

Measurable Student Learning Outcomes of Four Course Sequence for San Francisco State Math Education Masters and FLM Candidates

Overall Student Goals. Learn mathematics that was not previously known. Deepen her or his understanding of mathematical ideas that are already familiar. Expand her or his idea of what mathematics is and develop an appreciation and enjoyment of mathematics. Increase confidence in her or his ability to examine and solve mathematical problems, based on increased knowledge and experience. Examine the process of learning mathematics and develop techniques and ideas for teaching mathematics.

Math 575 (Mathematics for Middle School Teachers):

1. [measure physical quantities] solve and explain problems by finding the length, area, surface area, and volume of objects using standard and non-standard units, and find such quantities both by direct measurement and by computation;
2. [calculate angles] solve and explain problems by finding angles, particularly at the vertices of polygons, both by direct measurement and computation;
3. [geometric similarity] solve and explain problems using the concept of geometric similarity;
4. [use graphing calculators] solve problems with and discuss appropriate use of graphing calculators;
5. [integer arithmetic] understand and explain arithmetic with integers, particularly negative ones, and the associative, commutative and distributive properties;
6. [solve linear problems] solve problems, particularly involving linear functions, using different representations such as symbolic, graphical, tabular, and verbal;
7. [solve non-routine problems] solve non-routine problems by finding patterns and fitting formulas to data;
8. [write clear explanations] write clear explanations of mathematical reasoning;

Math 576 (Mathematics for Middle School Teachers II):

1. [probability and expected value] solve and explain problems by computing probabilities and expected values of events, and estimate probabilities by carrying out trials;
2. [solve linear systems] solve and explain problems by setting up and analyzing systems of linear equations;
3. [solve linear inequalities] solve and explain problems by setting up and analyzing systems of linear inequalities;

4. [solve non-routine problems] solve non-routine problems by finding patterns and fitting formulas to data;
5. [write clear explanations] write clear explanations of mathematical reasoning;

Math 577 (Mathematics for Middle School Teachers III):

1. [linear and quadratic functions] Calculate and interpret symbolic features of linear and quadratic functions, such as roots, slope, axis of symmetry, and vertex;
2. [exponential functions] Calculate and justify operations with exponential functions, such as laws of exponents and the conventions for zero and negative exponents;
3. [geometry] Use and justify area formulas for basic geometric shapes, such as triangles, quadrilaterals and circles;
4. [trigonometry] Calculate and justify simple values for trig functions, such as for 30, 45 and 60 degrees;
5. [combinations and permutations] Calculate combinations and permutations in multiple representations;
6. [binomial distribution] Analyze and interpret problems using binomial distributions, such as (possibly biased) coin flip trials;
7. [solve non-routine problems] Solve non-routine problems by finding patterns and fitting formulas to data;

Math 578 (Mathematics for Middle School Teachers IV):

1. [Exponential functions] Identify situations that involve exponential growth/decay, write appropriate equations, and solve exponential equations using logarithms.
2. [Trigonometric functions] Identify situations that can be represented by sinusoids, and write the particular equations using amplitude, period, phase shift and vertical shift.
3. [Inverse functions] Find inverses for linear, quadratic, exponential, and logarithmic functions.
4. [Meaning of and estimation of the derivative of a function] Use slope of the tangent line and average rate of change of a function to estimate the derivative of a function at a point. Interpret the meaning of the derivative in various situations.
5. [Definition of derivative] Use limits to calculate the derivative of a polynomial function.
6. [Conceptual understanding of definite integrals] Estimate definite integrals using the trapezoidal rule and Riemann sums, and interpret the meaning of the definite integral in various situations.