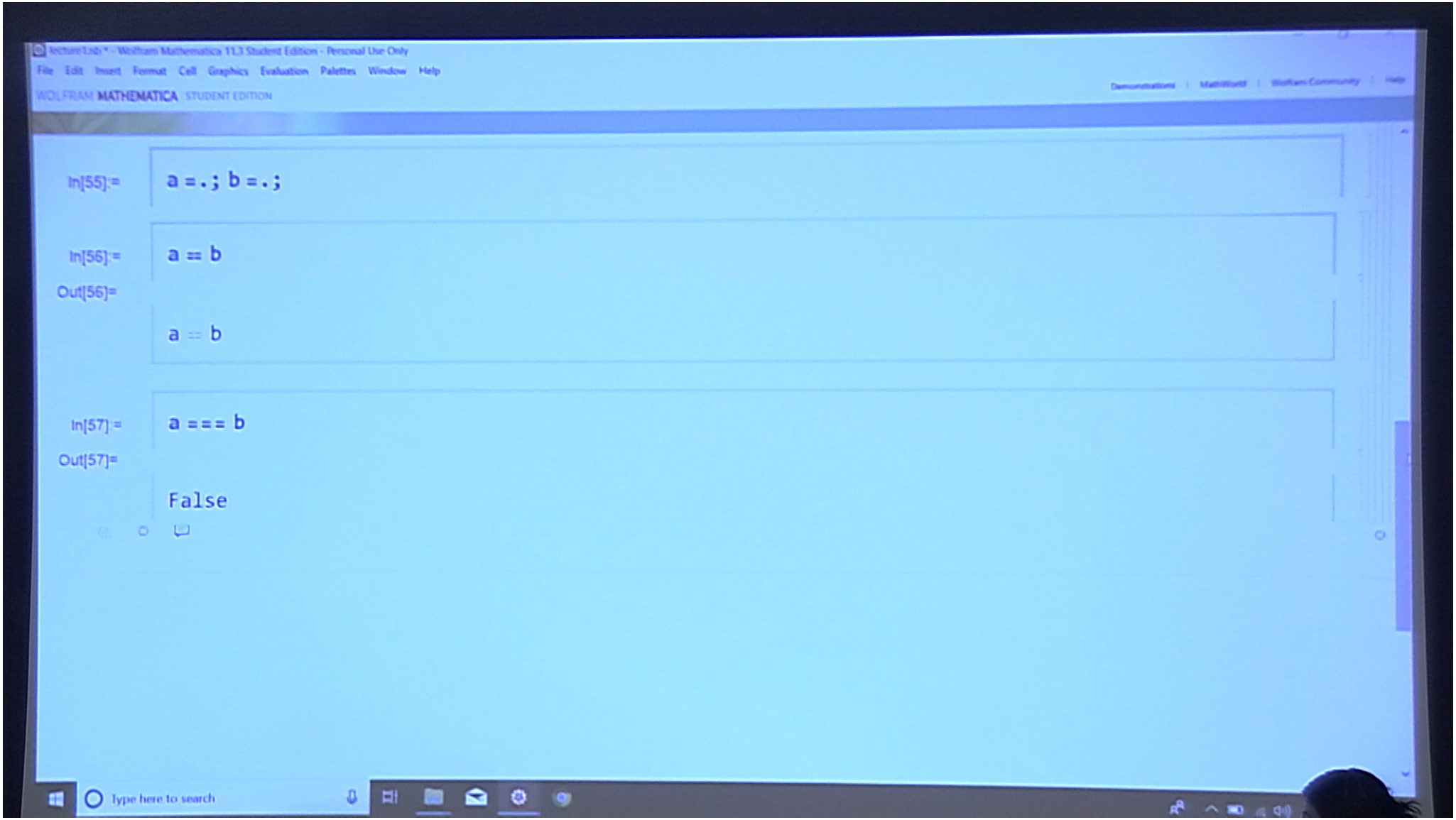

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WOLFRAM MATHEMATICA STUDENT EDITION
Equal Signs: Not all equal
assignments: Set, SetDelayed
assignments to variable
assignments to functions
Set v.s. SetDelayed
In[38]:= x = .
In[39]:= g[x_] = x + 9;
x = 5;
g[10]
Out[41]= 19
prime? binary form number of primes ≤ 19 range
comparison
Type here to search
9:53 AM

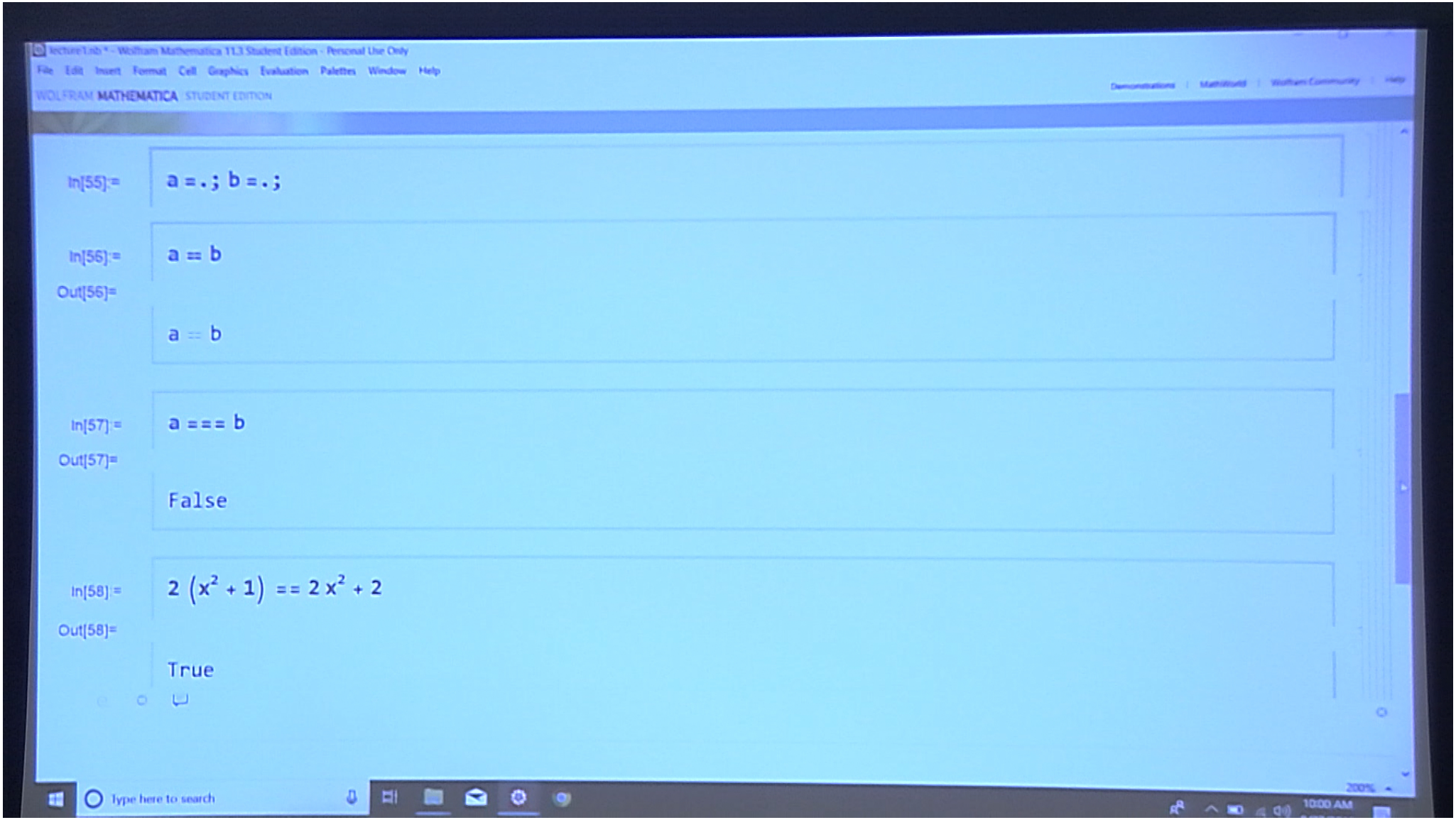

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File Edit Insert Format Cell Graphics Evaluation Palettes Window Help
WOLFRAM MATHEMATICA STUDENT EDITION
assignments to functions
Set v.s. SetDelayed
In[38]:= x = .
In[39]:= g[x_] = x + 9;
x = 5;
g[10]
Out[41]= 19
In[42]:= ?g
Global`g
g[x] = 9 + x
g[x_] = 9 + x
Type here to search
9:53 AM

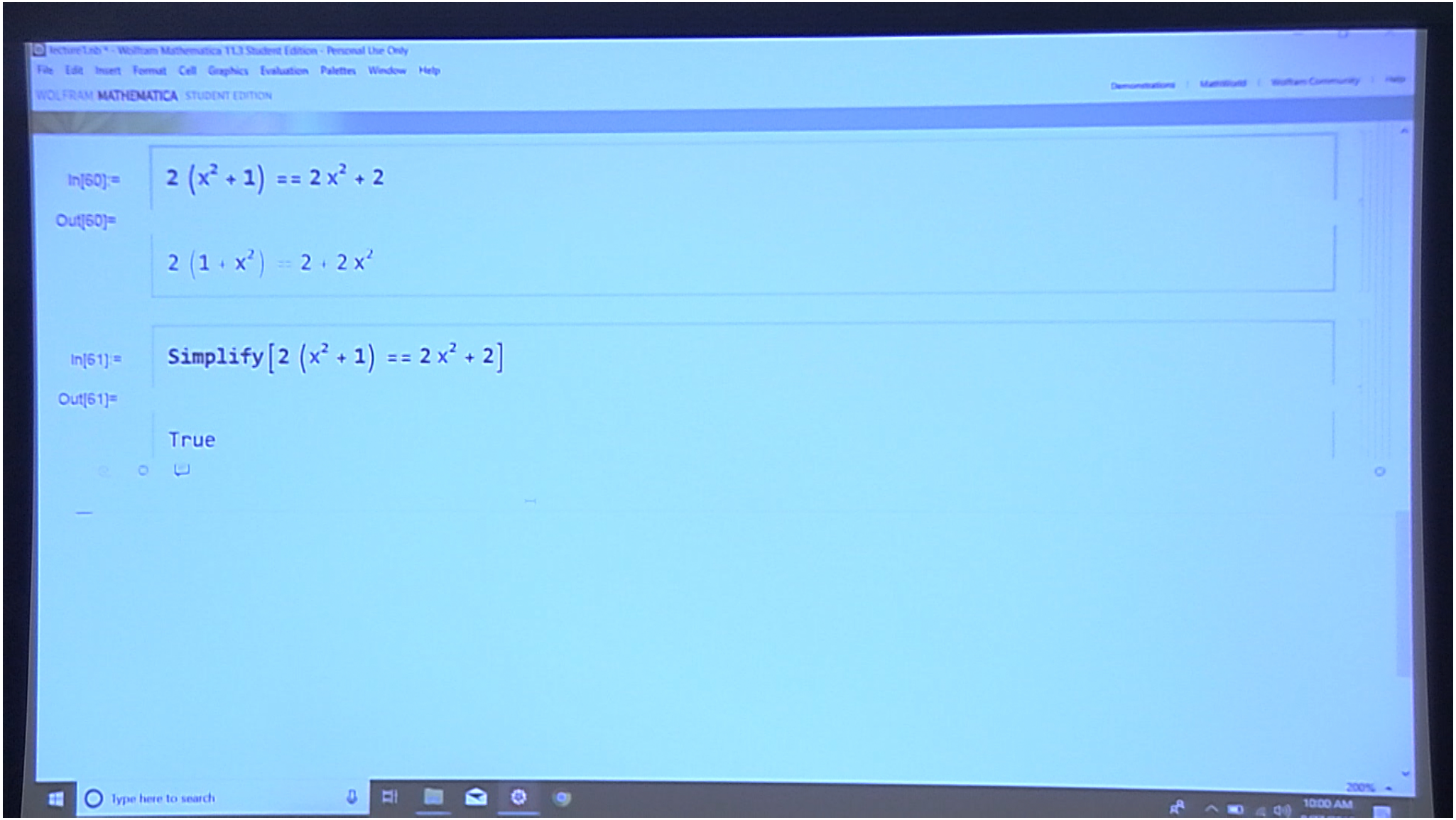

File Edit Insert Format Cell Graphics Evaluation Palettes Window Help
WOLFRAM MATHEMATICA STUDENT EDITION
g[10]
Out[45]=
14
In[46]:=
x = 5;
g[x_] := x + 9
g[10]
Out[48]=
19
prime? binary form number of primes ≤ 19 range
comparison
Type here to search
9:56 AM

