6th Grade Mathematics

Dividing Fractions

Unit 4 Pacing Calendar – Illustrative Mathematics

ORANGE PUBLIC SCHOOLS

OFFICE OF CURRICULUM AND INSTRUCTION

OFFICE OF MATHEMATICS

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From the New Jersey Student Learning Standards:

In **Grade 6**, instructional time should focus on four critical areas: (1) connecting ratio and rate to whole number multiplication and division and using concepts of ratio and rate to solve problems; (2) completing understanding of division of fractions and extending the notion of number to the system of rational numbers, which includes negative numbers; (3) writing, interpreting, and using expressions and equations; and (4) developing understanding of statistical thinking.

(1) Students use reasoning about multiplication and division to solve ratio and rate problems about quantities. By viewing equivalent ratios and rates as deriving from, and extending, pairs of rows (or columns) in the multiplication table, and by analyzing simple drawings that indicate the relative size of quantities, students connect their understanding of multiplication and division with ratios and rates. Thus students expand the scope of problems for which they can use multiplication and division to solve problems, and they connect ratios and fractions. Students solve a wide variety of problems involving ratios and rates.

(2) Students use the meaning of fractions, the meanings of multiplication and division, and the relationship between multiplication and division to understand and explain why the procedures for dividing fractions make sense. Students use these operations to solve problems. Students extend their previous understandings of number and the ordering of numbers to the full system of rational numbers, which includes negative rational numbers, and in particular negative integers. They reason about the order and absolute value of rational numbers and about the location of points in all four quadrants of the coordinate plane.

(3) Students understand the use of variables in mathematical expressions. They write expressions and equations that correspond to given situations, evaluate expressions, and use expressions and formulas to solve problems. Students understand that expressions in different forms can be equivalent, and they use the properties of operations to rewrite expressions in equivalent forms. Students know that the solutions of an equation are the values of the variables that make the equation true. Students use properties of operations and the idea of maintaining the equality of both sides of an equation to solve simple one-step equations. Students construct and analyze tables, such as tables of quantities that are in equivalent ratios, and they use equations (such as $3x = y$) to describe relationships between quantities.

(4) Building on and reinforcing their understanding of number, students begin to develop their ability to think statistically. Students recognize that a data New Jersey Student Learning Standards for Mathematics 40 distribution may not have a definite center and that different ways to measure center yield different values. The median measures center in the sense that it is roughly the middle value. The mean measures center in the sense that it is the value that each data point would take on if the total of the data values were redistributed equally, and also in the sense that it is a balance point. Students recognize that a measure of variability (interquartile range or mean absolute deviation) can also be useful for summarizing data because two very different sets of data can have the same mean and median yet be distinguished by their variability. Students learn to describe and summarize numerical data sets, identifying clusters, peaks, gaps, and symmetry, considering the context in which the data were collected.

Yearlong Pacing Guide
Grade 6

Grade	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
5	Unit 1 5.NBT	Unit 2 5.NBT		Unit 3 5.NF		Unit 4 5.NF		Unit 5 5.MD	Unit 6 5.OA & 5.G	
6	**Unit 1 6.G**	**Unit 2 6.RP**	**Unit 3 6.RP**	**Unit 4 6.NS**		**Unit 5 6.NS**	**Unit 6 6.EE**	**Unit 7 6.NS**	**Unit 8 6.SP**	
7	Unit 1 7.G	Unit 2 7.RP	Unit 3 7.G	Unit 4 7.RP	Unit 5 7.NS	Unit 6 7.EE		Unit 7 7.G	Unit 8 7.SP	
8	Unit 1 8.G	Unit 2 8.G	Unit 3 8.EE	Unit 4 8.EE		Unit 5 8.F	Unit 6 8.SP	Unit 7 8.EE	Unit 8 8.G	

Unit 1	**Geometry:** Area and Surface Area	Unit 2	**Ratios & Proportional Relationships:** Introducing Ratios	Unit 3	**Ratios & Proportional Relationships:** Unit Rates & Percentages	Unit 4	**Number System:** Dividing Fractions
Unit 5	**Number System:** Arithmetic in Base Ten	Unit 6	**Expressions & Equations:** Expressions & Equations	Unit 7	**Number System:** Rational Numbers	Unit 8	**Statistics & Probability:** Data Sets and Distributions

