Fractions/Ratios/Rational Expressions Standards Jumble

For each standard below, identify the grade level where you think they appear in the 2011 Massachusetts Framework for Mathematics. No cheating! Do not look them up.
Note: These are not all the standards -- just a select few.

GRADE	STANDARD
	Recognize and generate simple equivalent fractions (e.g., $^1/_2 = ^2/_4$, $^4/_6 = ^2/_3$). Explain why the fractions are equivalent, e.g., by using a visual fraction model.
	Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.
	Solve real world and mathematical problems involving the four operations with rational numbers. *(Footnote: Computations with rational numbers extend the rules for manipulating fractions to complex fractions.)*
	Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.
	Compare two fractions with the same numerator or the same denominator, by reasoning about their size. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.
	Use proportional relationships to solve multistep ratio and percent problems. Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.
	Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. *For example, we define $5^{(1/3)}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3 \times 3)}$ to hold, so $(5^{1/3})^3$ must equal 5.*
	Understand informally that every number has a decimal expansion; the rational numbers are those with decimal expansions that terminate in 0s or eventually repeat. Know that other numbers are called irrational.
	Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.
	Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. *For example, if a person walks $^1/_2$ mile in each $^1/_4$ hour, compute the unit rate as the complex fraction $(^1/_2)/(^1/_4)$ miles per hour,*
	Explaining why multiplying a given number by a fraction greater than 1 results in a product greater than the given number (recognizing multiplication by whole numbers greater than 1 as a familiar case); explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number; and relating the principle of fraction equivalence a/b = (n×a) / (n×b) to the effect of multiplying a/b by 1.
	Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole. *For example, partition a shape into 4 parts with equal area, and describe the area of each part is 1/4 of the area of the shape.*
	Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.
	Add and subtract mixed numbers with like denominators, e.g. by replacing each mixed number with an equivalent fraction and/or by using properties of operations and the relationship between addition and subtraction.
	Interpret the product $(^a/_b) \times q$ as a parts of a partition of q into b equal parts; equivalently, as the result of a sequence of operations a × q ÷ b.

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	Explain why a fraction a/b is equivalent to a fraction (n × a)/(n × b) by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions.
	Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators. *For example, $^2/_3 + ^5/_4 = ^8/_{12} + ^{15}/_{12} = ^{23}/_{12}$. (In general, $^a/ + ^c/ = ^{(ad + bc)}/$)*
	Partition circles and rectangles into two and four equal shares, describe the shares using the words *halves, fourths,* and *quarters*, and use the phrases *half of, fourth of*, and *quarter of*. Describe the whole as two of, or four of the shares. Understand for these examples that decomposing into more equal shares creates smaller shares.
	Interpret a fraction as division of the numerator by the denominator ($^a/_b$ = a ÷ b). Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers, e.g., by using visual fraction models or equations to represent the problem.
	Explain why the sum or product of rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.
	Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., p2). For example, by truncating the decimal expansion of show that is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.
	Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. *(... division of a fraction by a fraction is not a requirement at this grade.)*
	Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. *For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.*
	Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
	Apply and extend previous understandings of multiplication to multiply a fraction by a whole number.
	Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.
	Rewrite simple rational expressions in different forms; write $^{a(x)}/_{b(x)}$ in the form *q(x) + r(x)/b(x)*, where *a(x), b(x), q(x),* and *r(x)* are polynomials with the degree of *r(x)* less than the degree of *b(x)*, using inspection, long division, or, for the more complicated examples, a computer algebra system.
	Understand a fraction 1/b as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size 1/b.
	Use decimal notation for fractions with denominators 10 or 100. *For example, rewrite 0.62 as $^{62}/_{100}$; describe a length as 0.62 meters; locate 0.62 on a number line diagram.*
	Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem.
	Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.
	Understand a fraction $^a/_b$ with a > 1 as a sum of fractions 1/b.

