

WORCESTER PUBLIC SCHOOLS – NEW COURSE REQUEST FORM

Date of Request: 5/21/14 Requesting School/ Office: South

Proposed Course Name: Advanced Quantitative Reasoning (AQR) Required Prerequisite Course/s: Algebra II

Proposed Course Level				
(check all that apply)				
A.P.	<input type="checkbox"/>	Honors	<input checked="" type="checkbox"/>	College
			<input checked="" type="checkbox"/>	

Proposed Course Credit				
(check all that apply)				
1.0	<input checked="" type="checkbox"/>	.5	<input type="checkbox"/>	.25

G.P.A.		Honor Roll	
Yes	No	Yes	No
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Proposed Course Department	Select one	
	Core Course	Core Elective
	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Is proposed course a Career/Vocational Technical Course			
Yes	No	(if yes check one)	
		Chapter 74	Non-Chapter 74
<input type="checkbox"/>	<input checked="" type="checkbox"/>		

Proposed Course Description:

In this course students will study concepts of algebra, geometry, statistics and probability in relevant, engaging contexts, emphasizing statistical and financial applications. Students will solve real-world problems and apply concepts of Algebra to decision-making through the analysis of data, modeling change, and mathematical relationships. Coursework includes standards from the *Probability and Statistics* domain and the *Model Advanced Quantitative Reasoning* course outlined in the MA Frameworks for Mathematics, incorporating the Common Core State Standards.

Essential question/s for the course:

- How do I find out something I don't know?
- What do models of algebraic relationships tell us?
- Why do some mathematical models have limitations in real-world situations?

Standards addressed in the course:

Standards for Mathematical Practice (priorities in bold)

- MP.1** Make sense of problems and persevere in solving them.
- MP.2** Reason abstractly and quantitatively.
- MP.3 Construct viable arguments and critique the reasoning of others.
- MP.4** Model with mathematics.
- MP.5** Use appropriate tools strategically.
- MP.6 Attend to precision.
- MP.7 Look for and make use of structure.
- MP.8 Look for and express regularity in repeated reasoning.

Standards for Mathematical Content

Algebra

Arithmetic with Polynomials and Rational Expressions

A-APR

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Use polynomial identities to solve problems.

5. (+) Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of x and y for a positive integer n , where x and y are any numbers, with coefficients determined for example by Pascal's Triangle.¹

Reasoning with Equations and Inequalities

A-REI

Solve systems of equations.

8. (+) Represent a system of linear equations as a single matrix equation in a vector variable.
 9. (+) Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3×3 or greater).

Functions

Trigonometric Functions

F-TF

Extend the domain of trigonometric functions using the unit circle.

3. (+) Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$ and $\pi/6$, and use the unit circle to express the values of sine, cosine, and tangent for $\pi - x$, $\pi + x$, and $2\pi - x$ in terms of their values for x , where x is any real number.
 4. (+) Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.

Statistics and Probability

Interpreting Categorical and Quantitative Data

S-ID

Interpret linear models.

9. Distinguish between correlation and causation. ★

Making Inferences and Justifying Conclusions

S-IC

Make inferences and justify conclusions from sample surveys, experiments, and observational studies.

4. Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling. ★
 5. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. ★
 6. Evaluate reports based on data. ★

Conditional Probability and the Rules of Probability

S-CP

Use the rules of probability to compute probabilities of compound events in a uniform probability model.

8. (+) Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = P(A)P(B|A) = P(B)P(A|B)$, and interpret the answer in terms of the model. ★
 9. (+) Use permutations and combinations to compute probabilities of compound events and solve problems. ★

Using Probability to Make Decisions

S-MD

Calculate expected values and use them to solve problems.

1. (+) Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions. ★
 2. (+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution. ★
 3. (+) Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. *For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.* ★
 4. (+) Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. *For example, find a current data distribution on the number of TV sets per household in the United States, and calculate the expected number of sets per household. How many TV sets would you expect to find in 100 randomly selected households?* ★

¹ The Binomial Theorem can be proved by mathematical induction or by a combinatorial argument.

(+) indicates standard beyond College and Career Ready.

★ indicates Modeling standard.

(+) indicates standard beyond College and Career Ready.

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Use probability to evaluate outcomes of decisions.

5. (+) Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. ★
 - a. (+) Find the expected payoff for a game of chance. *For example, find the expected winnings from a state lottery ticket or a game at a fast-food restaurant.* ★
 - b. (+) Evaluate and compare strategies on the basis of expected values. *For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.* ★
6. (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator). ★
7. (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).²

MassCore is a rigorous and comprehensive course study recommended by the Commonwealth as preparation for college and career. MassCore is also the vehicle through which high school students can gain competence in computational, scientific, visual, creative, and critical thinking and can engage opportunities for “hands-on” application and exploration of new areas of knowledge and experiences.

How does this course support the readiness of students for college and career?

The Advanced Quantitative Reasoning course prepares students to use a variety of mathematical tools and approaches to model a range of situations and solve problems, which are embodied in the *Standards for Mathematical Practice*. The course also helps students develop college and career skills such as collaboration, conducting research, and making presentations.

Please Note:
 All New Course Requests
 must come through the
 school principal.

For Office Use Only	
Approved Date:	_____
S.C. Item Number:	_____
Assigned Course Number:	_____
Dept. Code:	_____
Subject Area Code Number:	_____
Subject Area Course:	_____
Zip Code Number:	_____

² Replacing the hockey goalie with an extra skater.