2019-2020 Grade 6 (iM)							
Quarter 1		**Quarter 2**		**Quarter 3**		**Quarter 4**	
Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8
6.G.1(S) 6.G.4(S)	6.RP.1(M) 6.RP.3a(M)	6.RP.2(M) 6.RP.3(M) 6.RP.3b(M) 6.RP.3c(M) 6.RP.3d(M)	6.NS.1(M) 6.G.2(S)	6.NS.3(A) 6.NS.2(A)	6.EE.6(M) 6.EE.5(M) 6.EE.7(M) 6.EE.4(M) 6.EE.2(M) 6.EE.3(M) 6.EE.1(M) 6.EE.9(M)	6.NS.5(M) 6.NS.6(M) 6.NS.7(M) 6.EE.8(M) 6.NS.8(M) 6.NS.4(A) 6.G.3(S)	6.SP.1(A) 6.SP.5(A) 6.SP.4(A) 6.SP.2(A) 6.SP.3(A)
22 Days	19 Days	19 Days	20 Days	18 Days	20 Days	20 Days	21 Days
Oct. 11	Nov. 15	Dec. 19	Jan. 31	Mar. 6	Apr. 9	May 19	Jun. 19

Major Work Supporting Content Additional Content

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I. Unit Overview

Work with fractions in grade 6 draws on earlier work in operations and algebraic thinking, particularly the knowledge of multiplicative situations developed in grades 3 to 5, and making use of the relationship between multiplication and division. Multiplicative situations include three types: equal groups; comparisons of two quantities; dimensions of arrays or rectangles.

At beginning of the unit, students consider how the relative sizes of numerator and denominator affect the size of their quotient. Students first compute quotients of whole numbers, then without computing, consider the relative magnitudes of quotients that include divisors which are whole numbers, fractions, or decimals. The second section of the unit focuses on equal groups and comparison situations. It begins with partitive and quotitive situations that involve whole numbers, represented by tape diagrams and equations.

The third section concerns computing quotients of fractions. Students build on their work from the previous section by considering quotients related to products of numbers and unit fractions, e.g., “How many 3s in 12?” and “What is 1/3 of 12?,” to establish that dividing by a unit fraction 1/b is the same as multiplying by its reciprocal b. The fourth section returns to interpretations of division in situations that involve fractions. This time, the focus is on using division to find an unknown area or volume measurement.

II. Pacing Guide

Activity	New Jersey State Learning Standards (NJSLS)	Estimated Time (Blocks)
Unit 4 Pre-Unit Diagnostic Assessment *Optional*	4.NF.A.2, 5.NF.A.1, 5.NF.B.3, 5.NF.B.4, 5.NF.B.6, 5.NF.B.7, 5.MD.C.5	**1/2**
Lesson 1: Size of Divisor and Size of Quotient	5.NBT.B.6 , 6.NS.A.1	1
Lesson 2: Meanings of Division	6.NS.A.1	1
Lesson 3: Interpreting Division Situations	6.NS.A.1	1
Lesson 4: How Many Groups (Part 1)	6.NS.A.1	1
Lesson 5: How Many Groups (Part 2)	6.NS.A.1	1
Lesson 6: Using Diagrams to Find the Number of Groups	6.NS.A.1	1
Lesson 7: What Fraction of a Group?	6.NS.A.1	1
Lesson 8: How Much in Each Group (Part 1)	6.NS.A.1	1
Lesson 9: How Much in Each Group (Part 2)	6.NS.A.1	1
Unit 4 Mid-Unit Assessment *Optional*	6.NS.A.1	1
Lesson 10: Dividing by Unit and Non-Unit Fractions	6.NS.A.1	1
Lesson 11: Using an Algorithm to Divide Fractions	6.NS.A.1	1
Lesson 12: Fractional Lengths	6.NS.A.1	1
Lesson 13: Rectangles with Fractional Side Lengths	6.NS.A.1	1
Lesson 14: Fractional Lengths in Triangles and Prisms	6.NS.A.1; 6.G.A.1; 6.G.A.2	1
Lesson 15: Solving Problems Involving Fractions	6.G.A.2	1
Lesson 16: Solving Problems Involving Fractions	6.NS.A.1	1
Lesson 17: Fitting Boxes into Boxes	6.NS.A.1; 6.G.A.2	1
Unit 4 End-Unit Assessment *Optional*	6.NS.A.1; 6.G.A.2	**1**
Performance Task 4		**1 /2**
Total Time		**20 Blocks**

Major Work Supporting Content Additional Content

III. Pacing Calendar

Please complete the pacing calendar based on the suggested pacing (*see Pacing Guide on page 1)*.

JANUARY

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

Please complete the pacing calendar based on the suggested pacing (*see Pacing Guide on page 1)*.

