Intentionally Integrating Prior Knowledge into Daily Lessons

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Encouraging Effective Teaching Innovation

MathFest

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Background

- Flipped Classroom, Fall 2013

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- Next three years: fairly consistent implementation

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- Next three years: fairly consistent implementation
- Recent: less focus on videos, move to hands-on preparation activities

M145 Finite Mathematics - Activity I

Course Basics

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Course Basics

Activity I: Introduction to Linear Programming

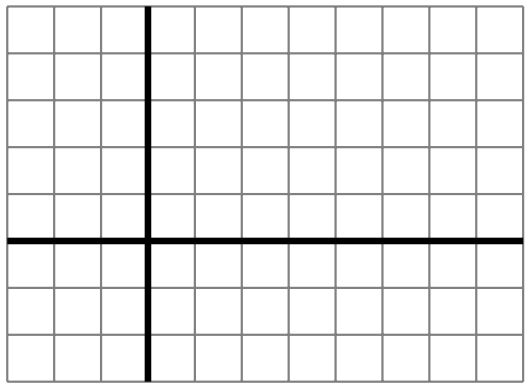
- Graph a system of linear inequalities
- Find corner points of a feasible region

M145 Finite Mathematics - Activity I

Directions: Graphs need to be as accurate as possible! Do not round decimals; use fractions. If you find a corner point by inspection, make absolutely sure it is exact and not rounded.

1. Graph the feasible region for the system of constraints.

$$\begin{cases} 3x + 4y \geq 12 \\ 2x - y \geq -1 \\ 0 \leq x \leq 7 \\ 0 \leq y \leq 4 \end{cases}$$



2. Find the corner points of the feasible region. (Hint: There are five.)

M148 Calculus I with Precalculus, Part 1 - Activity I

Course Basics

M148 Calculus I with Precalculus, Part 1 - Activity I

Course Basics

Activity I: Introduction to Limits

- Function notation
- Domain of rational functions

M148 Calculus I with Precalculus, Part 1 - Activity I

1. Find the domain of $f(x) = \dfrac{x^2 + x - 6}{x - 2}$.
2. Complete the following tables for $f(x)$. Do not round any of the y-values.

x	$y = f(x)$
1.5	
1.8	
1.9	
1.99	
1.999	
1.999 9	
1.999 99	

x	$y = f(x)$
2.5	
2.2	
2.1	
2.01	
2.001	
2.000 1	
2.000 01	

M148 Calculus I with Precalculus, Part 1 - Activity II

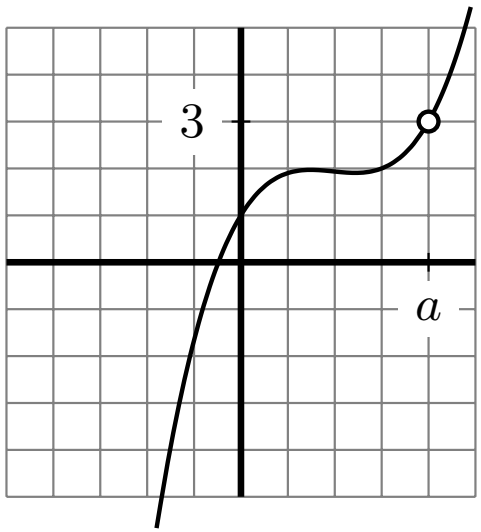
Activity II: Introduction to Continuity

- Definition of limits (included sided limits)
- Graphical computation of limits and function values

M148 Calculus I with Precalculus, Part 1 - Activity II

Directions: For the following six problem find the requested limits and functions values. Remember that $\pm\infty$ and DNE are possible answers.

1.



