

Ohio's Mathematical Modeling & Reasoning Course Scope and Sequence

Updated 7/31/23

Real-World Contexts	Title of Lesson	Short Description	Math Practice Standards	Ohio Learning Standards	Remediation Free Standards	Number of 45-minute classes	Number of 90-minute classes
Theme 0: Problem Solving: Introduction to the Mathematical Practices							
	Introduction	The first few weeks concentrate on fostering a growth mindset in students and expose them to problem-solving strategies.	all				
Day 1	Collaboration – Marshmallow Challenge	Students will work with groups to complete the Marshmallow Challenge.	MP.1			1	0.5
Day 2	Collaboration	Students will have a game where they can find the most numbers in order. The class will begin establishing classroom norms surrounding collaboration.	MP.7			1	0.5
Day 3	Launching a Lesson	This task sets the routine of launching lessons using the “I notice, I wonder routine.”	MP.1			1	0.5
Day 4	Mindset – 3-Act Task	Students practice their noticing and wondering in the context of a 3-Act Task	MP.1			1	0.5
Day 5	Mathematical Mindset: Promoting Productive Struggle and Perseverance	Students will learn about and experience productive struggle and perseverance by watching the tiger video and starting Noah’s Ark task.	MP.1			1	0.5
Day 6	Mathematical Mindset - Making Mistakes	Students use the Four 4’s task to continue problem solving emphasizing equivalence and learning about factorials.	MP.7			1	0.5
Day 7	Overview of the Mathematical Practices & Number Talks	Students will learn about the importance of using different representations by doing a Dot Plot. Then students will use the jigsaw method to explore the standards of mathematical practices.	MP.1 MP.2 MP.3 MP.4 MP.5 MP.6 MP.7 MP.8			1	0.5

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Theme 0: Problem Solving: Introduction to the Mathematical Practices							
Day 8	Communication, Reasoning, and Precision	Students will use Number Talks and Fermi Problems to communicate their reasoning to other and defend their own reasoning and critique the reasoning of others.	MP.2 MP.3 MP.6			1	0.5
Day 9	Communication, Reasoning, and Precision	Students will continue constructing viable arguments using Number Talks. Students will implement Math Practices 7 and 8 using the Border Problem and then reflect on the math practices.	MP.3 MP.7 MP.8			1	0.5
Day 10	Convincing, Defending, and Proof	Students explore proof in the context of trying to convince someone of their hypothesis as a defendant and being a skeptic (prosecutor) of other's hypothesis.	MP.3			1	0.5
Day 11	Use Tools Strategically and With Precision	Students analyze all the mathematical tools available at their disposal including benefits and drawbacks.	MP.1 MP.5			1	0.5
	Reinforcement Activities					1	0.5
Total:						12	6

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Theme 1: Number and Quantity							
Context 1	Farm Co-op Swap Meet	Students explore dimensional analysis and perform single and multiple unit conversions. They construct viable arguments as to why their calculations are correct and critique the reasoning of others.	MP.1 MP.3 MP.5 MP.7	N.Q.1	MP.PS.C MP.PS.D MP.CMI.A MP.CMI.C MP.CM.I.B MP.AUTT.A NO.SNS.A NO.O.D	2	1
Context 2	Remodeling the Classroom	Students develop a cost estimate for remodeling the classroom. The remodel includes running a gas line, new carpet, and paint.	MP.1 MP.5	A.CED.1a F.BF.1 G.MG.3 S.ID.9	MP.PS.A MP.PS.D MP.AUTT.B A.G.C A.FA.E G.M.E	5	2.5
Context 3	Gear Ratios	Students are introduced to the way gears work and the relationships between sizes of gears, based on the relative number of teeth in the gears, gear ratios, and relative speeds of the bicycle wheels. Students later list gear combinations and ratios for bicycles of different speeds.	MP.1 MP.3 MP.4 MP.6 MP.7	G.MG.3	NO.O.D MP.CPC.B	2	1
Context 4	Driving for Gas	Students use the Spy, Analyze, Model routine to model the Driving for Gas problem. Intro to Spreadsheets	MP.1 MP.2 MP.3 MP.4 MP.6			2	1