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SOLUTIONS

GRADE	STANDARD
3.NF.3b	Recognize and generate simple equivalent fractions (e.g., $^1/_2 = ^2/_4$, $^4/_6 = ^2/_3$). Explain why the fractions are equivalent, e.g., by using a visual fraction model.
6.RP.3	Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.
7.NS.3	Solve real world and mathematical problems involving the four operations with rational numbers. *(Footnote: Computations with rational numbers extend the rules for manipulating fractions to complex fractions.)*
7.SP.5	Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Larger numbers indicate greater likelihood. A probability near 0 indicates an unlikely event, a probability around 1/2 indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.
3.NF.3d	Compare two fractions with the same numerator or the same denominator, by reasoning about their size. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.
7.RP.3	Use proportional relationships to solve multistep ratio and percent problems. Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.
9-12.N-RN.1	Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. *For example, we define $5^{(1/3)}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3x3)}$ to hold, so $(5^{1/3})^3$ must equal 5.*
8.NS.1	Understand informally that every number has a decimal expansion; the rational numbers are those with decimal expansions that terminate in 0s or eventually repeat. Know that other numbers are called irrational.
9-12.A.APR.7 (-	Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.
7.RP.1	Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. *For example, if a person walks $^1/_2$ mile in each $^1/_4$ hour, compute the unit rate as the complex fraction $(^1/_2)/(^1/_4)$ miles per hour,*
5.NF.5b	Explaining why multiplying a given number by a fraction greater than 1 results in a product greater than the given number (recognizing multiplication by whole numbers greater than 1 as a familiar case); explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number; and relating the principle of fraction equivalence a/b = (n×a) / (n×b) to the effect of multiplying a/b by 1.
3.G.2	Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole. *For example, partition a shape into 4 parts with equal area, and describe the area of each part is 1/4 of the area of the shape.*
9-12.A.REI.2	Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.
4.NF.3c	Add and subtract mixed numbers with like denominators, e.g. by replacing each mixed number with an equivalent fraction and/or by using properties of operations and the relationship between addition and subtraction.
5.NF.4a	Interpret the product $(^a/_b) \times q$ as a parts of a partition of q into b equal parts; equivalently, as the result of a sequence of operations a × q ÷ b.

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4.NF.1	Explain why a fraction a/b is equivalent to a fraction (n × a)/(n × b) by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions.
5.NF.1	Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators. *For example,* $^{2}/_{3} + ^{5}/_{4} = ^{8}/_{12} + ^{15}/_{12} = ^{23}/_{12}$. *(In general,* $^{a}/_{b} + ^{c}/_{d} = ^{(ad + bc)}/_{bd}$*.)*
1.G.3 and 2.G.3	Partition circles and rectangles into two and four equal shares, describe the shares using the words *halves, fourths,* and *quarters*, and use the phrases *half of, fourth of*, and *quarter of*. Describe the whole as two of, or four of the shares. Understand for these examples that decomposing into more equal shares creates smaller shares.
5.NF.3	Interpret a fraction as division of the numerator by the denominator ($^{a}/_{b} = a \div b$). Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers, e.g., by using visual fraction models or equations to represent the problem.
9-12.N-RN.3	Explain why the sum or product of rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.
8.NS.2	Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., p2). For example, by truncating the decimal expansion of show that is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.
5.NF.7	Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. *(... division of a fraction by a fraction is not a requirement at this grade.)*
8.EE.5	Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. *For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.*
9-12.F.IF.7d (+)	Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
4.NF.4 and 5.NF.4	Apply and extend previous understandings of multiplication to multiply a fraction by a whole number.
6.NS.6	Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.
9-12.A.APR.6	Rewrite simple rational expressions in different forms; write $^{a(x)}/_{b(x)}$ in the form $q(x) + r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system.
3.NF.1	Understand a fraction 1/b as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size 1/b.
4.NF.6	Use decimal notation for fractions with denominators 10 or 100. *For example, rewrite 0.62 as* $^{62}/_{100}$ *; describe a length as 0.62 meters; locate 0.62 on a number line diagram.*
6.NS.1	Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem.
7.EE.1	Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.
4.NF.3	Understand a fraction $^{a}/_{b}$ with a > 1 as a sum of fractions 1/b.