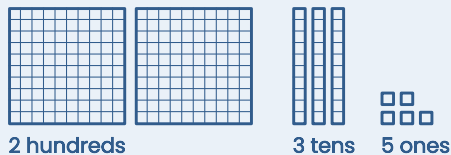


Place Value Detectives: Case Files

6 complete activities from Place Value Detectives, each with a worked answer.



HOW TO USE

1. Read the situation and the evidence first.
2. Show your thinking in the work boxes, not only an answer.
3. Explain how you know your answer makes sense.
4. Try the new problem at the bottom of the page.

6 activities • 3 answer pages • From the 36-activity collection

10 US Letter pages • Print at 100% / Actual Size

Original Bobotemp educational printable • Fictional names, places and prices

Name _____ Date _____

LEVEL 1



Use a place-value chart as your evidence. Write the value of each digit before you compare.

Detective Rivera found the case number 7,770 on a file folder. Three of its digits look the same, but they are not worth the same amount. Compare the 7 in the thousands place with the 7 in the hundreds place. How many times as great is the thousands-place 7? Then describe how the tens-place 7 compares with the hundreds-place 7.

CASE NUMBER 7,770

thousands	hundreds	tens	ones
7	7	7	0

EVIDENCE TO USE

- Case number: 7,770
- Chart columns: thousands | hundreds | tens | ones
- Each place is worth 10 times the place to its right.

1. Write the value of each 7 in 7,770.

[illegible]

2. Divide to compare the thousands-place 7 with the hundreds-place 7.

A blank sheet of graph paper with a grid of squares. The grid consists of 10 columns and 8 rows of squares. The entire grid is enclosed within a rounded rectangular border.

3. Complete: 70 is ___ of 700.

TRY IT • In 5,505, how does the 5 in the thousands place compare with the 5 in the hundreds place? How does it compare with the 5 in the ones place?

Name _____ Date _____

LEVEL 1



Find the value of each card by converting every unit to ones. Show your addition.

Four suspect cards claim to show 3,506 in unbundled form. Three cards are honest and one is an impostor. Card A: 35 hundreds + 6 ones. Card B: 350 tens + 6 ones. Card C: 3 thousands + 50 tens + 6 ones. Card D: 3 thousands + 5 tens + 6 ones. Find the value of each card and identify the impostor.

35 hundreds + 6 ones

350 tens + 6 ones

- Target number: 3,506
- 1 hundred = 10 tens
- 1 thousand = 10 hundreds = 100 tens
- Exactly one card does not equal 3,506.

3 thousands + 50 tens + 6 ones

3 thousands + 5 tens + 6 ones

1. Rewrite each card using values in ones, such as 35 hundreds = 3,500.



2. Add to find each card's total.

A blank sheet of graph paper with a grid pattern. The grid consists of 10 columns and 8 rows of squares. The paper has rounded corners and a light gray border.

3. Name the impostor and write its real value.

TRY IT • Write 4,207 in two different unbundled ways: once using hundreds and ones, and once using tens and ones.

Name _____ Date _____

LEVEL 2 ●●○

Extend the place-value chart to thousandths. Convert values to a common unit before you divide.

The code 3.333 appears on an evidence tag. Compare each 3 with the 3 just to its right. Then compare the 3 in the tenths place with the 3 in the thousandths place. How many times as great is the tenths-place 3? Finally, how does the ones-place 3 compare with the thousandths-place 3?

CODE 3.333

ones	tenths	hundredths	thousandths
3	3	3	3

EVIDENCE TO USE

- Code: 3.333
- Chart: ones | tenths | hundredths | thousandths
- $0.1 = 100$ thousandths

1. Write the value of each 3 as a decimal.

2. Write the tenths-place 3 and the thousandths-place 3 in thousandths and divide.

A blank sheet of graph paper with a grid pattern. The grid consists of 10 columns and 8 rows of squares. The paper has rounded corners and a light gray border.

3. Describe the ones-place 3 compared with the thousandths-place 3.

TRY IT • In 0.555, what fraction of the tenths-place 5 is the thousandths-place 5?

Name _____ Date _____

Decimal Rounding Interval Cards

LEVEL 2 ●●○

Rounding rule: round-half-up. For each test, draw a number line with both benchmarks and the midpoint.

Five interval cards are on the evidence table: 7.248, 7.256, 7.263, 7.268, and 7.341. Exactly one card matches all three clues. Clue 1: It rounds to 7.3 to the nearest tenth. Clue 2: It rounds to 7.26 to the nearest hundredth. Clue 3: Its thousandths digit is odd. Test every card and name the match.

INTERVAL CARDS

Candidate	Clue 1	Clue 2	Clue 3
7.248			
7.256			
7.263			
7.268			
7.341			

EVIDENCE TO USE

- Cards: 7.248 | 7.256 | 7.263 | 7.268 | 7.341
- Clue 1: rounds to 7.3 (nearest tenth)
- Clue 2: rounds to 7.26 (nearest hundredth)
- Clue 3: thousandths digit is odd

1. For Clue 1, label the benchmarks and midpoints near 7.3 and list the survivors.

2. For Clue 2, use the midpoints 7.255 and 7.265 and list the survivors.

3. Apply Clue 3 and name the one card left.

TRY IT • Round 4.951 to the nearest tenth and to the nearest hundredth. Show the midpoint you used each time.