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Theme 1: Number and Quantity							
Context 5	Planning a Road Trip	Students will choose a destination and plan a trip with the following requirements. Each group will be given a budget limit. Students will create a spreadsheet and a presentation.	MP.2 MP.3 MP.5 MP.6	N.Q.1 N.Q.2 N.Q.3 A.CED.1a F.BF.1	MP.PS.C MP.PS.D MP.CMI.A MP.CMI.B MP.CMI.C MP.AUTT.A MP.AUTT.B MP.AUTT.C NO.O.D	5	2.5
Context 6	Credit Cards	Students will take a dive into credit card finances by learning some important vocabulary, analyzing different ways to payoff credit cards and analyze the different types of credit cards that are available for different situations.	MP.1 MP.2 MP.3 MP.5	N.Q.1 N.Q.2 A.SSE.3 A.REI.1 A.CED.4	MP.PS.A MP.PS.B MP.PS.D MP.CMC.A MP.AUAT.A NO.SNS.A NO.O.A NO.E. A.OAO.C	5	2.5
	Reinforcement Activities					3	1.5
	Assessment					1	0.5
Total:						25	12.5

Real-World Contexts	Title of Lesson	Short Description	Math Practice Standards	Ohio Learning Standards	Remediation Free Standards	Number of 45-minute classes	Number of 90-minute classes
Theme 2: Functions – Part 1							
Context 7	Which Amusement Park?	Students will review their knowledge of different types of functions and their multiple representations through the context of choosing entrance fees to an amusement park that best fit their individual needs.	MP.1 MP.2 MP.3 MP.4 MP.5	A.REI.6 A.REI.10 F.LE.1 F.LE.3 F.LE.5	MP.PS.A MP.PS.D MP.AUTT.B MP.CMI.B MP.CMC.A A.EI.B A.EI.D A.FA.E A.OAO.C A.G.A PS.RUD.A	2	1
Context 8	Bungee Drop	Using experimental design and mathematical modeling, students will collect, organize, and analyze data to construct a bungee cord, which can provide an optimal jump from a specified height.	MP.1 MP.5	A.CED.2a F.IF.4a F.BF.1ai S.ID.6	MP.PS.D MP.CMI.C MP.AUTT.A MP.AUTT.B A.EI.D A.FA.E A.OAO.C PS.RUD.A	4	2
Context 9	Follow the Bouncing Ball	Students use experimental design and mathematical modeling to collect, organize, and analyze data and construct a model which describes the functional relationship between initial drop height and height of first bounce.	MP.1 MP.2 MP.3 MP.4 MP.5 MP.6	A.CED.2 A.CED.3 F.IF.4 F.IF.6 S.ID.6 S.ID.8 S.ID.9	MP.PS.A MP.PS.D MP.AUTT.B MP.CMI.A MP.CMI.B MP.CMC.A A.EI.D A.FA.E A.OAO.C A.G.A PS.RUD.A PS.RUD.C	5	2.5

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Theme 2: Functions – Part 1							
Context 10	One Good Bounce	Students explored linear and exponential functions. This lesson revisits the idea of modeling a bouncing ball and extends it to quadratic functions. The concepts of using the quadratic formula, vertex, and zeros are emphasized.	MP.1 MP.2 MP.3 MP.4 MP.5 MP.6	A.SSE.1 A.SSE.3 A.APR.3 A.CED.2b A.CED.2c A.REI.4b A.REI.10 F.IF.1 F.IF.4b F.IF.5b F.IF.5c F.IF.7b F.IF.7d	MP.AUT.B NO.EI.C A.G.B A.G.C A.G.F G.M.D	3	1.5
Context 11	Hopping through Optimization	Students will shade regions of a map to consider inequalities. Students will create visual descriptions of discrete combinations that describe a solution set for a real-life inequality. Finally, students write the algebraic representation of systems of linear equations.	MP.1 MP.2 MP.4 MP.5 MP.6 MP.7 MP.8	A.REI.12	MP.PS.B MP.CUMI.A MP.CMC.A MP.AUTOT.A MP.AUTOT.C A.EI.D A.G.A A.G.C	3	1.5