$\lim_{x \to a^-} f(x) =$ $\lim_{x \to a^+} f(x) =$

$\lim_{x \to a} f(x) =$ $f(a) =$

M152 Calculus II - Activity I

Activity I: Applications of Improper Integrals (p-integrals)

- Definition of improper integral
- Opportunity to wrestle with parameters

M152 Calculus II - Activity I

Directions: Fill in the missing parts (ie blanks) of the following problems. Stop at the last blank, do not compute the limit. We will complete them in class. (See Sec 7.6 Theorem 1 for help). In each problem $a > 0$ and p are parameters (treat them exactly like you would a number in that spot).

1. $$\int_a^\infty \frac{1}{x^p}\,dx = \lim_{R\to\infty}\int_a^R \_\_\_\_\_\,dx = \lim_{R\to\infty} \_\_\_\_\_\Big|_a^R = \lim_{R\to\infty} \_\_\_\_\_$$

2. $$\int_0^a \frac{1}{x^p}\,dx = \lim_{R\to a^-}\int_0^R \_\_\_\_\_\,dx = \lim_{R\to a^-} \_\_\_\_\_\Big|_0^R = \lim_{R\to a^-} \_\_\_\_\_$$

M252 Linear Algebra - Activity I

Activity I: TFSAE Theorem and Matrix Inverses

- Matrix representation of systems
- Consistent systems
- Finding inverses

M252 Linear Algebra - Activity I

Directions: Complete the following for your matrix (if you were not in class use the matrix A found on the very top of p62).

1. Write the general linear system which uses your matrix as the coefficient matrix.
2. For which values of b is the system consistent?
3. Find the inverse of your A.
4. How does the A^{-1} relate to your answer for 2.?

M252 Linear Algebra - Activity II

Activity II: Properties of the Determinant

- Matrix computations
- Calculation of the determinant

M252 Linear Algebra - Activity II

Directions: The effects of certain matrix operations can be seen in the determinant. Your task for Wednesday is to experiment (with your calculator and different matrices) and make a prediction as to how the determinants of the following matrices are related. Assume A and B are square matrices.

1. How is the $\det(AB)$ related to the $\det(A)$ and $\det(B)$?

2. How is the $\det(A+B)$ related to the $\det(A)$ and the $\det(B)$?

3. How is the $\det(kA)$ related to the $\det(A)$ if k is a scalar?

4. How is the $\det(A^{-1})$ related to the $\det(A)$? (A invertible)

M252 Linear Algebra - Activity III

Activity III: Gram-Schmidt Process

- Vector definitions: angle, unit vector, distance
- Vector space bases
- Inner product of a vector space

M252 Linear Algebra - Activity III

Part 1: View $\mathbb{R}^2$ as an inner product space with the standard vector operations and the standard Euclidean inner product and let $\mathbf{u}_1 = (3, 4)$ and $\mathbf{u}_2 = (1, 0)$.

1. Show $\mathbf{u}_1$ and $\mathbf{u}_2$ form a basis for $\mathbb{R}^2$.

2. Find the angle between $\mathbf{u}_1$ and $\mathbf{u}_2$.

3. Find a unit vector in the direction of $\mathbf{u}_1$.

4. Find

a) $\langle \mathbf{u}_2, \mathbf{u}_1 \rangle$ b) $||\mathbf{u}_1||^2$ c) $\mathbf{u}_2 - \dfrac{\langle \mathbf{u}_2, \mathbf{u}_1 \rangle}{||\mathbf{u}_1||^2} \mathbf{u}_1$

M341 Differential Equations - Activity I

Activity I: Linear Systems: Determining Stability of Equilibrium Points

- Matrix notation of systems
- Eigenvalue computation

M341 Differential Equations - Activity I

Directions: Find the matrix representation and then the eigenvalues for each system.

1. $x' = -x, y' = -5y$
2. $x' = 2x, y' = 2y$
3. $x' = x, y' = 5y$
4. $x' = y, y' = -4x$
5. $x' = y, y' = -y - 2x$
6. $x' = -2x, y' = -2y$
7. $x' = x, y' = -5y$
8. $x' = y, y' = y - 2x$

M411 Analysis - Activity I

Activity I: A “good faith” attempt at

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