FEBRUARY

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29

IV. PARCC Assessment Evidence Statements

Type I Type II Type III

NJSLS	Evidence Statement	Clarification	Math Practices	Calculator ?
6.NS.1-2	Solve word problems involving division of fractions by fractions, For example, “How much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 3/4-cup servings are in 2/3 of a cup of yogurt? How wide is a rectangular strip of land with length 3/4 mi and area 1/2 square mi?”	i) Only the answer is required. For the explanations and representations aspect of 6.NS.1-2, see 6.C.2 and 6.C.3. ii) Note that the italicized examples correspond to three meanings/uses of division: (1) equal sharing; (2) measurement; (3) unknown factor These meanings/uses of division should be sampled equally. iii) Tasks may involve fractions and mixed numbers but not decimals.	MP.4	No
6.G.1	Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques	-	MP.1 MP.2 MP.5 MP.7	Yes
6.G.2-1	Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths, and show that the volume is the same as would be found by multiplying the edge lengths of the prism.	i) Tasks do not have a context. ii) Tasks require focusing on the connection between packing the solid figure and computing the volume.	MP.2	No

6.G.2-2	Apply the formulas V = l w h and V = B h to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.	i) Tasks focus on using the formulas in problem-solving contexts.	MP.1 MP.4 MP.5	Yes
6.C.2	Base explanations/reasoning on the relationship between addition and subtraction or the relationship between multiplication and division. Content Scope: Knowledge and skills articulated in 6.NS.1	-	MP.2 MP.3 MP.4 MP.6	Yes
6.C.3	Base arithmetic explanations/reasoning on concrete referents such as diagrams (whether provided in the prompt or constructed by the student in her response), connecting the diagrams to a written (symbolic) method. Content Scope: Knowledge and skills articulated in 6.NS.1	-	MP.2 MP.3 MP.4 MP.6	Yes
6.D.1	Solve multi-step contextual word problems with degree of difficulty appropriate to Grade 6, requiring application of knowledge and skills articulated in Type I, Sub-Claim A Evidence Statements.	i) Tasks may have scaffolding, if necessary, in order yield a degree of difficulty appropriate to Grade 6.	MP.1 MP.2 MP.4 MP.5 MP.7	Yes

V. Differentiated Instruction

Supporting English Language Learners

There are four design principles for promoting mathematical language use and development in curriculum and instruction. The design principles and related routines work to make language development an integral part of planning and delivering instruction while guiding teachers to amplify the most important language that students are expected to bring to bear on the central mathematical ideas of each unit.

The design principles are:
- Design Principle 1: Support sense-making
- Design Principle 2: Optimize output
- Design Principle 3: Cultivate conversation
- Design Principle 4: Maximize linguistic and cognitive meta-awareness

These four principles are intended as guides for curriculum development and planning and execution of instruction, including the structure and organization of interactive opportunities for students, and the observation, analysis, and reflection on student language and learning. The design principles motivate the use of mathematical language routines (MLRs).

These eight routines are:
- MLR1: Stronger and Clearer Each Time
- MLR2: Collect and Display
- MLR3: Critique, Correct, and Clarify
- MLR4: Information Gap
- MLR5: Co-Craft Questions and Problems
- MLR6: Three Reads
- MLR7: Compare and Connect
- MLR8: Discussion Support

Supporting Students with Disabilities

Lessons are designed to maximize access for all students, and include additional suggested supports to meet the varying needs of individual students. While the suggested supports are designed for students with disabilities, they are also appropriate for many children who struggle to access rigorous, grade-level content. Teachers should use their professional judgment about which supports to use and when, based on their knowledge of the individual needs of students in their classroom.

The inclusion of additional supports for students with disabilities offers additional strategies for teachers to meet the individual needs of a diverse group of learners. Lesson and activity-level supports for students with disabilities are aligned to an area of cognitive functioning and are paired with a suggested strategy aimed to increase access and eliminate barriers. These lesson specific supports help students succeed with a specific activity without reducing the mathematical demand of the task. All of the supports can be used discreetly and are designed to be used as needed.