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Theme 2: Functions – Part 1							
Context 12	Buying a Car	<p>Part 1: Students have inherited some money that they will use to buy a car. Students are given three different scenarios and need to make a decision about which they pursue.</p> <p>Part 2: Students explore simple and compound interest using tables, functions, and graphs in the context of a savings account.</p>	MP.1 MP.2 MP.3 MP.4 MP.5	N.Q.1 N.Q.2 N.Q.3 A.CED.2re A.CED.4 F.IF.4 F.IF.7 F.LE.1 F.LE.2 F.LE.3	MP.PS.A MP.PS.C MP.PS.D MP.CMI.A MP.CMI.B MP.AUTT.B MP.CMC.A NO.O.A NO.O.C A.OAO.A A.G.A A.FA.A A.FA.E	7	3.5
	Reinforcement Activities					5	
	Assessment					1	0.5
Total						30	15

Real-World Contexts	Title of Lesson	Short Description	Math Practice Standards	Ohio Learning Standards	Remediation Free Standards	Number of 45-minute classes	Number of 90-minute classes
Theme 3: Functions – Part 2							
Context 13	Catapult Project	Students create a small catapult with craft sticks, use it to project marshmallows, then measure the distance traveled and the time the marshmallow was in the air. They then write a quadratic function describing the height of the marshmallow as a function of the time in the air.	MP.1 MP.4 MP.5 MP.7	A.CED.1 F.IF.4	MP.PS.D MP.CMC.B A.G.E A.G.F A.G.I A.G.J	5	2.5
Context 14	Modeling Cancer Cells with M&M's	The purpose of this activity is to provide a simple model to illustrate exponential growth of cancerous cells.	MP.4 MP.7	A.CED.2c F.LE.1 F.LE.2	MP.PS.D MP.MR.D A.EI.B A.FA.A A.FA.B A.FA.E	3	1.5
Context 15	Buying a House	Students see if they can afford their dream house. They start by learning about different types of mortgages and closing costs. They use a spreadsheet to analyze interest and see the need for an explicit formula. They use the formula to see if they can afford their dream house and present their findings on a poster.	MP.1 MP.2 MP.4 MP.5 MP.7	N.Q.1 N.Q.2 A.SSE.1 A.SSE.4 A.REI.1 F.IF.8 F.BF.1 F.LE.5	MP.PS.A MP.PS.C MP.PS.D MP.CMC.A MP.AUTOT.A MP.AUTOT.C NO.SNS.A NO.O.A. NO.O.B A.EI.G	4	2

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Theme 3: Functions – Part 2							
Context 16	Skid Mark Trial	Using experimental design and mathematical modeling, students will collect, organize, and analyze data to construct a Model to predict the speed of a car based upon the length of the skid marks the car left when braking. The students will then prepare an argument based on their model as to whether a driver was exceeding the speed limit or not.	MP.1 MP.2 MP.3 MP.4 MP.5 MP.6	A.CED.2 A.CED.3 S.ID.6	MP.PS.A MP.PS.D MP.AUTT.B MP.CMI.A MP.CMI.B MP.CMC.A A.EI.D A.FA.A A.FA.E	4	2
Context 17	The Big Fish Story	Students use the story of a stocked fishpond and spreadsheets to gain an understanding of linear difference equations and equilibrium for a stocked pond.	MP.1 MP.2 MP.4 MP.5 MP.6 MP.7 MP.8	N.Q.1 N.Q.2 N.Q.3 A.CED.2c A.CED.3a F.IF.3 F.IF.9 F.BF.1c F.BF.2	MP.PS.A MP.PS.D MP.AUTT.B MP.CMI.A MP.CMI.B MP.CMC.A MP.MR.D NO.SNS.A NO.O.B A.EI.D A.EI.F A.G.A A.FA.A A.FA.B	2	1
	Reinforcement Activities					4	
	Assessment					1	0.5
Total:						23	11.5