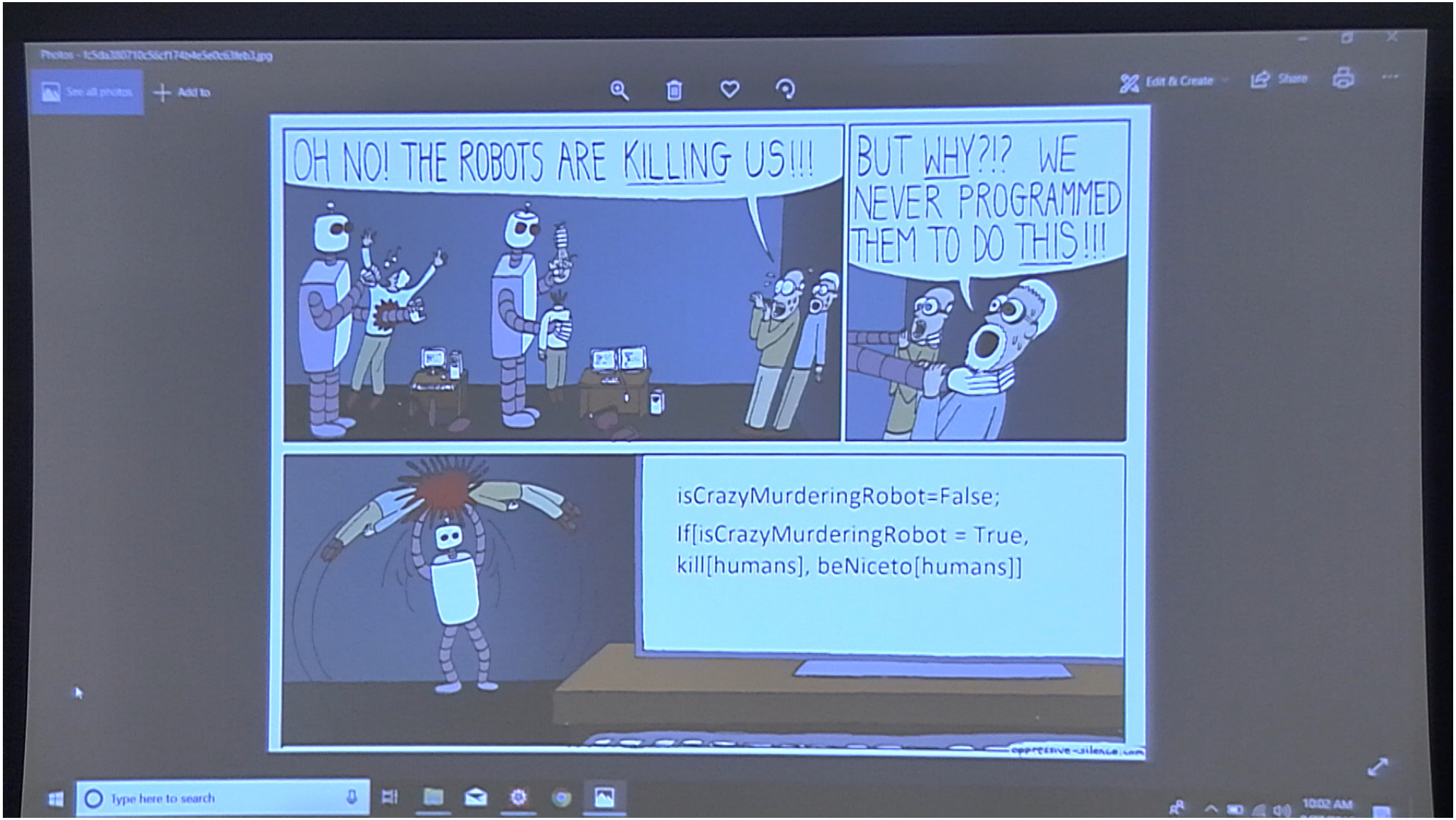

lecture1.nb * - Wolfram Mathematica 11.3 Student Edition - Personal Use Only
File Edit Insert Format Cell Graphics Evaluation Palettes Window Help
WOLFRAM MATHEMATICA STUDENT EDITION
In[46]:=
x = 5;
g[x_] := x + 9
g[10]
Out[48]=
19
x = Random[]
comparison
Type here to search
9:56 AM

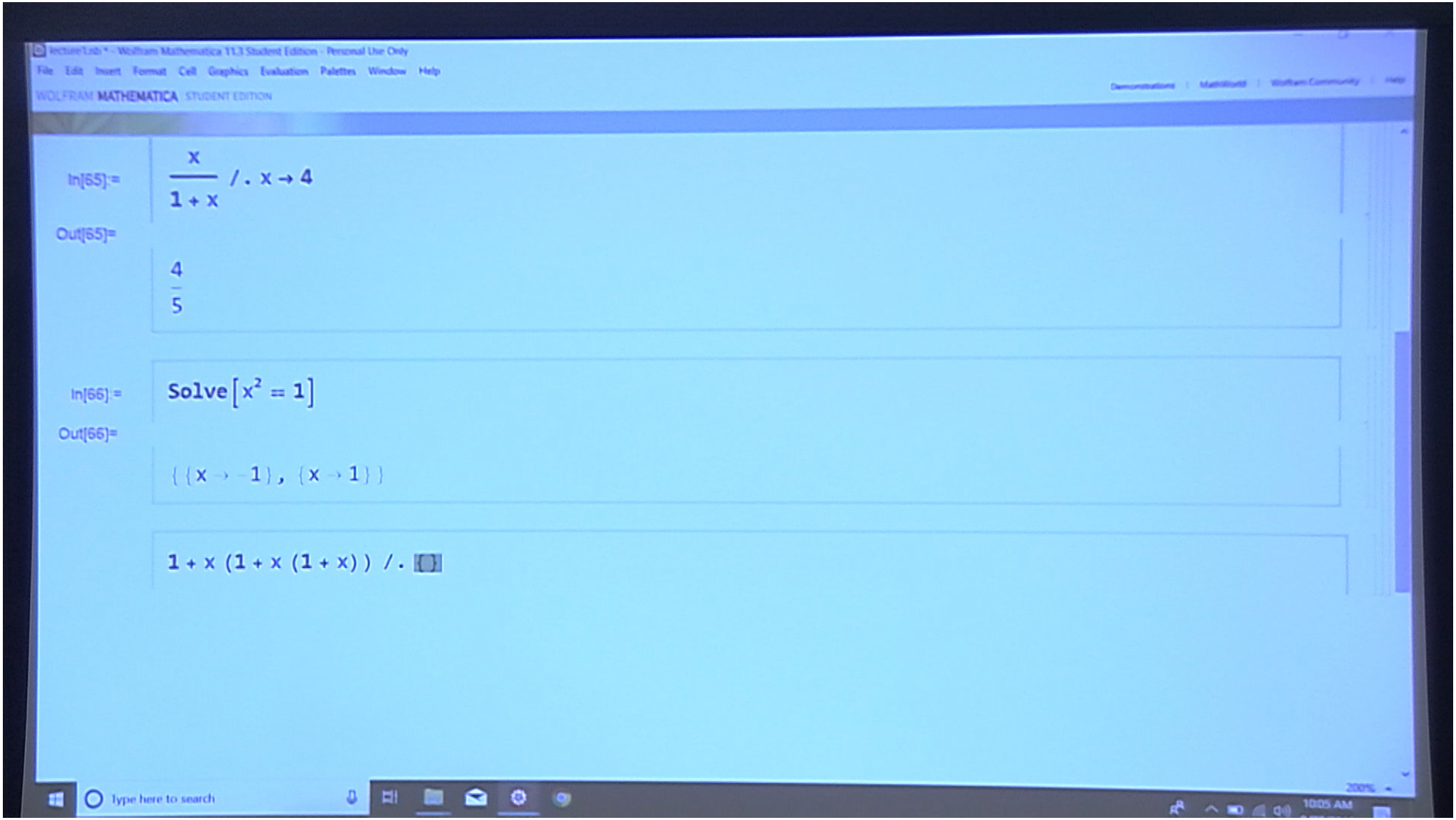

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File Edit Insert Format Cell Graphics Evaluation Palettes Window Help
WOLFRAM MATHEMATICA STUDENT EDITION
In[50]:= x + 2
Out[50]=
2.86313
In[51]:= y := Random[]
In[52]:= y
Out[52]=
0.769948
In[53]:= y + 2
Out[53]=
2.05782
show all digits integer part digits root approximant
Type here to search
9:57 AM

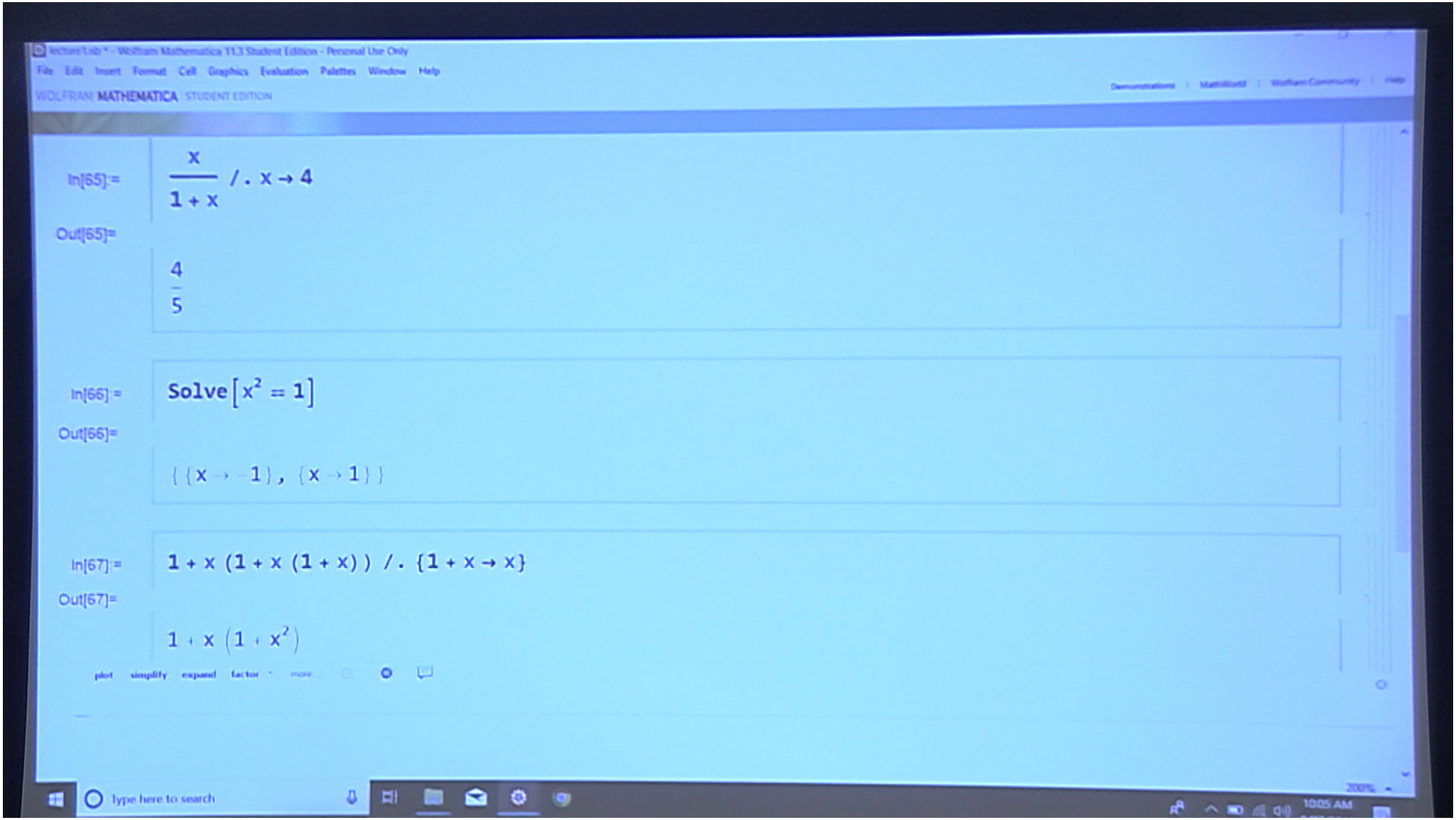

File Edit Insert Format Cell Graphics Evaluation Palettes Window Help
WOLFRAM MATHEMATICA STUDENT EDITION
In[55]:= a = .; b = .;
In[56]:= a == b
Out[56]= a == b
In[57]:= a === b
Out[57]= False
Type here to search