Suggestions for supports fall under the following categories:

Eliminate Barriers
Processing Time
Peer Tutors
Assistive Technology
Visual Aids
Graphic Organizers
Brain Breaks

For a more descriptive account of these supports, reference the following:

https://im.openupresources.org/6/teachers/teacher_course_guide.html - supporting-students-with-disabilities

VI. Assessment Framework

Unit 4 Assessment Framework				
Assessment	**NJSLS**	**Estimated Time**	**Format**	**Graded ?**
Pre-Unit Diagnostic Assessment (Beginning of Unit – Optional) *Illustrative Mathematics*	4.NF.A.2, 5.NF.A.1, 5.NF.B.3, 5.NF.B.4, 5.NF.B.6, 5.NF.B.7, 5.MD.C.5	½ Block	Individual	Yes (No Weight)
Mid-Unit Assessment (Middle of Unit – Optional) *Illustrative Mathematics*	6.NS.A.1	½ Block	Individual	Yes (No Weight)
End-of-Unit Assessment (End of Unit – Optional) *Illustrative Mathematics*	6.NS.A.1; 6.G.A.2	1 Block	Individual	Yes

Unit 4 Performance Assessment Framework				
Assessment	**NJSLS**	**Estimated Time**	**Format**	**Graded ?**
Unit 4 Performance Task 1 (Late January) Dan's Division Strategy	6.NS.A.1	½ Block	Individual w/ Interview Opportunity	Yes; Rubric
Unit 4 Performance Task Option 1 (Optional) *Video Game Credits*	6.NS.A.1	Teacher Discretion	Teacher Discretion	Yes, if administered

Name _____ Block _____ Date _____

Dan's Division Strategy? (6.NS.A.1)

Dan observes that

$$6/10 \div 2/10 = 6 \div 2$$

He says,

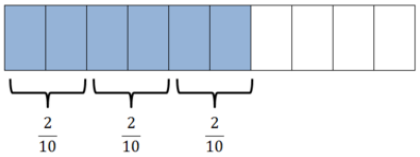
> *I think that if we are dividing a fraction by a fraction with the same denominator, then we can just divide the numerators.*

Is Dan's conjecture true for all fractions? Explain how you know.

Unit 4 Performance Task 1 PLD Rubric

SOLUTION

Yes, Dan's rule is correct for all fractions. Student shows work to explain their answer.



Possible Solution:

There are 6 tenths shaded, and we want to know how many groups of 2 tenths we can make; there are 3 such groups. We can see that there is nothing special about the fact that the small rectangles represent tenths; the same reasoning would work for any denominator.

Level 5: Distinguished Command	**Level 4: Strong Command**	**Level 3: Moderate Command**	**Level 2: Partial Command**	**Level 1: No Command**
Clearly constructs and communicates a complete response based on concrete referents provided in the prompt or constructed by the student such as diagrams that are connected to a written (symbolic) method, number line diagrams or coordinate plane diagrams, including: • a logical approach based on a conjecture and/or stated assumptions • a logical and complete progression of steps • complete justification of a conclusion with minor computational error	Clearly constructs and communicates a complete response based on concrete referents provided in the prompt or constructed by the student such as diagrams that are connected to a written (symbolic) method, number line diagrams or coordinate plane diagrams, including: • a logical approach based on a conjecture and/or stated assumptions • a logical and complete progression of steps • complete justification of a conclusion with minor conceptual error	Clearly constructs and communicates a complete response based on concrete referents provided in the prompt or constructed by the student such as diagrams that are connected to a written (symbolic) method, number line diagrams or coordinate plane diagrams, including: • a logical, but incomplete, progression of steps • minor calculation errors • partial justification of a conclusion • a logical, but incomplete, progression of steps	Constructs and communicates an incomplete response based on concrete referents provided in the prompt such as: diagrams, number line diagrams or coordinate plane diagrams, which may include: • a faulty approach based on a conjecture and/or stated assumptions • An illogical and Incomplete progression of steps • majr calculation errors • partial justification of a conclusion	No parts are correct. The student shows no work or justification.

Name _____ Block _____ Date _____

Video Game Credits (6.NS.A.1)

Task

It requires 1/4 of a credit to play a video game for one minute.

a. Emma has 7/8 credits. Can she play for more or less than one minute? Explain how you know.

b. How long can Emma play the video game with her 7/8 credits?

VIII. 21st Century Career Ready Practices

CRP1. Act as a responsible and contributing citizen and employee.
CRP2. Apply appropriate academic and technical skills.
CRP3. Attend to personal health and financial well-being.
CRP4. Communicate clearly and effectively and with reason.
CRP5. Consider the environmental, social and economic impacts of decisions.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP9. Model integrity, ethical leadership and effective management.
CRP10. Plan education and career paths aligned to personal goals.
CRP11. Use technology to enhance productivity.
CRP12. Work productively in teams while using cultural global competence.

For additional details see **21st Century Career Ready Practices** .

References

"Illustrative Mathematics" *Open Up Resources.* 2018

<https://auth.openupresources.org/register/complete>