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Theme 4: Geometry							
Context 18	Logo Design (Circles)	Students will design a logo using circles and transformations to investigate symmetry and circumference and area of irregular figures.	MP.1 MP.4 MP.5 MP.7 MP.8	G.CO.2 G.CO.3 G.CO.5 G.CO.12 G.C.5	G: M: C G: GR: C G: GR: D	5	2.5
Context 19	Working with Triangles	Students are presented with two worksheets that will require the students to investigate angles and side lengths using similar triangles and the Pythagorean Theorem in the context of the problem.	MP 1 MP 2 MP 3	G.SRT.4 G.SRT.5 F.BF.1 F.IF.7	MP.PS.B MP.PS.D NO.O.D G.S.B G.S.D	2	1
Context 20	Mini-golf Design	Students will work in groups to design a miniature golf course. Each student in the class will be responsible for designing one of the holes that will be used for the course with the goal of designing a hole that is challenging as well as creative. Students will then create an instructional book describing how to use geometry to get a hole in one.	MP.1 MP.4 MP.5 MP.6	G.GMG3 G.GMD1 7.G.1a 7.G.6	MP:PS:A MP:PS:D G:S:B G:S:D G:R:B G:M:B G:M	4	2
Context 21	Unraveling the Unit Circle	Students will investigate trigonometry through investigations with the unit circle. In part one, students construct the unit circle using right triangles and paper folding. In part two, students make connections between degrees and radians using the unit circle. In part three, students use Monkey String to create the sine curve. Finally, students investigate applications of the unit circle in part four.	MP.1 MP.2 MP.3 MP.4 MP.5 MP.6 MP.7 MP.8	F.TF.2 F.TF.5 G.MG.3	A.G.C G.M.E G.M.F	4	2
	Reinforcement Activities					4	1.5
	Assessment					1	0.5
					Total:	20	10

Real-World Contexts	Title of Lesson	Short Description	Math Practice Standards	Ohio Learning Standards	Remediation Free Standards	Number of 45-minute classes	Number of 90-minute classes
Theme 5: Statistics							
Context 22	Misusing Statistics	Students will look at various graphs that are manipulated to convey a message. Then students will create their own misleading graphs.	MP.2 MP.3 MP.6	S.ID.3 S.ID.7 S.ID.8 S.ID.9 S.IC.1 S.IC.6	TBD	1	0.5
Context 23	Flinging Frogs	Students will fling toy frogs to collect data in order to gain an intuition about measures of spread using a dot plot.	MP.2 MP.4 MP.5 MP.6	S.ID.1 S.ID.2 S.ID.3 N.Q.2 N.Q.3	MP.CMC.A MP.AUTT.A MP.CMI.A MP.CMI.D PS.DDI.A PS.DDI.B	4	2
Context 24	M&M's Sampling Distributions	Use data collection to gain intuition about proportional reasoning, sampling distributions, and Central Limit Theorem. (Level B. Also see STEW)	MP.1 MP.2 MP.4 MP.5 MP.6	S.ID.1 S.IC.1 S.IC.3 S.IC.4 S.IC.6	MP.PS.D MP.AUTT.B MP.CMI.A MP.CMC.A PS.DDI.A PS.DDI.B	3	1.5
Context 25	What Does the Normal Distribution Sound Like (STEW)	Students investigate the rate of change when popping microwave popcorn. They will summarize data using histograms and approximate a normal curve for the relationship between the rate of popping and shape of distribution. The effects of human error in data collection will be discussed.	MP.1 MP.2 MP.4 MP.6 MP.7	S.ID.1 S.ID.4	TBD	3	1.5
Context 26	Colors Challenge (STEW)	Students design and perform an experiment mimicking the Stroop Effect. Five Number Summaries and box plots are used to summarize the data. (Level B)	MP.1 MP.2 MP.3 MP.4 MP.5	S.ID.1 S.ID.2 S.ID.3 S.IC.1 S.IC.5		2	1
Context 27	Are Double stuffed Oreos actually Double Stuffed?	Collect data to determine sample size, extrapolation, graphical representation of categorical data. (Level C STEW)	MP.1 MP.2 MP.3 MP.4	S.ID.1 S.ID.2 S.ID.3 S.IC.1	TBD	2	1