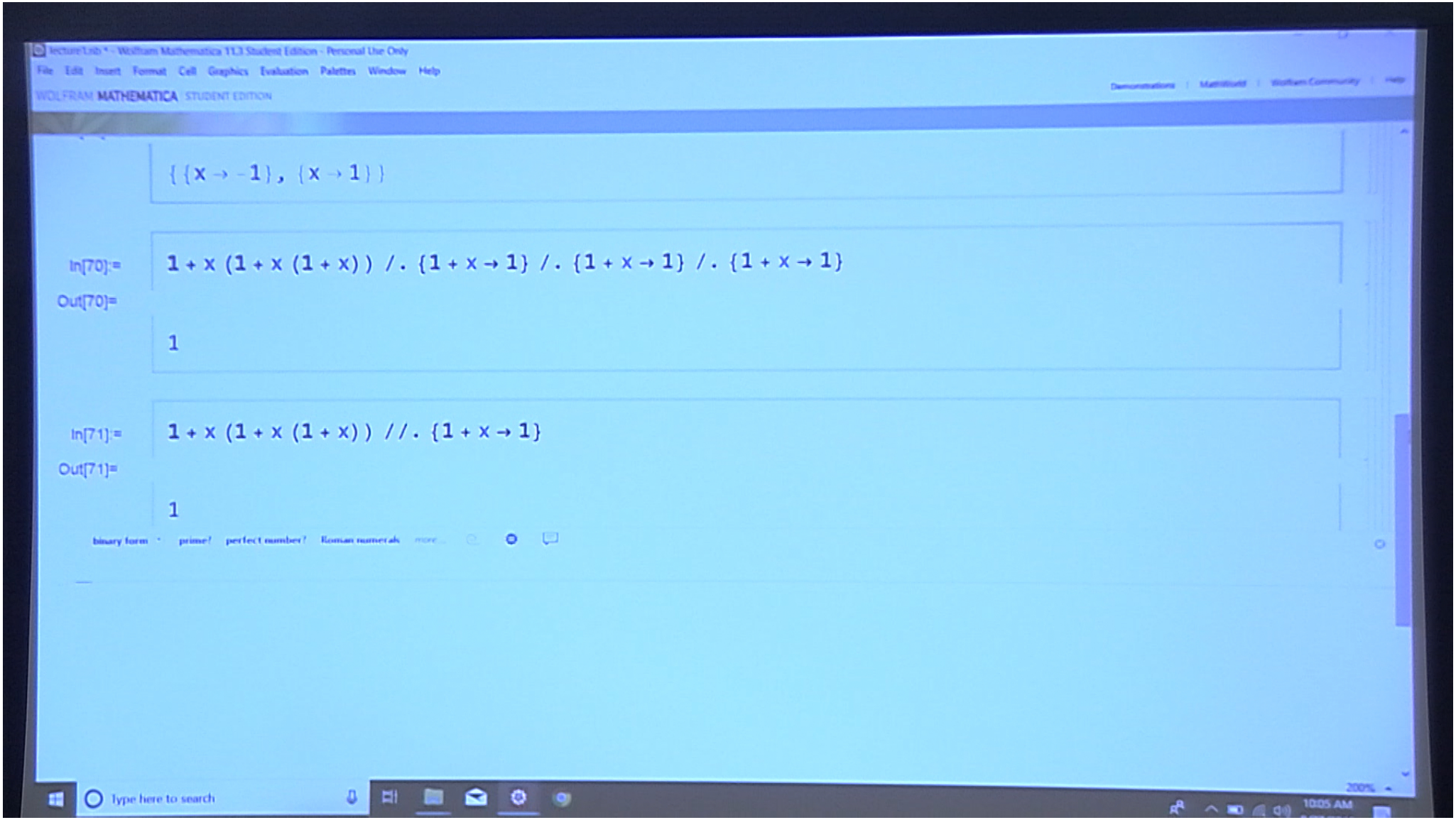

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File Edit Insert Format Cell Graphics Evaluation Palettes Window Help
WOLFRAM MATHEMATICA STUDENT EDITION
In[55]:= a = .; b = .;
In[56]:= a == b
Out[56]= a == b
In[57]:= a === b
Out[57]= False
In[58]:= 2 (x^2 + 1) == 2 x^2 + 2
Out[58]= True
Type here to search
10:00 AM

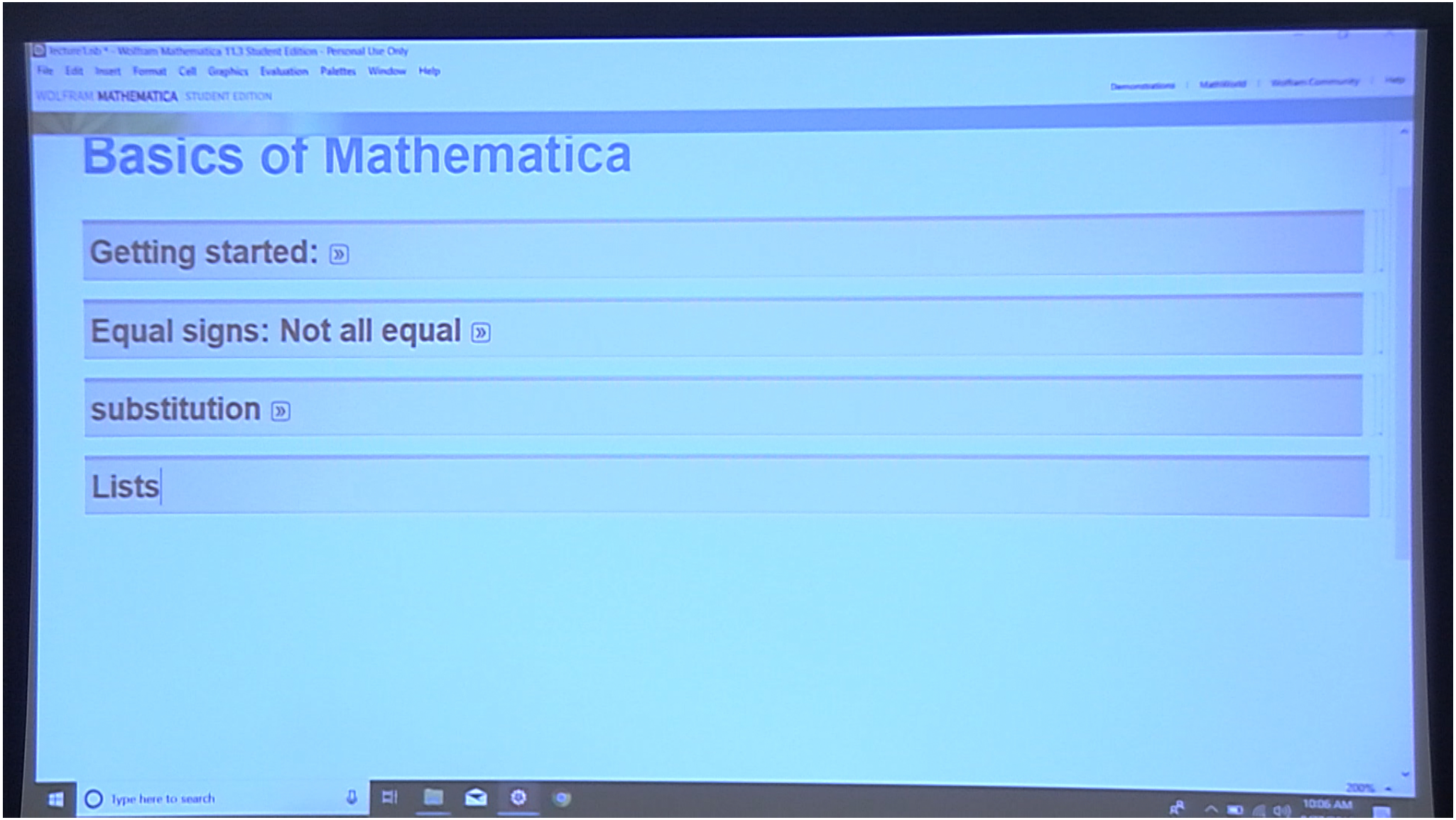

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WOLFRAM MATHEMATICA STUDENT EDITION
In[60]:= 2 (x^2 + 1) == 2 x^2 + 2
Out[60]=
2 (1 + x^2) == 2 + 2 x^2
In[61]:= Simplify[2 (x^2 + 1) == 2 x^2 + 2]
Out[61]=
True
Type here to search
10:00 AM

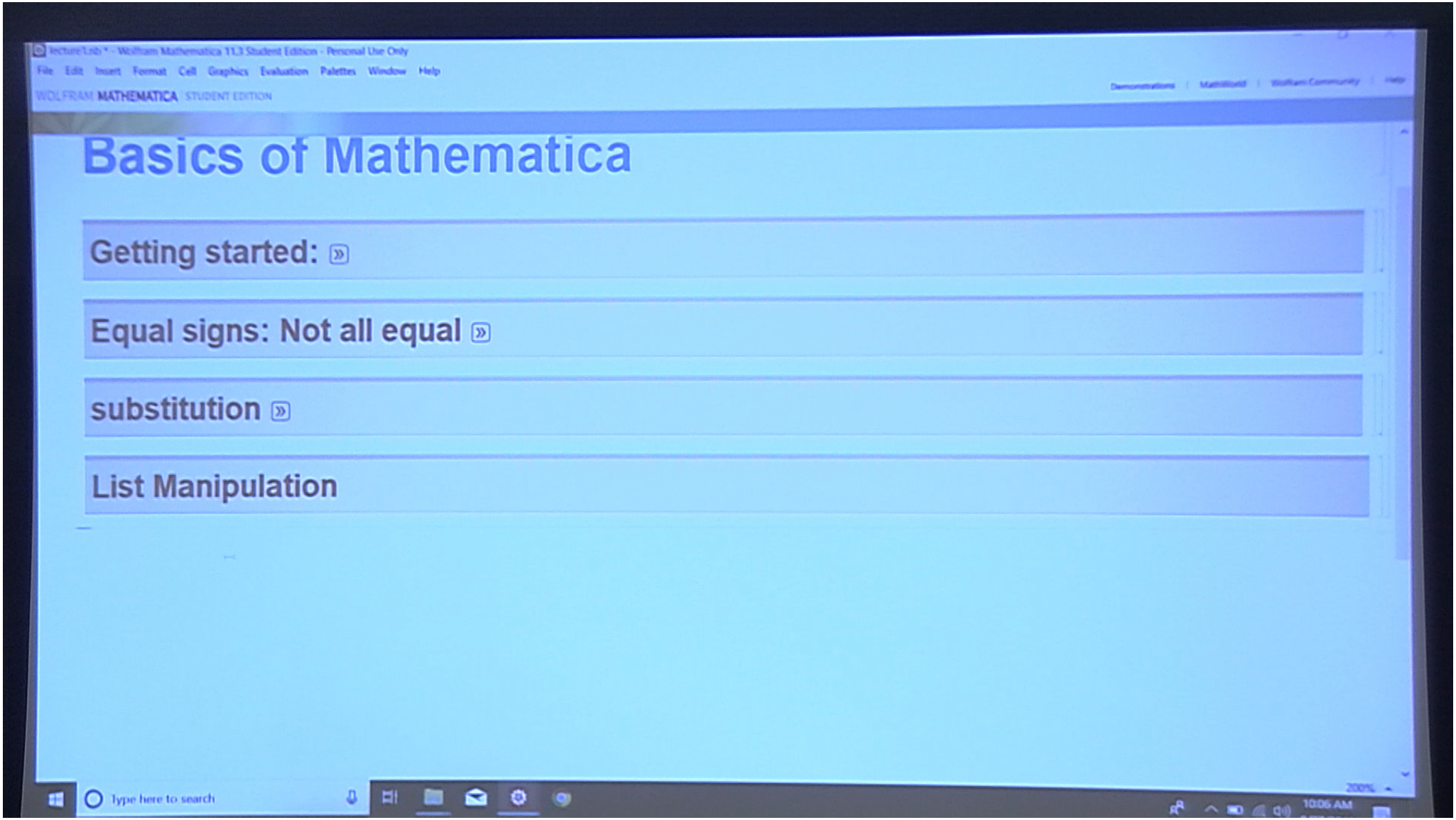

OH NO! THE ROBOTS ARE KILLING US!!!
BUT WHY?!? WE NEVER PROGRAMMED THEM TO DO THIS!!!
isCrazyMurderingRobot=False;
If[isCrazyMurderingRobot = True, kill[humans], beNiceto[humans]]

