Asking Questions to Build Understanding About Decimals

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Game plan

- We will do some mathematical tasks and consider how to support students thinking through the discussions of tasks

Going on the premise:

Worthwhile Tasks + Discussion increases potential for learning

Mentally evaluate each expression…

$$\frac{25}{100}+\frac{5}{10}+\frac{75}{100}$$

$$4\frac{13}{100}+7\frac{7}{10}-3\frac{13}{100}$$

$$6\frac{9}{10}+\frac{25}{100}+1\frac{75}{100}$$

$$7\frac{15}{100}-\frac{15}{100}+\frac{1}{10}$$

Mentally evaluate each expression…

- For these tasks what "strategies" did you use to help you?
- What foundational skills would students need to be successful with these mental calculations?

Mentally evaluate each expression…

- 0.25 + 0.5 + 0.75 =
- 6.9 + 0.25 + 1.75 =
- 4.13 + 7.7 – 3.13 =
- 7.15 – .15 + 0.1 =

- For these tasks what "strategies" did you use to help you?
- What foundational skills would students need to be successful with these mental calculations?

What is the difference between these in terms of difficulty?

- 0.25 + 0.5 + 0.75 = $\frac{25}{100}+\frac{5}{10}+\frac{75}{100}$
- 6.9 + 0.25 + 1.75 = $6\frac{9}{10}+\frac{25}{100}+1\frac{75}{100}$
- 4.13 + 7.57 – 3.13 = $4\frac{13}{100}+7\frac{7}{10}-3\frac{13}{100}$
- 7.15 – 0.1 – 0.05 = $7\frac{15}{100}-\frac{1}{10}-\frac{5}{100}$

Please order from easiest to hardest

Round Decimals

Compare two decimals to the thousandths place

Compare two decimals to the hundredths place

Adding and subtracting fractions with like denominators

Multiply decimals

Convert a fraction to a decimal by dividing (e.g., 3/5 = 0.60

Use decimal notation for fractions with denominators 10 and 100

Subtract decimals

Grade 4

Use decimal notation for fractions with denominators 10 and 100

Compare two decimals to the hundredths place

Adding and subtracting fractions with like denominators

Grade 5

Compare two decimals to the thousandths place

Round Decimals

Subtract decimals

Multiply decimals

Convert a fraction to a decimal by dividing?

Grade 4

Use decimal notation for fractions with denominators 10 and 100

Compare two decimals to the hundredths place

Adding and subtracting fractions with like denominators

Grade 5

Compare two decimals to the thousandths place

Round Decimals

Subtract decimals

Multiply decimals

How could this influence:
The order that I teach concepts?
The mathematical connections that I can have in class?

Number Talks vs. Discussions

- Number Talks are the "Taylor Swift of math"
  Very very popular!
  - "Number talks were developed for classroom teachers to engage students in "mental math" through grappling with interesting mathematics problems." (Inside Mathematics)
  - Mental math tasks, lots of reasoning and thinking about numbers
  - Typically done whole class but….
    - Small group number talks may engage some students more
  - Accountability tends to vary
    - Recording work, strategies, reflecting on what students learn

Mentally evaluate each expression…

0.25 + 0.5 + 0.75

"I know that 0.25 plus 0.75 = 1.
Then I can add 1 more to 5.5 to get 6.5."

"I stacked them. There were 2 5's in the hundredths place so I put a 0 and carried the 1. In the tenths place I added 2, 5, 7, and 1 and got 15. I put a 4 and carried a 1. I got 1.50."

What follow-up questions could you pose for each student?

Math Discussions

- More broad view than Number Talks
- Anytime, yes anytime….
  - Students are sharing or discussing strategies or concepts
- Research tidbits…
  - Teachers say that math discussions are important
  - Teachers leave out discussions or trim their time greatly
  - Teachers tend to resort to "telling" instead of facilitating a discussion

Mathematical Discussions

- **S**hare strategies
- **C**ompare strategies
- **R**eason about the mathematics
- **A**sk questions about concepts
- **P**ose another task

What is my decimal?

