Non-Traditional OERs for Teaching First-Year Calculus

It’s the little things that count.
Non-Traditional OERs for Teaching First-Year Calculus
Infinitesimal Calculus

Inventors/discoverers of the calculus?

- Sir Isaac Newton: 1642 - 1726
- Gottfried Wilhelm Leibniz: 1646 - 1716
Infinitesimal Calculus

- Inspired by Fermat
- Inspired by Diophantus

Pierre de Fermat: 1607 - 1665
Diophantus of Alexandria: 200 – 284 ± 14
Infinitesimal Calculus

- Grounding the calculus
- Returning the calculus

\[ \lim_{x \to a} f(x) = L \text{ provided } \forall (\varepsilon > 0) \exists (\delta > 0) \text{ such that } |x - a| < \delta \Rightarrow |f(x) - L| < \varepsilon \]

\[ \lim_{x \to a} f(x) = L \text{ provided } x \approx a \Rightarrow f(x) \approx L \]
Infinitesimal Calculus

H. Jerome Keisler

1971

1936 -
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Revised February 2012
Infinitesimal Calculus

• Bridging the decades
### Infinitesimal Calculus

- **First step - videos**

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Infinitesimal Calculus

• Homework
Infinitesimal Calculus

• Homework
Infinitesimal Calculus

Answer to prayer

Welcome

Free and Open
Extensive library
Extensive library
2nd Place - Calculus
Find 4 − 3

7  1  -12  ☐

Submit  New Version
Select all the functions that are periodic

☐ $x^2$
☐ $\tan(x)$
☐ $\sin^{-1}(x)$
☐ $\csc(x)$
☐ $\sin(x)$

Submit  New Version
Match each function with its graph

Function | Graph Color
---------|-------------
$f(x)$    | a. blue     
$\int f(x) \, dx$ | b. red     
$f'(x)$   | c. green
Find $\bar{x}$

<table>
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<tr>
<td>7</td>
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<tr>
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<td>5</td>
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<tr>
<td>4</td>
</tr>
<tr>
<td>8</td>
</tr>
</tbody>
</table>

Submit  New Version
Add: \[
\begin{bmatrix}
3 & 4 & 2 \\
2 & 9 & 8 \\
\end{bmatrix} +
\begin{bmatrix}
3 & 1 & 1 \\
7 & 9 & 8 \\
\end{bmatrix}
\]
Write the intervals shown above. Use oo for $\infty$, -oo for $-\infty$, U for union.
Solve the equation $x^2 + x - 12 = 0$

Enter all solutions below as a list of numbers, separated with commas
Add the polynomials:

\((-5x^5 + 8x^4 - 11x + 2) + (6x^5 + 4x^4 - 11x^2 - 3x)\)
Let $h(x) = f(x) + g(x)$

Write an equation for $h(x)$

$h(x) = \boxed{\phantom{0}}$
Simplify \( \frac{x^{-7}}{x^{-1}} \)

Write your answer with positive exponents only.

Ans=

Submit  New Version

Question ID: 1. Seed: 3813. Message owner to report problems

Description: Example of function type

Author: Lippman, David, mb Lippman, David

Last Modified: 07/18/17 2:21 pm

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Plot these points:

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
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<tbody>
<tr>
<td>1</td>
<td>3</td>
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<tr>
<td>8</td>
<td>8</td>
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<tr>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

- Plotting Points
Sketch a graph of $f(x) = \begin{cases} 0 & \text{if } x \leq -2 \\ 2 & \text{if } -2 < x \leq 1 \\ 0 & \text{if } x > 1 \end{cases}$
Plot the number $\frac{7}{4}$ on the numberline below.
In the above circuit we have a resistor in series and two resistors in parallel.

2.1. Work out the total external resistance for this circuit

\[ R = \ldots \, \Omega \]
This is an essay question. Type your answer here.
• Native student interface
• Export to Canvas
Alternative Exports
To learn the material for this section, take notes while watching each video and then demonstrate what you learned by doing the exercise below it.

Example 2: Graph $3x + 6y = 30$.

Steps:
1. Solve this equation for $y$.
2. Choose multiples of 3 to substitute.

Here are the multiples of 3 to substitute for $x$:

<table>
<thead>
<tr>
<th>$x$</th>
<th>$y$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
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</table>

Sketch a graph of $y = -\frac{1}{2}x + 1$
Assignment 2.2: Graphs of Linear Functions

Score: 0/140  0/14 answered

Instructor Preview of All Questions  Show All Answers  Hide Intro and Between-Question Text

1. Question 1
   The slope of the line below is: 
   ![Graph of a line](image)

   Question Help: Video

   Submit Question  Jump to Answer

2. Question 2
   Match each linear equation with its graph.

   - Equation: \( y = -\frac{1}{2}x - 3 \), Graph Color: a. purple
To the best of your ability, answer each and every question. This iRAT will be timed and you will have to submit your answers whether finished or not.

Question 1
Let \( f \) be a real function of one variable. The derivative of \( f \) is a new function \( f' \) whose value at \( x \) is the slope of \( f \) at \( x \). In symbols,

\[
f'(x) = \lim_{\Delta x \to 0} \frac{f(x + \Delta x) - f(x)}{\Delta x}
\]

where \( \Delta x \) is any infinitesimal.

Question 2
If \( f(u) = (u + 2)^2 \), simplify the expression

\[
f(u + \Delta u) = \quad 
\]

Question 3
If \( f(u) = (u + 2)^2 \), simplify the expression

\[
f(u + \Delta u) - f(u) = \quad 
\]
• Creating Courses
• A Large Community that Shares
A Large Community that Shares
A Large Community that Shares
• A Large Community that Shares
Can’t find what you need
<table>
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<tr>
<td>• OER</td>
<td>• No technical support</td>
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<td>• Stand alone management</td>
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<td>• Integrates with LMS</td>
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<td>• Fully customizable</td>
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<td>• Large community of contributors</td>
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<tr>
<td>• Many builds directly tied to OER textbooks</td>
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Thank you