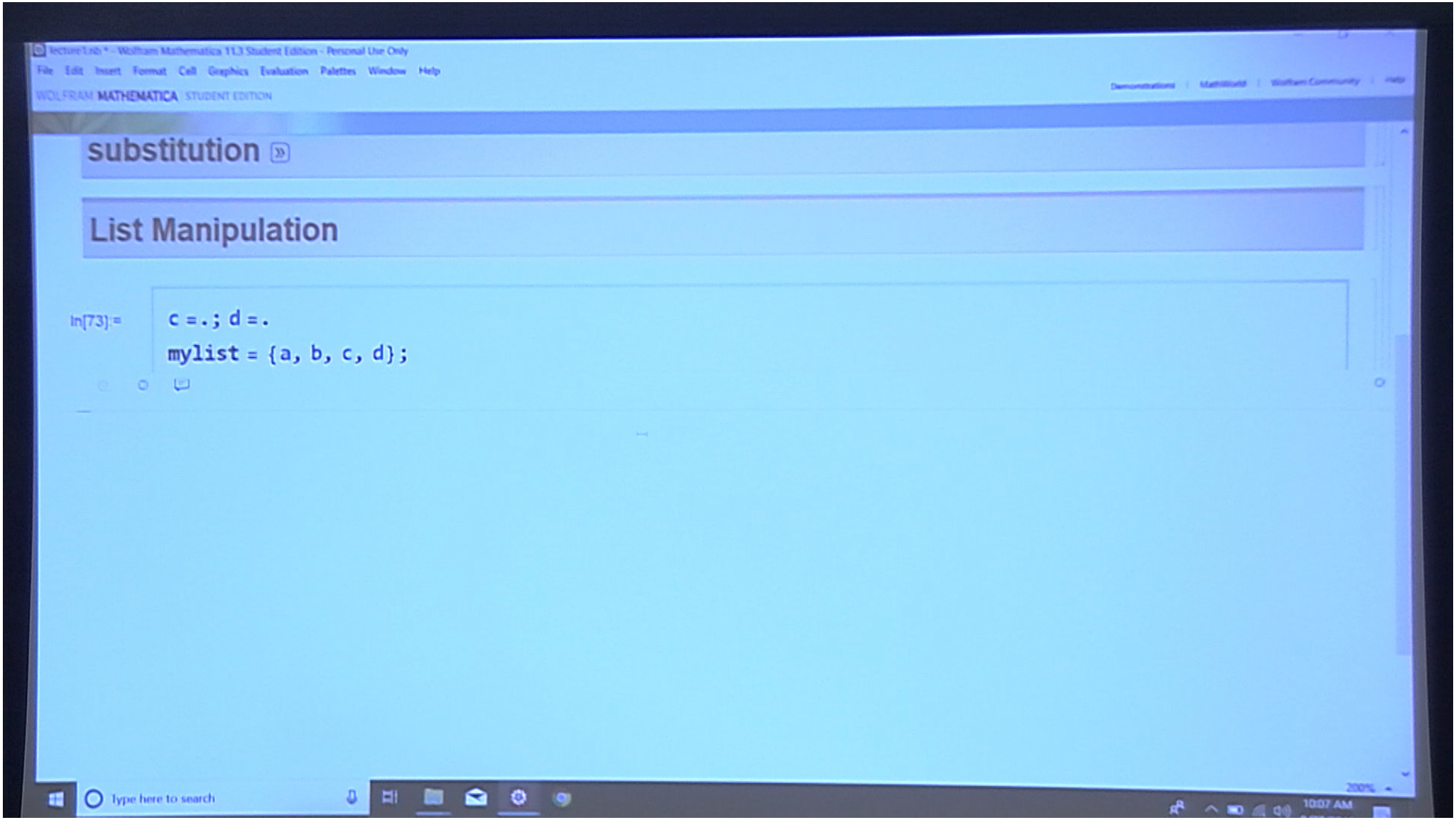

File Edit Insert Format Cell Graphics Evaluation Palettes Window Help
WOLFRAM MATHEMATICA STUDENT EDITION
In[65]:= x / (1 + x) /. x → 4
Out[65]= 4/5
In[66]:= Solve[x^2 == 1]
Out[66]= {{x → -1}, {x → 1}}
1 + x (1 + x (1 + x)) /. {}
Type here to search
10:05 AM

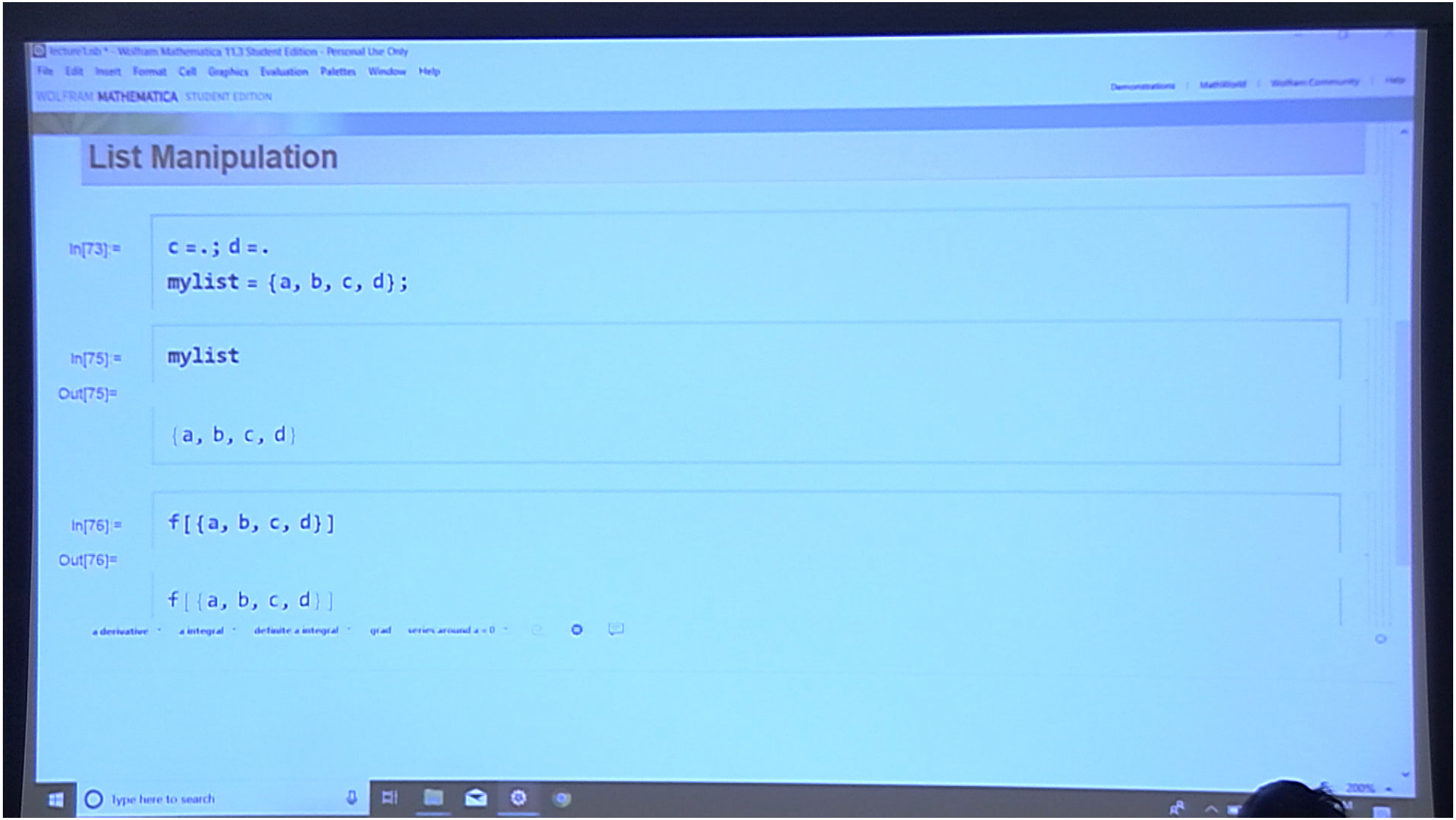

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WOLFRAM MATHEMATICA STUDENT EDITION
In[65]:= x / (1 + x) /. x → 4
Out[65]= 4/5
In[66]:= Solve[x^2 == 1]
Out[66]= {{x → -1}, {x → 1}}
In[67]:= 1 + x (1 + x (1 + x)) /. {1 + x → x}
Out[67]= 1 + x (1 + x^2)
plot simplify expand factor more
Type here to search
10:05 AM

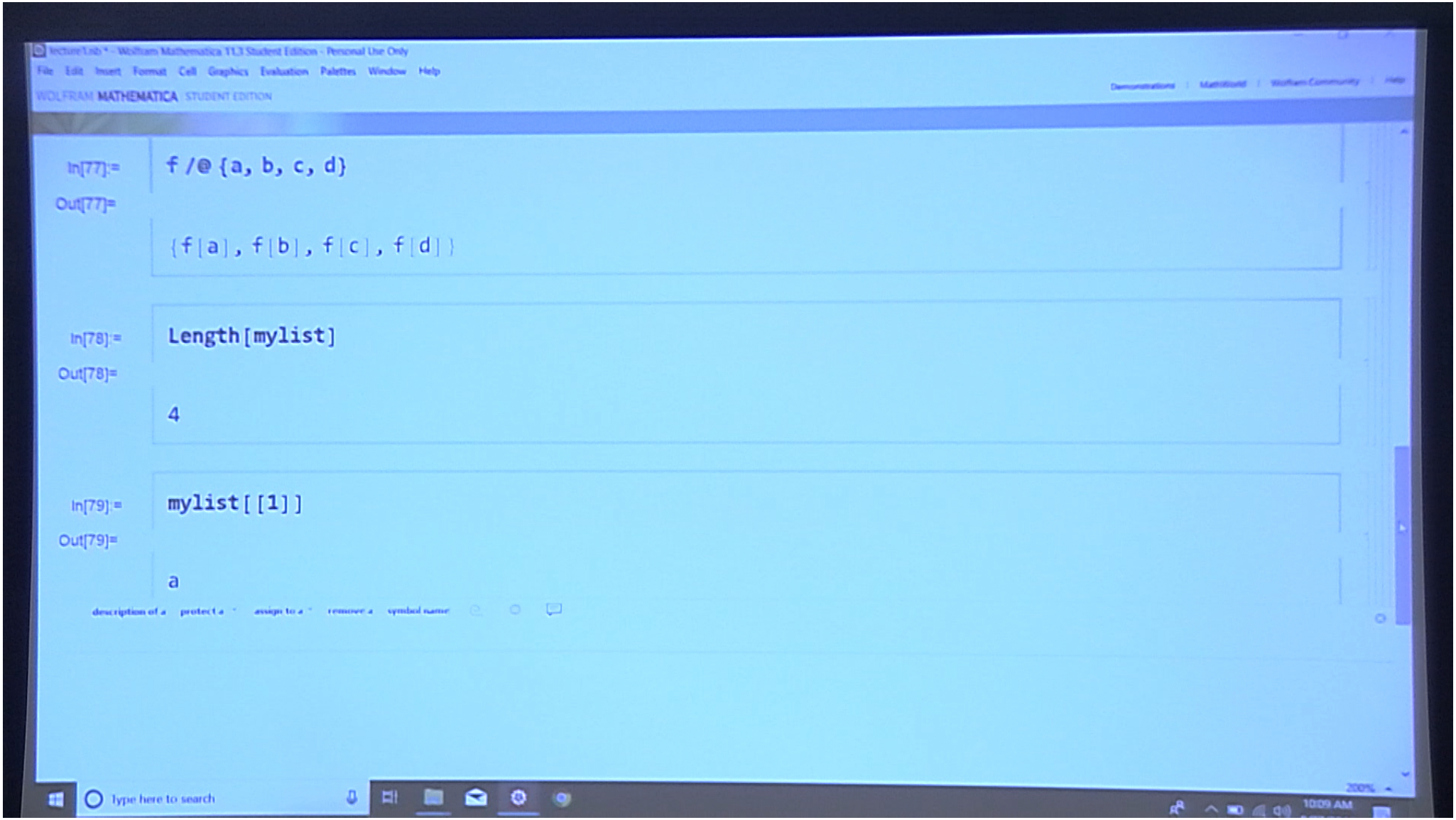

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WOLFRAM MATHEMATICA STUDENT EDITION
{{x → -1}, {x → 1}}
In[70]:= 1 + x (1 + x (1 + x)) /. {1 + x → 1} /. {1 + x → 1} /. {1 + x → 1}
Out[70]= 1
In[71]:= 1 + x (1 + x (1 + x)) //. {1 + x → 1}
Out[71]= 1
binary form prime? perfect number? Roman numerals more...
Type here to search
10:05 AM