Name _____ Date _____

LEVEL 3



Rounding rule: round-half-up. Find the full range for each clue, then find where the ranges overlap. List both endpoints.

Two witnesses describe the same secret whole number. Witness 1: 'Rounded to the nearest thousand, it is 4,000.' Witness 2: 'Rounded to the nearest hundred, it is 3,500.' Find the smallest and largest whole numbers that fit both witnesses, and find how many whole numbers are possible. Justify each endpoint with a midpoint.

EVIDENCE TO USE

- Witness 1: nearest thousand = 4,000
- Witness 2: nearest hundred = 3,500
- Rule: round-half-up

1. Write the full range of whole numbers for Witness 1, using midpoints.

A large rectangular grid consisting of 20 columns and 6 rows of squares, intended for drawing.

2. Write the full range of whole numbers for Witness 2.

A blank sheet of graph paper with a grid pattern. The grid consists of 10 columns and 8 rows of squares. The paper has rounded corners and a light gray border.

3. Find the overlap, both endpoints, and the count.

TRY IT • A whole number rounds to 2,000 to the nearest thousand and to 2,500 to the nearest hundred. Find the range.

Name _____ Date _____

LEVEL 3



Rounding rule: round-half-up. Draw number lines with both benchmarks and midpoints, and list both endpoints of every range.

Part 1: List every two-place decimal that rounds to 5.7 to the nearest tenth. Give the smallest, the largest, and the count. Part 2: A secret three-place decimal rounds to 5.7 to the nearest tenth AND to 5.65 to the nearest hundredth. List every possible value and tell how many there are. Explain why 5.649 is not on your list.

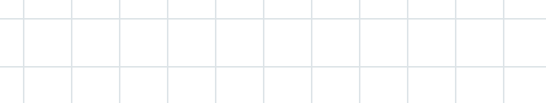
EVIDENCE TO USE

- Part 1: two places, nearest tenth = 5.7
- Part 2: three places, nearest tenth = 5.7 and nearest hundredth = 5.65
- Rule: round-half-up

1. Find the midpoints around 5.7 and list the Part 1 decimals.

[illegible]

2. Find the range for nearest hundredth 5.65 and overlap it with the Part 1 range.

A large rectangular area filled with a light gray grid, intended for drawing a picture. The grid consists of 10 columns and 10 rows of squares.

3. List the Part 2 decimals and explain why 5.649 fails.

A blank sheet of white paper with horizontal blue ruling lines, resembling notebook paper. The lines are evenly spaced and run across the width of the page. There is no handwriting or other markings on the paper.

TRY IT • List the smallest and largest two-place decimals that round to 3.0 to the nearest tenth.

1. Ten-Times Trail: The Triple Sevens

LEVEL 1

The thousands-place 7 is worth 7,000, and the hundreds-place 7 is worth 700. Because $7,000 \div 700 = 10$, the thousands-place 7 is 10 times the hundreds-place 7. The tens-place 7 is worth 70, which is $1/10$ of 700.

WORKED REASONING • Chart: 7 thousands, 7 hundreds, 7 tens, 0 ones. The values are 7,000, 700, and 70. Since $7,000 \div 700 = 10$, the 7 in the thousands place is 10 times the 7 in the hundreds place. Inverse check: $700 \times 10 = 7,000$. Moving one place to the right makes each value $1/10$ as great: $700 \div 10 = 70$. The 0 in the ones place holds that place, so each 7 keeps its value.

WATCH FOR • Some students say all three 7s are equal because the digit is the same. A digit's value depends on its place. The same digit one place to the left is worth 10 times as much.

TRANSFER • 5,000 is 10 times 500. 5,000 is also 1,000 times 5, the ones-place 5.

2. Regroup Lineup: Find the Impostor Card

LEVEL 1

Card D is the impostor. $3 \text{ thousands} + 5 \text{ tens} + 6 \text{ ones} = 3,000 + 50 + 6 = 3,056$, not 3,506. Cards A, B, and C each equal 3,506.

WORKED REASONING • Card A: 35 hundreds = 3,500, and $3,500 + 6 = 3,506$. Card B: 350 tens = 3,500, and $3,500 + 6 = 3,506$. Card C: 3 thousands = 3,000 and 50 tens = 500, so $3,000 + 500 + 6 = 3,506$. Card D: $3,000 + 50 + 6 = 3,056$. On a chart, Card D has 0 hundreds and 5 tens, but 3,506 has 5 hundreds and 0 tens.

WATCH FOR • Some students match cards by looking for the digits 3, 5, and 6 without checking the units. In Card D, the 5 counts tens, not hundreds, so the 5 sits in the wrong place.

TRANSFER • 42 hundreds + 7 ones, and 420 tens + 7 ones. Both equal 4,207.