- I am thinking of a number with digits to the thousandths place that can be rounded to…
  - 1
  - 1.3
  - 1.27

If my number has a number other than 0 in the thousandths place what could my number be? Write an explanation about how you know you are correct.

Debriefing *What is My Decimal*

- How did you think about this task?
- What math concepts are students working on?

Mathematical Discussions

- **S**hare strategies
  - What possible strategies would we expect?
- **C**ompare strategies
  - What would this look like?
- **R**eflect on and discuss the mathematics
  - What math concepts do we want students to reflect on?
- **A**sk questions about concepts
  - What questions can I ask about the concepts?
- **P**ose another task
  - What is a follow up task that I can give?

Mathematical Discussions

- **S**hare strategies
  - Discussing how students round, number line, decimal grid
- **C**ompare strategies
  - What would this look like?
- **R**eflect and discuss the mathematics
  - What math concepts do we want students to reflect?
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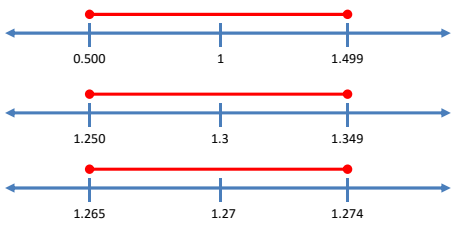
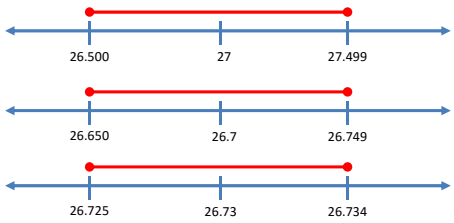


What is my decimal?

- I am thinking of a number with digits to the thousandths place that can be rounded to…
  - 27
  - 26.7
  - 26.73

If my number has a number other than 0 in the thousandths place what could my number be? Use a number line to prove your answer.



Task work vs. Discussion Time

- As students are talking with classmates what would we expect them to be talking about?
- In a whole class discussion what questions should I ask related to these tasks?

Task work vs. discussion

Task work

- Brainstorming strategies
- Discussing calculations
- Checking reasonableness of answers

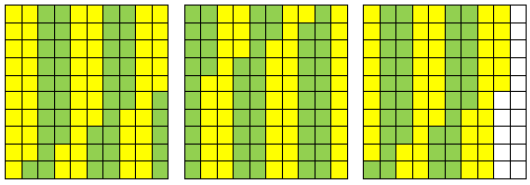
Whole class discussion

- Sharing a variety of strategies in a timely manner
- Comparing strategies
- Digging deeper at the mathematical concepts

Let's look at multiplication

Black beans are on sale for $0.19 per can. How much would 15 cans cost? Solve the task using your decimals grids and one other strategy.

One strategy for 0.19 x 15



2 full grids are shaded. In the third grid 85 out of 100 are shaded. That is 2.85.

What was the strategy?
Questions we would ask?

20 x 15 = 300

19 x 15 = 300 – 15 = 285

0.19 x 15 = 2.85

0.19 x 10 = 1.90
0.19 x 11 = 2.09
0.19 x 12 = 2.28
0.19 x 13 = 2.47
0.19 x 14 = 2.66
0.19 x 15 = 2.85

4
.19
X 15
95
+19
114

"Then you need to move the decimal two spots."
1.14

	0.10	0.09	
10	0.10 x 10 = 1	0.09 x 10 = 0.9	1 0.9
5	0.10 x 5 = 0.5	0.09 x 5 = 0.45	0.5 +0.45
			2.85

Mathematical Discussions

- **S**hare strategies
  - What possible strategies would we expect?
- **C**ompare strategies
  - What would this look like?
- **R**eflect and discuss the mathematics
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Multiplication

- What concepts should we talk about when we unpack the mathematics?