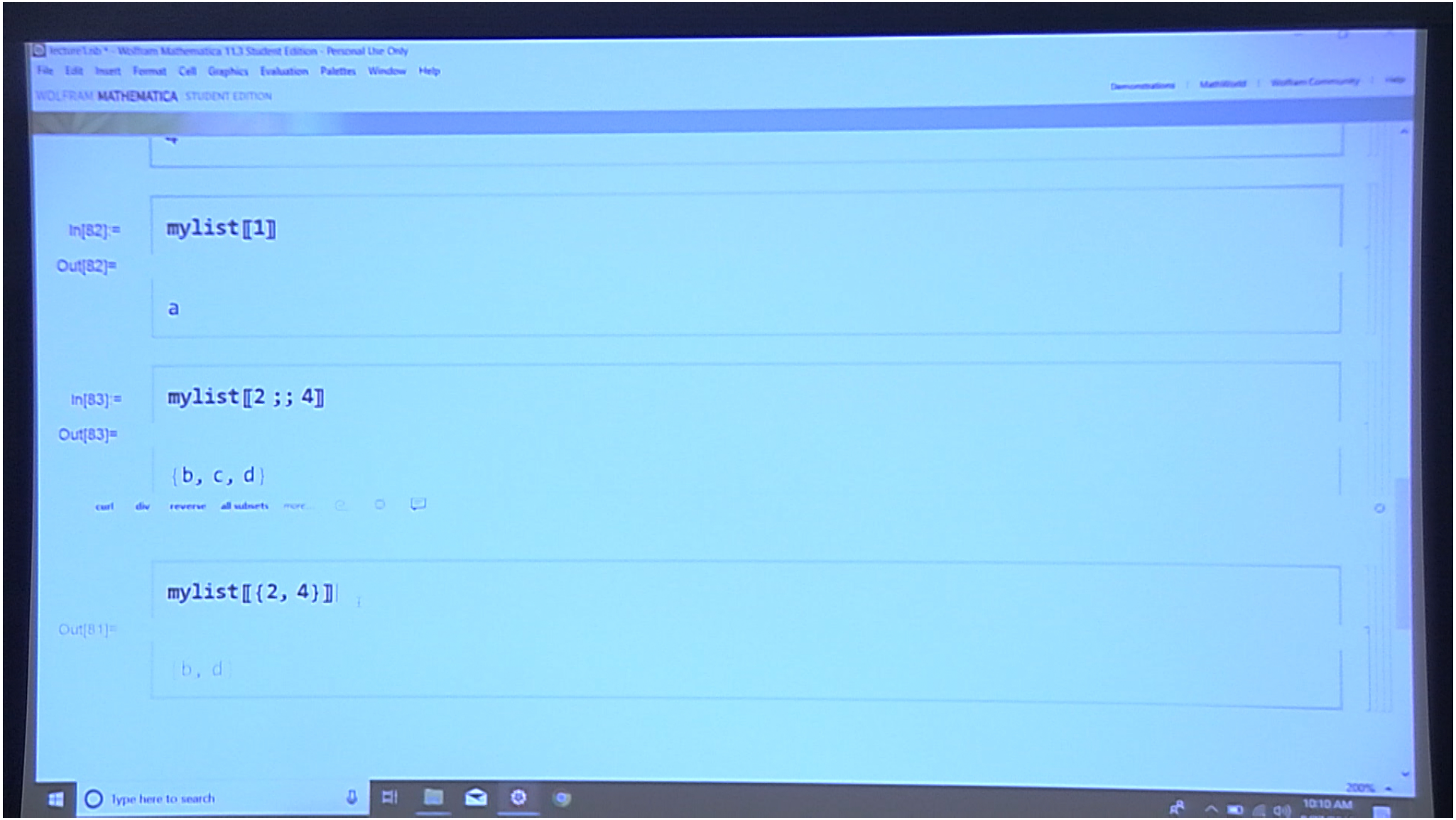

Basics of Mathematica
Getting started:
Equal signs: Not all equal
substitution
Lists
Type here to search

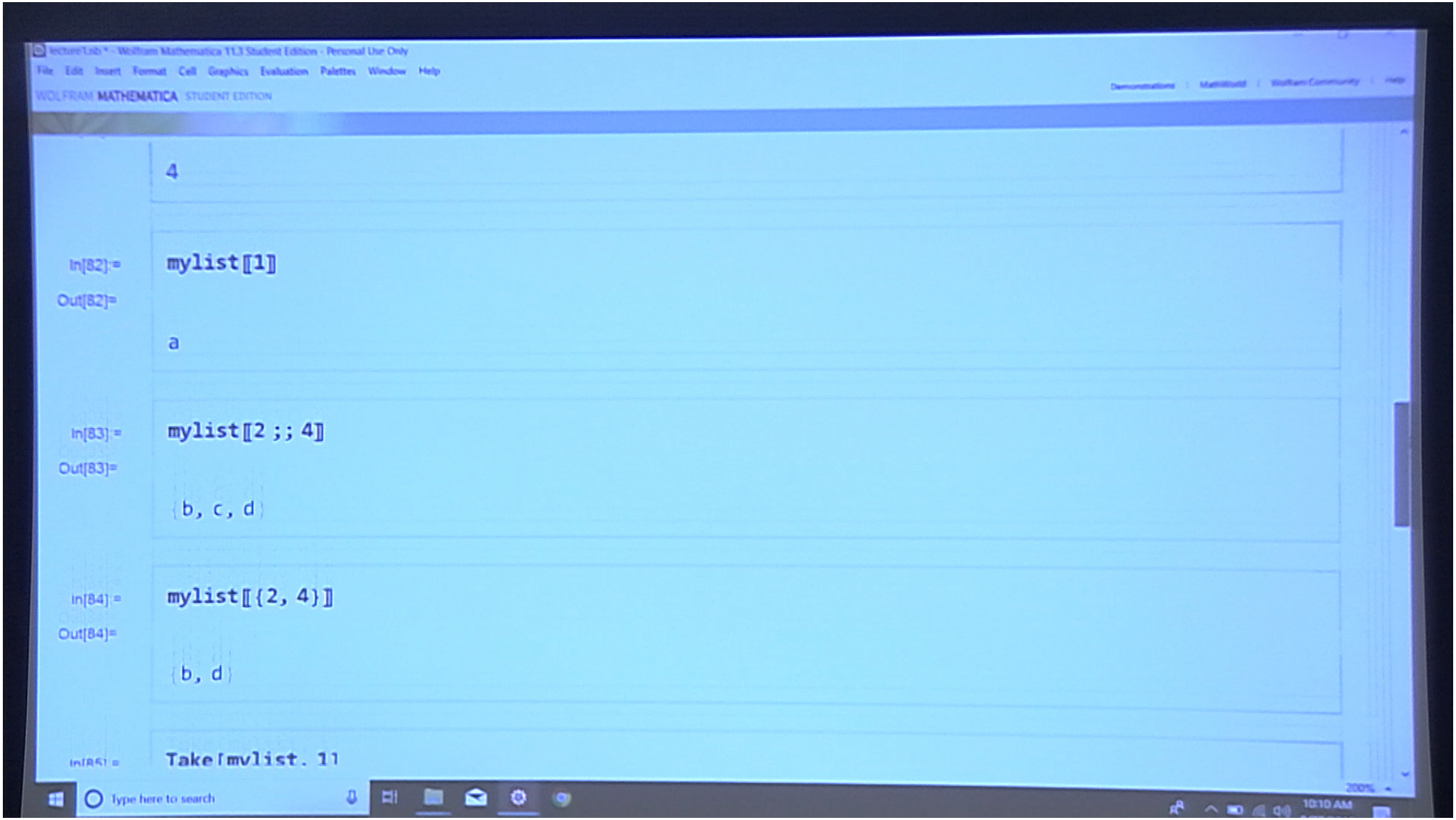

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WOLFRAM MATHEMATICA STUDENT EDITION
Demonstrations MathWorld Wolfram Community Help
Basics of Mathematica
Getting started: »
Equal signs: Not all equal »
substitution »
List Manipulation
Type here to search
200%
10:06 AM

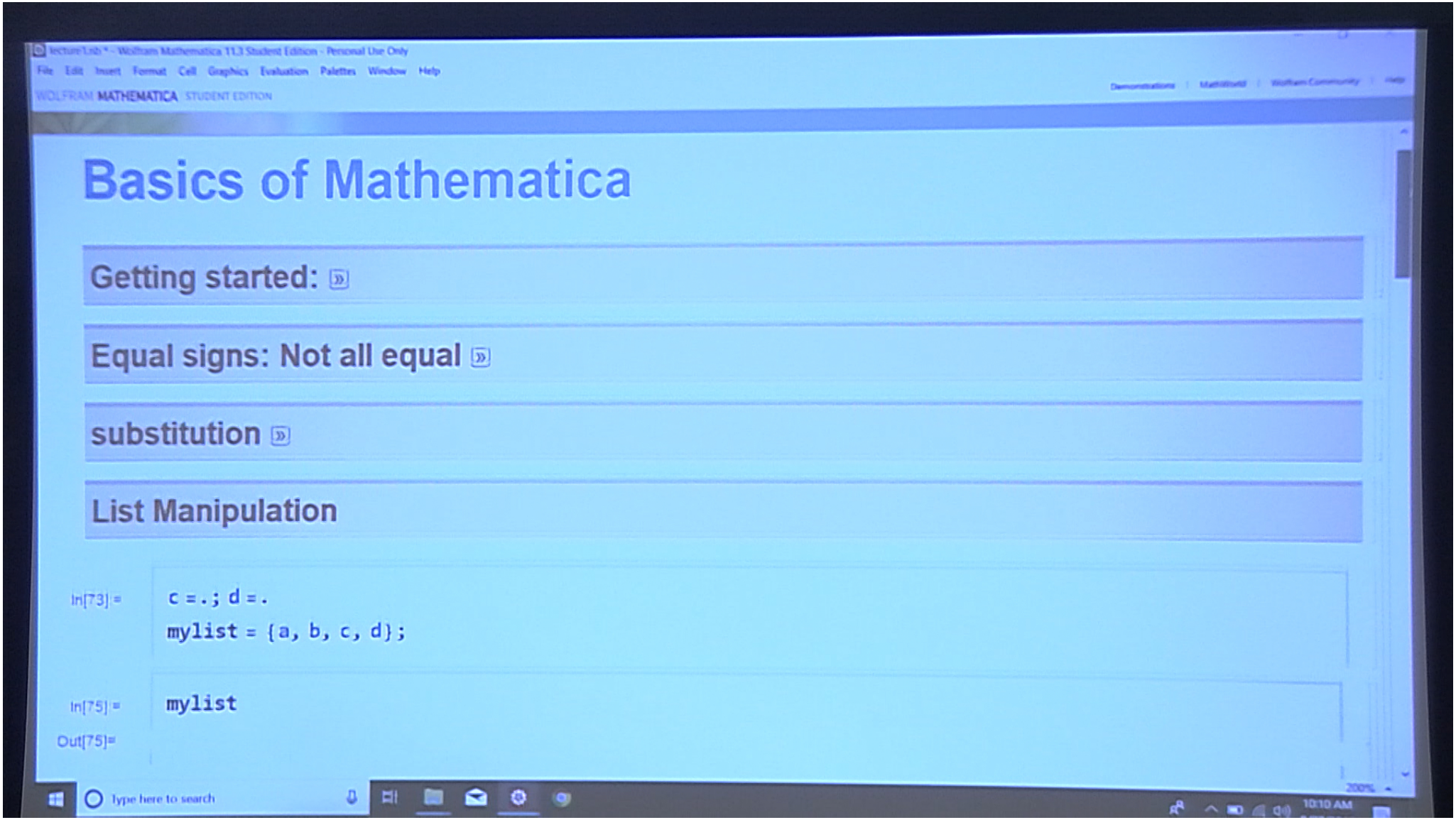

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WOLFRAM MATHEMATICA STUDENT EDITION
substitution
List Manipulation
In[73]:=
c = .; d = .
mylist = {a, b, c, d};
Type here to search
10:07 AM