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Theme 5: Statistics							
			MP.5 MP.6	S.IC.5			
	Reinforcement Activities					5	2
	Assessment					1	0.5
Total						21	10.5

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Theme 6: Probability							
Context 28	Taste Test Challenge	Students will design an experiment to taste test the difference between Coke and Pepsi (or some other equivalent comparison), as well as experience an introduction to binomial probabilities.	MP.2 MP.3 MP.4	S.IC.3 S.MD.7	PS.RUD.D PS.PC.B	2	1
Context 29	Free Throws for the Win	In this three act task, students will ask and answer questions about the probability that a basketball player will make three free throws in a row to win an NCAA tournament game.	MP.1 MP.2 MP.3	S.CP.1 S.CP.4 S.CP.5	PC.B PC.C	1	0.5
Context 30	Random Babies	Students will run a simulation of a random situation, generate probability distribution graphs, and calculate probabilities. In part one of the lesson, students will use note cards to collect data and in part two an applet will be used to generate 1000 trials.	MP.1 MP.4 MP.5	S.MD.1 S.MD.3 S.MD.4 S.IC.2	PS.DDI.A PS.PC.C	2	1
Context 31	Thinking about False Positives	Students will analyze the probability of getting a false positive when being screened for cancer. They will then discuss whether cancer screenings are useful.	MP.1 MP.2 MP.4 MP.6	S.CP.3 S.CP.4 S.CP.5 S.CP.6	MP.PS.A MP.PS.D MP.CMI.A MP.CMC.A PS.DDI.A PS.PC.B	2	1
Context 32	Carnival Games	Students will use their creativity and knowledge of probability to develop games of chance for other students to play. The topics of empirical and theoretical probability are also explored as students calculate the expected value of their games.	MP.1 MP.3 MP.4	S.MD.3 S.MD.4 S.MD.5	MP.PS.B MP.PS.C MP.PS.D MP.CMC.A PS.PC.C	5	2.5
	Reinforcement Activities					4	2
	Assessment					1	0.5
					Total	17	8.5

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Theme 7: Applications of Number and Quantity and Statistics							
Context 33	Inflation and Consumer Price Index	Students will explore the consumer price index and inflation. Students will learn how to calculate past and future costs of goods and services, how inflation impacts different groups of people (e.g., savers and retirees), and how U.S. inflation rates have changed during the past 100 year.	MP.3 MP.5	A.CED.1c A.CED.2c A.CED.3a A.CED.4d	MP.PS.A MP.PS.B MP.PS.C MP.PS.D MP.CMI.D MP.CMC.A	6	3
Context 34	Public Policy	Students will explore the effects of China's one child policy on its economy and population using simulation. Students will compare population of several countries and ultimately analyze if China needed to implement the one child policy.	MP.3 MP.5	S.IC.1 S.IC.6	MP.PS.A MP.PS.B MP.CUMI.B MP.CUMI.C MP.CMC.A	4	2
	Assessment						
					Total	10	5
Theme 8: Wrap-Up							
	How do I use Math in my Future?	3 page essay about college and future career and personal reflection.				2	1
					Total	2	1
					Grand Total:	160	80