Multiplication

- Strategies?
- Numbers in the task

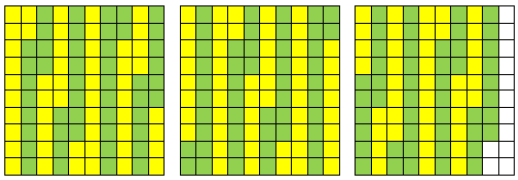
  0.19 x 15

  1.90 x 15

Let's look at division

- The package of turkey weighs 2.88 kilograms. If the turkey is divided into equal portions of 0.12 kilograms each how many portions are made? Solve using decimal grids and one other strategy.

2.88 divided by 0.12



I started with 2.88 and divided it into sections that were 0.12 each. There are 24 sections.

What was the strategy?
Questions we would ask?

2.88 divided by 0.12

2.88 ÷ 0.12
0.12 x 10 = 1.20
0.12 x 20 = 2.40
0.12 x 21 = 2.52
0.12 x 22 = 2.64
0.12 x 23 = 2.76
0.12 x 24 = 2.88

2.88 ÷ 0.12 = 24

2.88 ÷ 0.12
288 ÷ 12

12 | 2 8 8
-2 4 0 12 x 20= 240
4 8
- 4 8 12 x 4 = 48
0

20 + 4 = 24

What about powers of ten?

- In your pocket you have 8 bills that are the same value. What if the value of the bills were…

Number of Bills	Value of Each Bill	Total Value	Expression with an Exponent
8	$10	$80	8×10^1
8	$100		
8	$1,000		
8	$10,000		
8	$100,000		

Mathematical Discussions

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Between the Stars

- There are five stars that are seen in a straight line through a telescope. The stars are the following distance from the sun:
  - Star A 3.2×10^2 km from the sun
  - Star B 10^3 km further from the sun than Star A
  - Star C 10^4 km closer to the sun than Star B
  - Star D 10^1 km further from the sun than Star B
  - Star E 10^2 km farther to the sun than Star B
- Based on the measurements listed above find the actual distance from the sun of each star. Make sure you write an equation and show your work.

Between the Stars

Star C: It's 10^4 km closer to the sun than Star B
Star A is 3.2×10^2
Star B is 10^3 farther: $3.2 \times 10^2 \times 10^3 =$
$3.2 \times 10 \times 10 \times 10 \times 10 \times 10 = 320{,}000 = 3.2 \times 10^5$

Star C is 10^4 closer: $3.2 \times 10^2 \times 10^3 \div 10^4$
$3.2 \times 10 \times 10 \times 10 \times 10 \times 10 \div 10 \div 10 \div 10 \div 10$
$3.2 \times 100{,}000 \div 10{,}000 = 3.2 \times 10 = 32$

When students work on this what do we expect them to talk about?

Mathematical Discussions

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  - What possible strategies would we expect?
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Organizing your classroom

Multiple options… potentially overwhelming

Engage: Engaging, Ten minute math Activity (10 minutes)

Explore: Exploration of a task

Explain: Explanation and discussion of strategies and mathematics

Elaboration: Follow-up activity, targeted differentiation, small groups, math games

Take aways….

- How rich can discussions be if we pose low-level tasks to our students?
- If students struggle with high-level, rigorous tasks we need strategies to support them without doing it for them.
- Questions should elicit discussion and mathematical connections, not just answers.

Continue your learning…

- State-wide math add-on license
  - UNC Charlotte, 100% online with not online meetings
  - NC State, face-to-face cohorts
  - UNC/ECU/UNC-W- 100% online with some online meetings
- NCCTM- Greensboro in early November
- NCTM
  - Writers for Teaching Children Mathematics and the TCM blog- http://nctm.org/tcm-blog/
  - Reviewers for articles
- Drew.Polly@uncc.edu

Math Games

- Number Cards