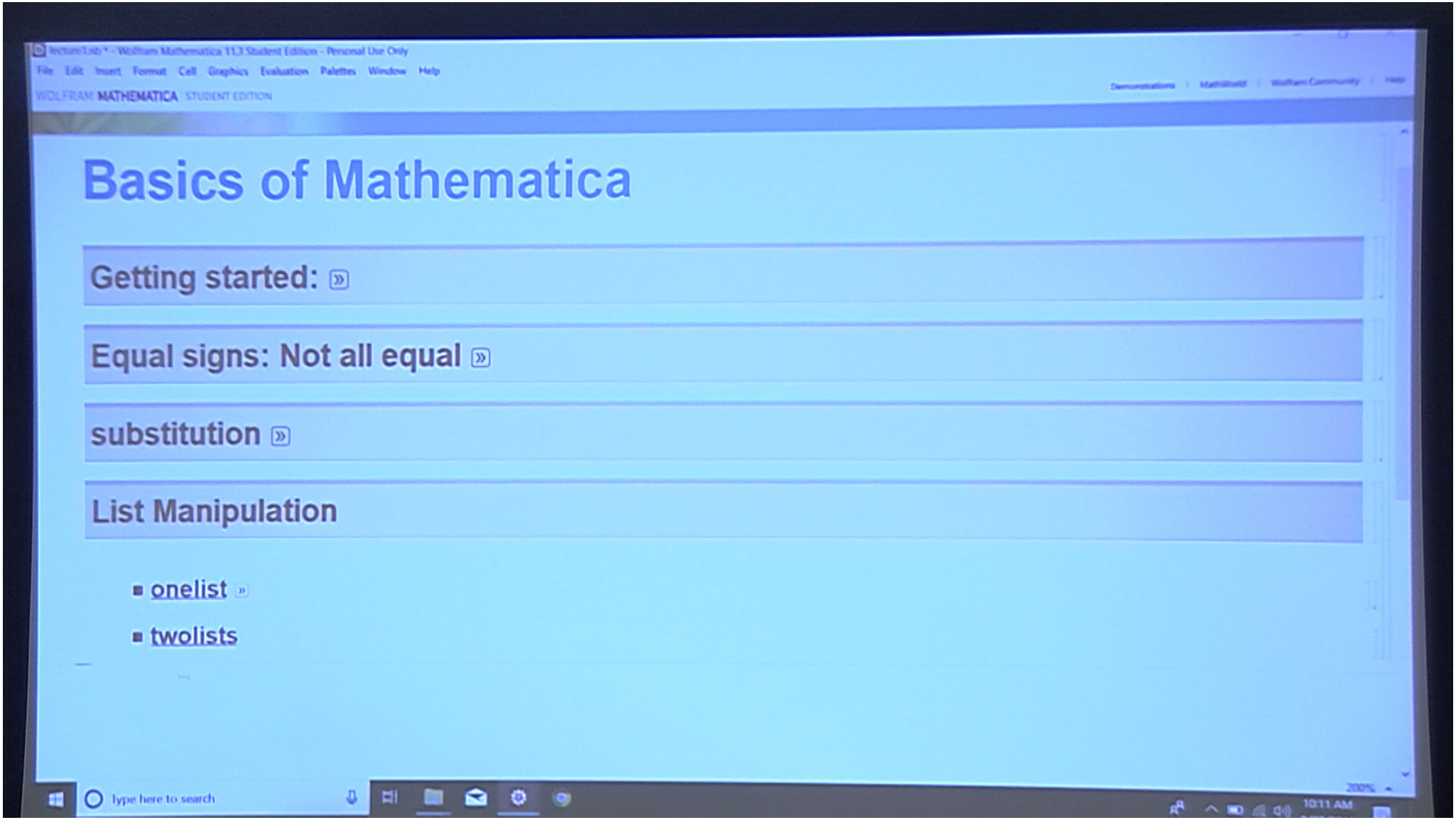

File Edit Insert Format Cell Graphics Evaluation Palettes Window Help
WOLFRAM MATHEMATICA STUDENT EDITION
List Manipulation
In[73]:=
c = .; d = .
mylist = {a, b, c, d};
In[75]:=
mylist
Out[75]=
{a, b, c, d}
In[76]:=
f[{a, b, c, d}]
Out[76]=
f[{a, b, c, d}]
Type here to search

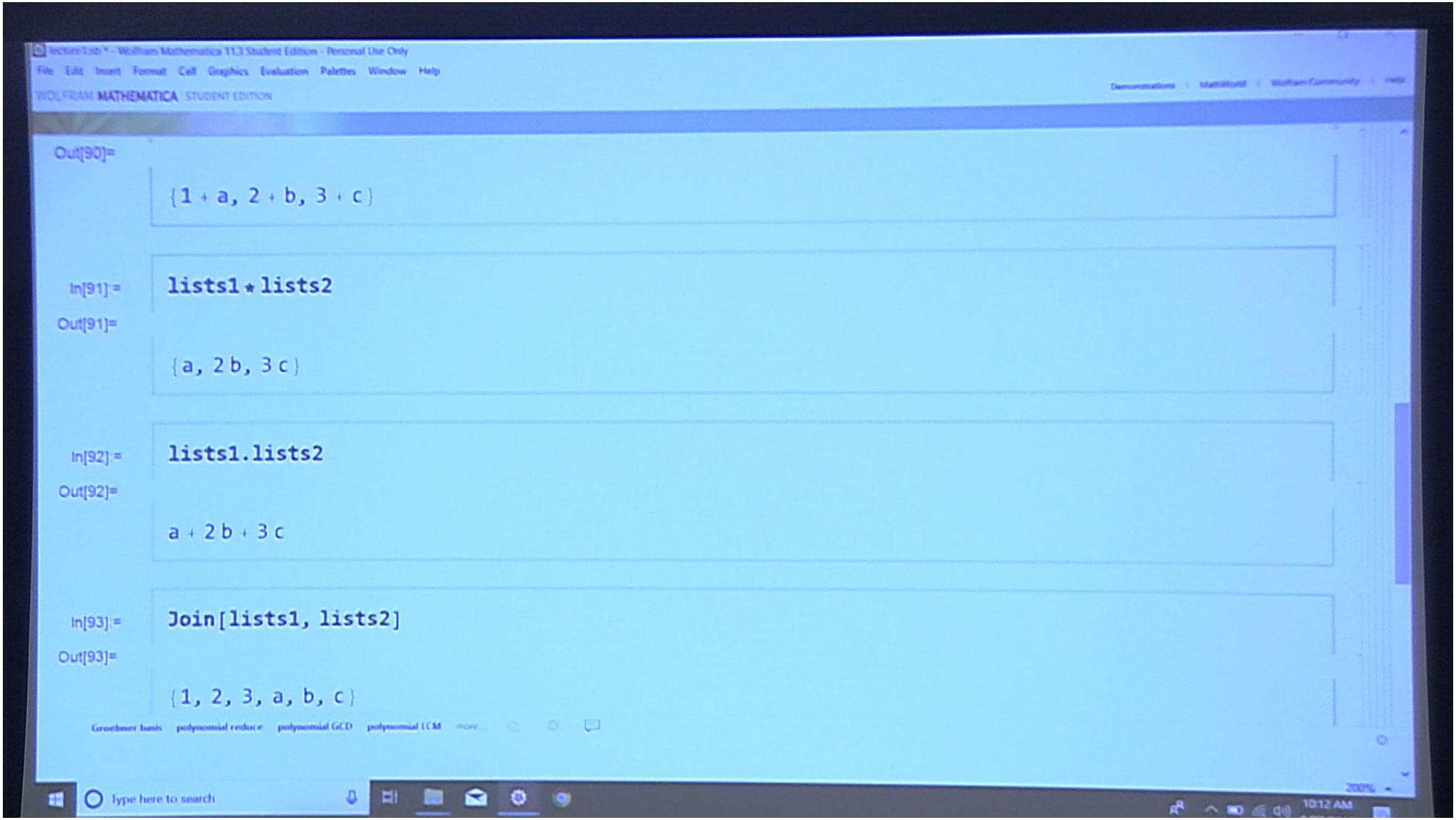

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WOLFRAM MATHEMATICA STUDENT EDITION
In[77]:= f /@ {a, b, c, d}
Out[77]= {f[a], f[b], f[c], f[d]}
In[78]:= Length[mylist]
Out[78]= 4
In[79]:= mylist[[1]]
Out[79]= a
Type here to search
10:09 AM

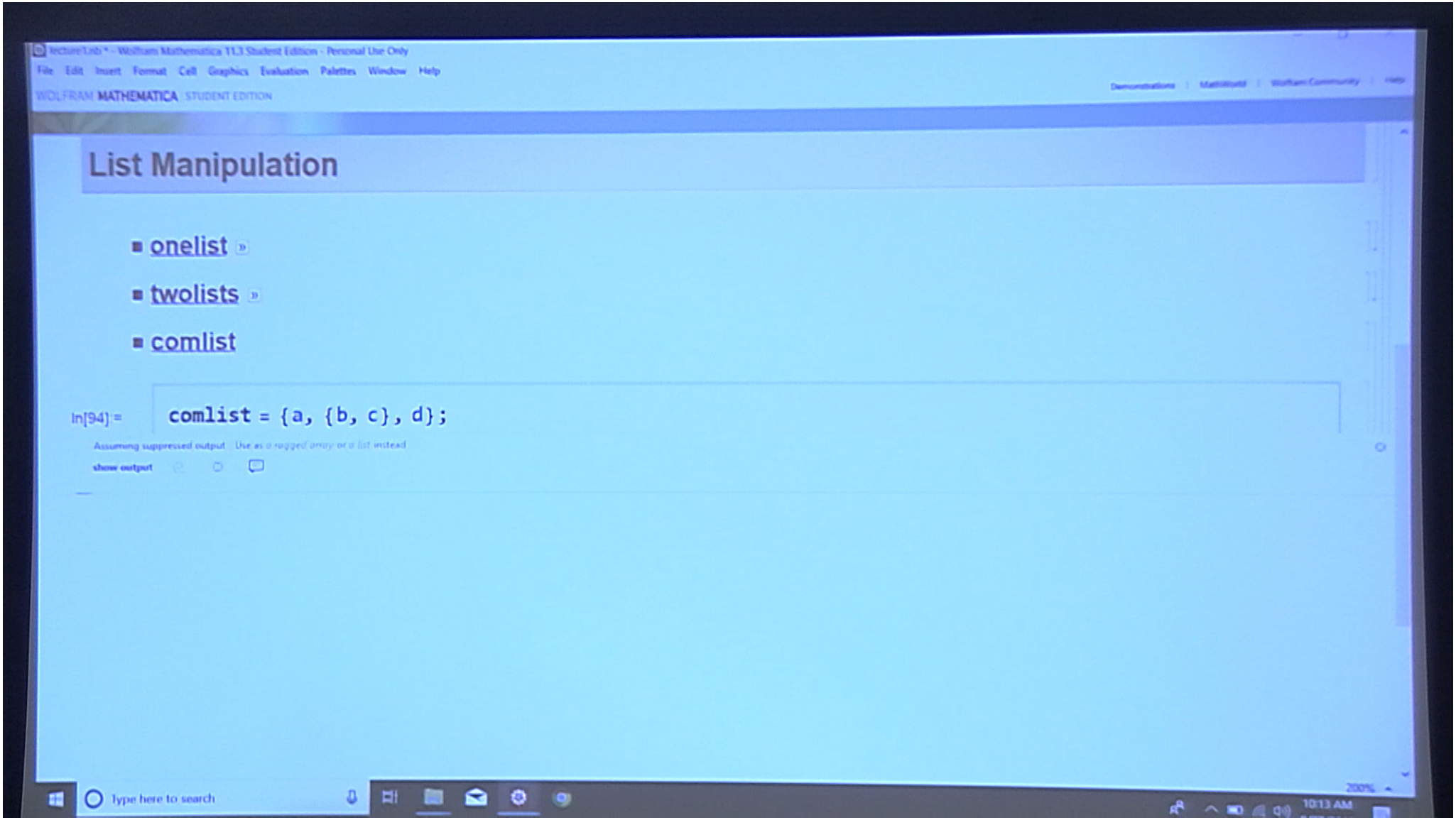

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File Edit Insert Format Cell Graphics Evaluation Palettes Window Help
WOLFRAM MATHEMATICA STUDENT EDITION
In[82]:= mylist[[1]]
Out[82]= a
In[83]:= mylist[[2 ;; 4]]
Out[83]= {b, c, d}
mylist[[{2, 4}]]
Out[81]= {b, d}
Type here to search
10:10 AM