13. Tenth-Times Trail: Four Threes

LEVEL 2

The tenths-place 3 (0.3) is 100 times the thousandths-place 3 (0.003), because $300 \text{ thousandths} \div 3 \text{ thousandths} = 100$. Each 3 is 10 times the 3 to its right. The ones-place 3 is 1,000 times the thousandths-place 3.

WORKED REASONING • The values are 3, 0.3, 0.03, and 0.003. Each step to the right is $1/10$ as great: $3 \div 10 = 0.3$, $0.3 \div 10 = 0.03$, and $0.03 \div 10 = 0.003$. In thousandths, $0.3 = 300 \text{ thousandths}$ and $0.003 = 3 \text{ thousandths}$, so $300 \text{ thousandths} \div 3 \text{ thousandths} = 100$, which is two 10-times steps ($10 \times 10 = 100$). The ones-place $3 = 3,000 \text{ thousandths}$, and $3,000 \text{ thousandths} \div 3 \text{ thousandths} = 1,000$. Check: $0.003 \times 100 = 0.3$.

WATCH FOR • Some students think the 10-times pattern stops at the decimal point. Others think values grow to the right because 'thousandths' sounds bigger than 'tenths.' Places to the right of the point keep getting $1/10$ as large.

TRANSFER • $1/100$. 0.005 is $1/100$ of 0.5, because $5 \text{ thousandths} \times 100 = 500 \text{ thousandths} = 0.5$.

14. Decimal Rounding Interval Cards

LEVEL 2

The matching card is 7.263.

WORKED REASONING • Clue 1: 7.3 to the nearest tenth needs a number from the midpoint 7.25 up to, but not including, the midpoint 7.35. $7.248 < 7.25$, so it rounds to 7.2 and is out. 7.256, 7.263, 7.268, and 7.341 survive. Clue 2: 7.26 to the nearest hundredth needs a number from the midpoint 7.255 up to, but not including, the midpoint 7.265. 7.256 and 7.263 survive. 7.268 rounds to 7.27, and 7.341 rounds to 7.34. Clue 3: odd thousandths digits are 7.263 (3) and 7.341 (1). Only 7.263 survives all three clues.

WATCH FOR • Some students round from the last digit in steps, such as $7.248 \rightarrow 7.25 \rightarrow 7.3$. Rounding to the nearest tenth compares the entire number with one midpoint, 7.25. Since 7.248 is below 7.25, it rounds to 7.2.

TRANSFER • To the nearest tenth: 5.0, because $4.951 > 4.95$. To the nearest hundredth: 4.95, because $4.951 < 4.955$.

25. Rounding Range Reverse: Two Witnesses

LEVEL 3

The smallest possible number is 3,500 and the largest is 3,549. There are 50 possible whole numbers, because $3,550 - 3,500 = 50$.

WORKED REASONING • Witness 1: the midpoints around 4,000 are 3,500 and 4,500. With half-up rounding, 3,500 rounds up to 4,000 and 4,500 rounds up to 5,000. So the range is 3,500 through 4,499. Witness 2: the midpoints around 3,500 are 3,450 and 3,550, so the range is 3,450 through 3,549. Overlap: 3,500 through 3,549. Count: $3,550 - 3,500 = 50$. Endpoint check: 3,549 rounds to 3,500 (below 3,550) and to 4,000 (below 4,500). 3,499 fails Witness 1 because it rounds to 3,000.

WATCH FOR • Some students give only one number, or use only the stricter clue, such as 3,450 through 3,549. Both ranges must hold at the same time, so 3,450 through 3,499 fails Witness 1.

TRANSFER • 2,450 through 2,499 (50 numbers). The nearest-thousand range is 1,500 through 2,499, and the nearest-hundred range is 2,450 through 2,549.

26. Decimal Rounding Reverse: Narrowing the Interval

LEVEL 3

Part 1: 5.65 through 5.74 (10 decimals). Part 2: 5.650, 5.651, 5.652, 5.653, and 5.654, which is 5 decimals (5,650 thousandths up to, but not including, 5,655 thousandths: $5,655 - 5,650 = 5$ values).

WORKED REASONING • Part 1: the adjacent benchmark pairs are 5.6 and 5.7, and 5.7 and 5.8, with midpoints 5.65 and 5.75. With half-up rounding, 5.65 rounds up to 5.7, and 5.75 rounds up to 5.8. That gives 5.65, 5.66, ..., 5.74, which is 10 decimals. Part 2: nearest hundredth 5.65 needs 5.645 through 5.654 (midpoints 5.645 and 5.655). Nearest tenth 5.7 needs 5.650 through 5.749. The overlap is 5.650 through 5.654. In thousandths, the list runs from 5,650 thousandths up to, but not including, 5,655 thousandths, so there are $5,655 - 5,650 = 5$ values. 5.649 rounds to 5.65 to the nearest hundredth, but it is below 5.65 and rounds to 5.6 to the nearest tenth.

WATCH FOR • Some students list only decimals that start with 5.7, which misses 5.65 through 5.69. Others include 5.75. The interval runs from the lower midpoint up to, but not including, the upper midpoint.

TRANSFER • The smallest is 2.95 and the largest is 3.04, because the midpoints are 2.95 and 3.05.