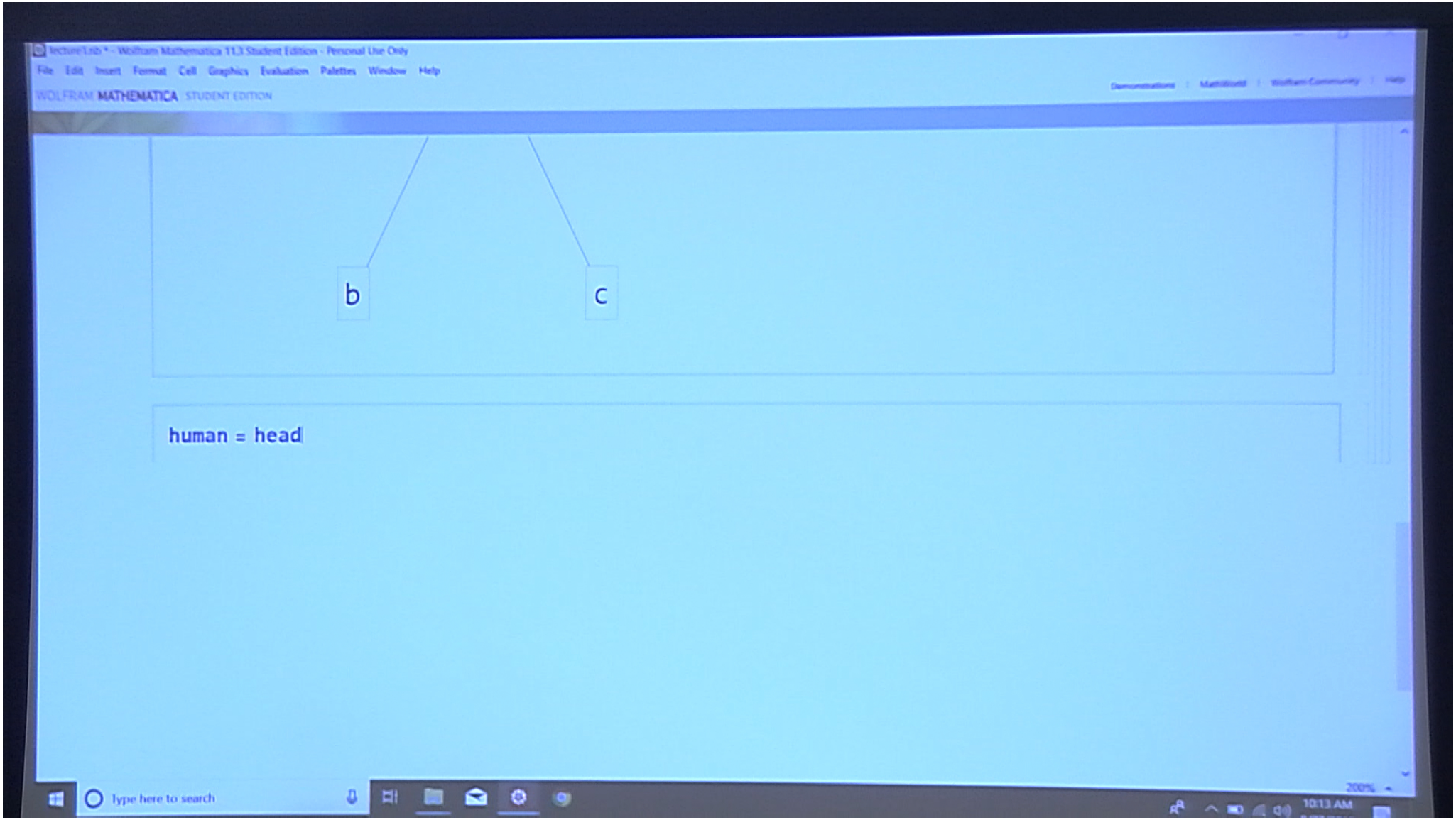

4
In[82]:= mylist[[1]]
Out[82]= a
In[83]:= mylist[[2 ;; 4]]
Out[83]= {b, c, d}
In[84]:= mylist[[{2, 4}]]
Out[84]= {b, d}

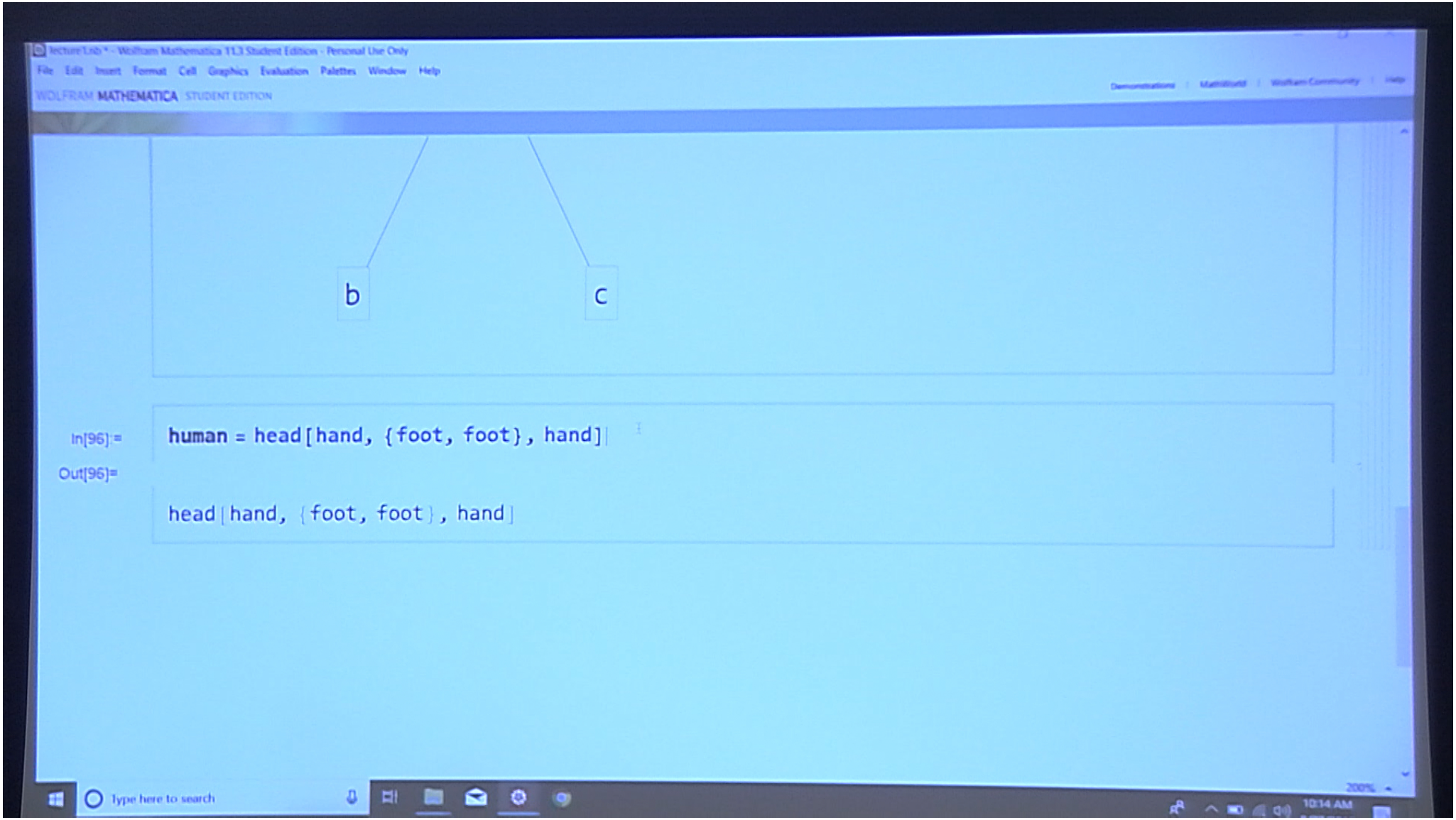

Lecture1.nb * - Wolfram Mathematica 11.3 Student Edition - Personal Use Only
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WOLFRAM MATHEMATICA STUDENT EDITION
Demonstrations | MathWorld | Wolfram Community | Help
Basics of Mathematica
Getting started:
Equal signs: Not all equal
substitution
List Manipulation
In[73]:=
c = .; d = .
mylist = {a, b, c, d};
In[75]:=
mylist
Out[75]=
Type here to search
10:10 AM

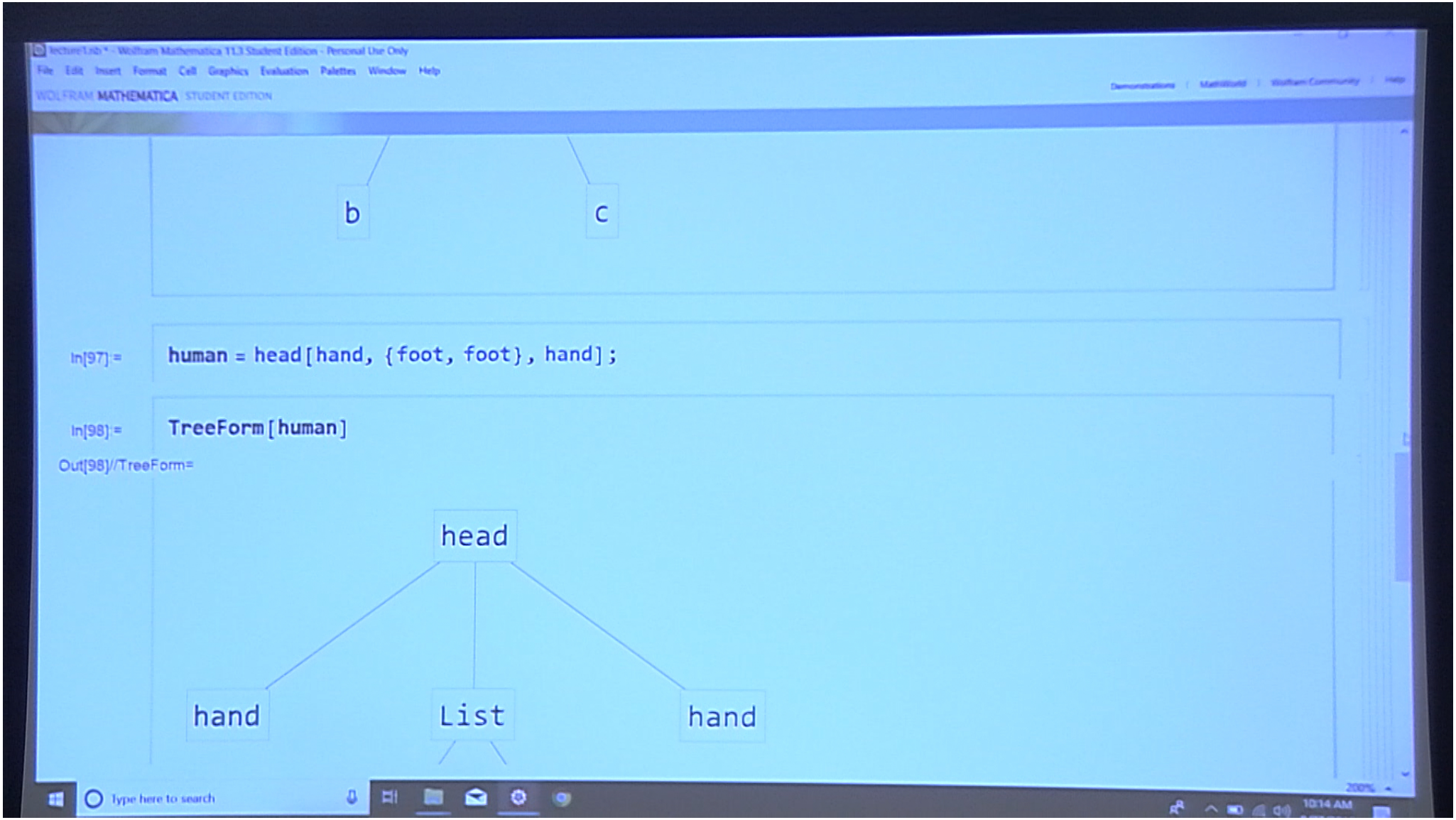

Basics of Mathematica
Getting started:
Equal signs: Not all equal
substitution
List Manipulation
onelist
twolists

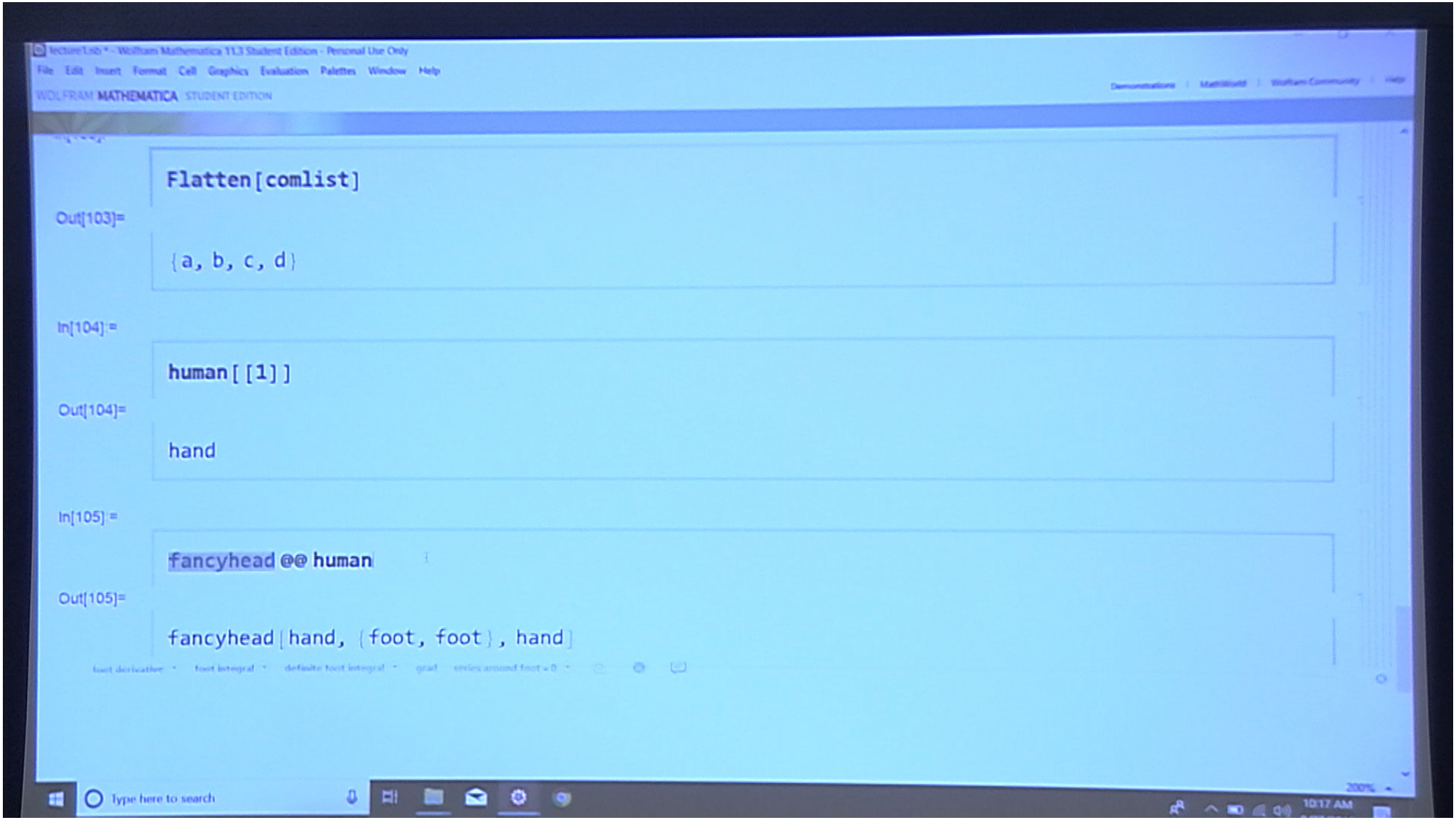

Out[90]=
{1 + a, 2 + b, 3 + c}
In[91]:= lists1 * lists2
Out[91]=
{a, 2 b, 3 c}
In[92]:= lists1.lists2
Out[92]=
a + 2 b + 3 c
In[93]:= Join[lists1, lists2]
Out[93]=
{1, 2, 3, a, b, c}
Type here to search

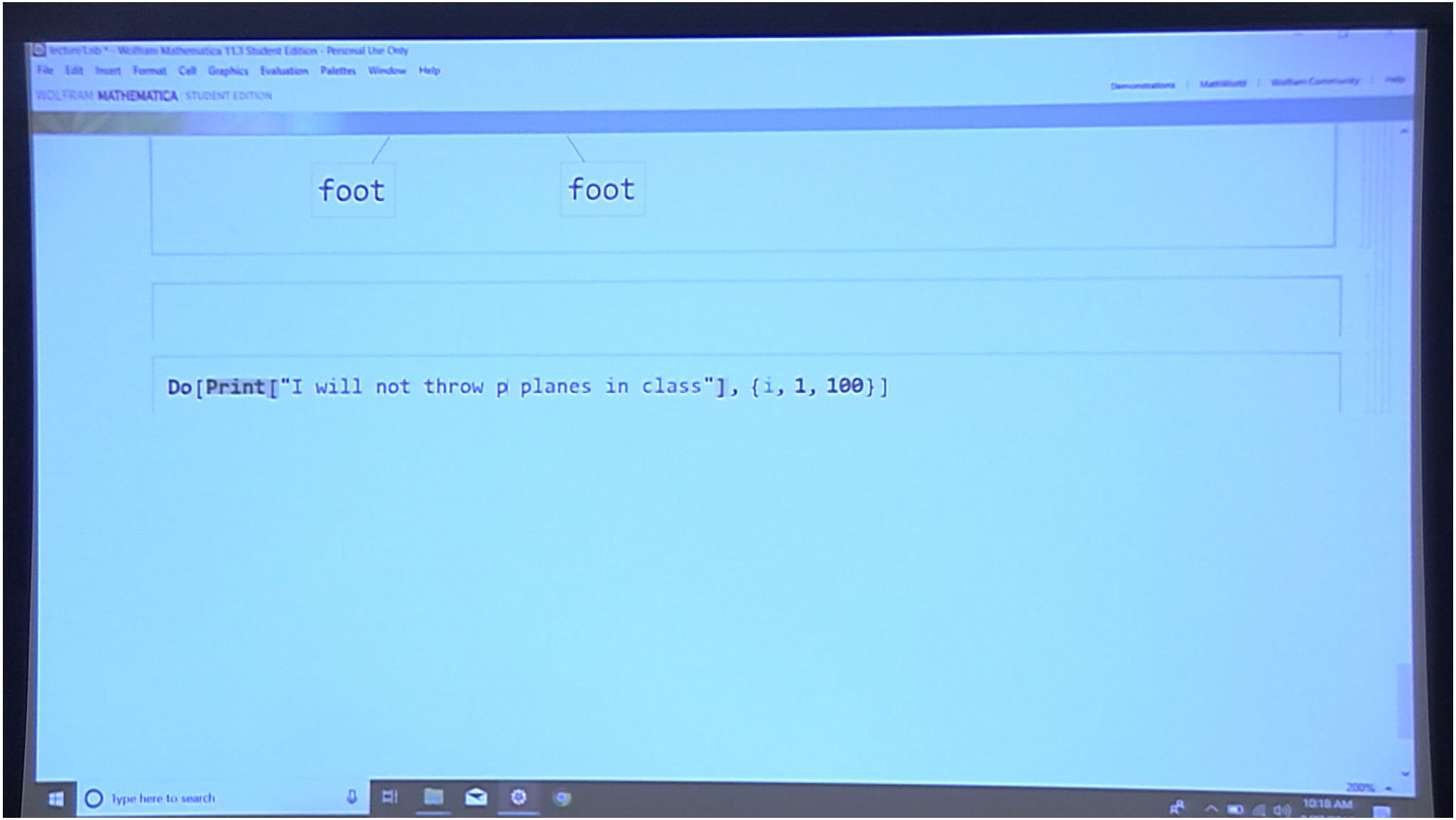

lectureUnb * - Wolfram Mathematica 11.3 Student Edition - Personal Use Only
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WOLFRAM MATHEMATICA STUDENT EDITION
Demonstrations | MathWorld | Wolfram Community | Help
List Manipulation
onelist »
twolists »
comlist
In[94]:= comlist = {a, {b, c}, d};
Assuming suppressed output. Use as a ragged array or a list instead.
show output
200%
Type here to search
10:13 AM

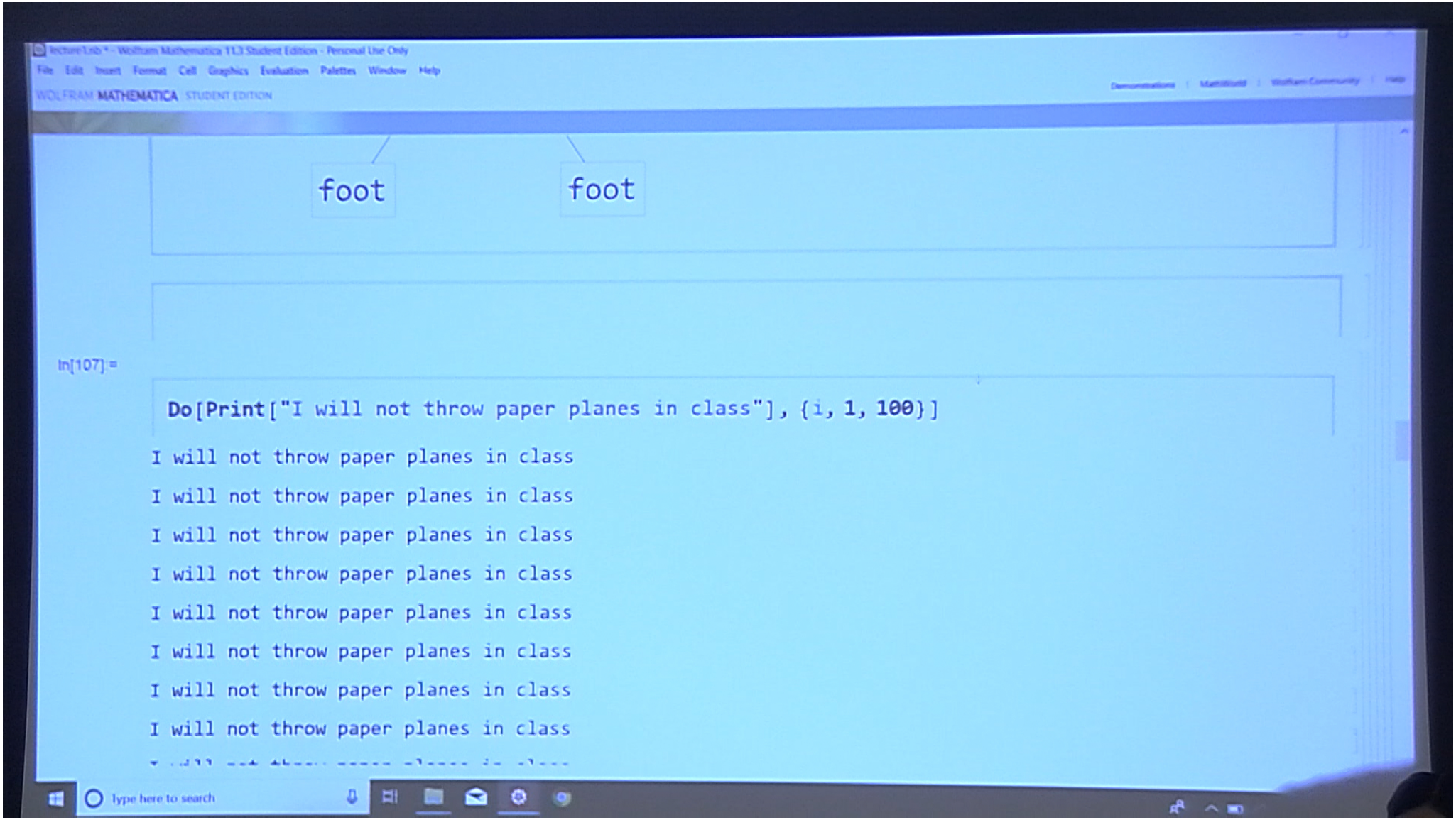

File Edit Insert Format Cell Graphics Evaluation Palettes Window Help
WOLFRAM MATHEMATICA STUDENT EDITION
b
c
human = head
Type here to search
10:13 AM


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File Edit Insert Format Cell Graphics Evaluation Palettes Window Help
WOLFRAM MATHEMATICA STUDENT EDITION
b
c
In[96]:= human = head[hand, {foot, foot}, hand]
Out[96]=
head[hand, {foot, foot}, hand]
Type here to search
10:14 AM


b
c
In[97]:= human = head[hand, {foot, foot}, hand];
In[98]:= TreeForm[human]
Out[98]//TreeForm=
head
hand
List
hand


File Edit Insert Format Cell Graphics Evaluation Palettes Window Help
WOLFRAM MATHEMATICA STUDENT EDITION
Flatten[comlist]
Out[103]=
{a, b, c, d}
In[104]:=
human[[1]]
Out[104]=
hand
In[105]:=
fancyhead @@ human
Out[105]=
fancyhead[hand, {foot, foot}, hand]
Type here to search
10:17 AM


File Edit Insert Format Cell Graphics Evaluation Palettes Window Help
WOLFRAM MATHEMATICA STUDENT EDITION
foot
foot
Do[Print["I will not throw p planes in class"], {i, 1, 100}]
Type here to search
10:18 AM


foot
foot
In[107] =
Do[Print["I will not throw paper planes in class"], {i, 1, 100}]
I will not throw paper planes in class
I will not throw paper planes in class
I will not throw paper planes in class
I will not throw paper planes in class
I will not throw paper planes in class
I will not throw paper planes in class
I will not throw paper planes in class
I will not throw paper planes in class
I will not throw paper planes in class
Type here to search