



DETAILED SOLUTIONS AND CONCEPTS - ROUNDING AND NUMBER COMPARISONS

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YOU MUST BE ABLE TO DO THE FOLLOWING PROBLEMS WITHOUT A CALCULATOR!

ROUNDING NUMBERS

Rounding a decimal number to a certain place value means that we want to find an **approximation** of the number. Rounding is the process for anyone who doesn't care to be exact. That's okay to a point because there are many different uses for numbers. Generally, the size of the number and its use dictates the place to which it should be rounded.

For example, the value for the number π (**pi**) given by the TI 30X IIS/B calculator is **3.141592954**. This is not the exact value of π which actually has an infinite number of decimal places. In real life, we often use the even less accurate, but still useful value of 3.14.

In this case, we would say that $\pi \approx$ **3.14**. This is read as "pi is approximately equal to 3.14." The symbol \approx means "approximately equal to."

When NASA sends the shuttle to the space station it might want to use the highly accurate value of the number π to ensure successful docking, but a carpenter cutting a circular arch is probably satisfied with a value of 3.14.

Rule:

- Locate the digit that occupies the rounding place.
- If the digit to the right of the rounding place is **less than 5**, leave the digit in the rounding place unchanged. Given a whole number, fill the remaining places with zeros. Given a decimal number, drop the remaining decimal places.
- If the digit to the right of the rounding place is **greater than 5 or equal to 5**, add **1** to the digit in the rounding place. This is called "rounding up." Given a whole number, fill the remaining places with zeros. Given a decimal number, drop the remaining decimal places.

Problem 1:

Round **6,296** to the nearest thousands place.

6 2 9 6

6 is in the thousands place. The digit to its right is 2, which is less than 5.

Therefore, **6,296** \approx **6,000**. Note that the remaining places were filled with zeros!

Problem 2:

Round **96.7945** to the nearest hundredths place!

9 6 . 7 9 4 5

9 is in the second decimal place. The digit to its right is 4, which is less than 5.

Therefore, **96.7945** \approx **96.79**. Note that the remaining places were dropped!

Problem 3:

Round **5,371** to the nearest hundreds place.

5 3 7 1

3 is in the hundreds place. The digit to its right is 7, which is greater than 5.

Therefore, **5,371** \approx **5,400**. Note that the remaining places were filled with zeros!

Problem 4:

Round **1,795** to the nearest tens place.

1 7 9 5

9 is in the tens place. The digit to its right is 5.

Note: When the digit in the rounding place is 9 and must be rounded up it becomes 10. The 0 replaces the 9 and the 1 is regrouped to the next place to the left.

Therefore, **1,795** \approx **1,800**. Note that the remaining places were filled with zeros!

Problem 5:

Round **58.6854** to the nearest tenths place!

5 8 . 6 8 5 4

6 is in the first decimal place. The digit to its right is 8, which is greater than 5.

Therefore, **58.6854** \approx **58.7**. Note that the remaining places were dropped!

Problem 6:

Round **21.1974** to the nearest hundredths place!

2 1 . 1 9 7 4

9 is in the second decimal place. The digit to its right is 7, which is greater than 5.

Note: When the digit in the rounding place is 9 and must be rounded up it becomes 10. The 0 replaces the 9 and the 1 is regrouped to the next place to the left.

Therefore, **21.1974** \approx **21.20**. Note that the remaining places were dropped! The **0** in the hundredths place has to show up to indicate that we rounded to two decimal places.

Problem 7:

Estimate the sum of **0.935 + 12.54 + 152.07 + 18** by rounding to tens. Then find the exact sum.

$$0 + 10 + 150 + 20 = 180$$

The exact sum is 183.545.

Problem 8:

Estimate the sum of **24,003 + 5,874 + 319,467 + 52,855** by rounding to thousands. Then find the exact sum.

$$24,000 + 6,000 + 319,000 + 53,000 = 402,000$$

The exact sum is 402,199.

Problem 9:

Estimate the difference of **427.45 - 125** by rounding to hundreds. Then find the exact sum.

$$400 - 100 = 300$$

The exact difference is 302.45.

Problem 10:

Estimate the difference of **4,048 - 36** by rounding to tens. Then find the exact sum.

$$4,050 - 40 = 4,010$$

The exact difference is **4,012**.

Problem 11:

Estimate the cost of 38 light bulbs if each bulb costs \$1.15 by rounding to one nonzero digit. Then find the exact price.

$$40 \times 1 = 40$$

The exact price is **\$43.70**.

Problem 12:

Estimate the cost of 54 knobs for your new kitchen cabinets if each knob costs \$3.40 by rounding to one nonzero digit. Then find the exact price.

$$50 \times 3 = 150$$

The exact price is \$183.60. In this case, the difference between the estimate and the exact product is quite large. This is due to the fact that both values were on the border of having to be rounded up.

Problem 13:

The owner of a sandwich shop tells you that he will charge you \$108 for 18 sandwiches that you want to buy for your party. Estimate the cost of one sandwich by rounding to one nonzero digit. Then find the exact price.

$$100 \div 20 = 5$$

The exact price for one sandwich is **\$6**.

COMPARING NUMBERS:

- Arrange the numbers vertically and add zeros, if necessary, to the end of numbers so that all numbers have the same number of digits.
- Compare the whole numbers.
- If the whole numbers are equal, compare the numbers in the decimal places starting with the first decimal place.
- When two digits in the same decimal place are different then the digit that is larger/smaller determines the larger/smaller decimal number.

Problem 14:

Which of the following numbers is the smallest?

0.016 0.106 0.16 0.601

Let's arrange the numbers vertically and add zeros to the end of some numbers so that all numbers have three digits.

0.016
0.106
0.160
0.601

The whole number parts are all zero. Therefore, we'll move to the first decimal place. When comparing the digits we find that the first number has the smallest one.

Therefore, 0.016 is the smallest number given our choices.

Problem 15:

Which of the following numbers is the largest?

0.097 0.3 0.103 0.023

Again, let's arrange the number vertically and add zeros to the end of some numbers so that all numbers have three digits.

0.097
0.300
0.103
0.023

The whole number parts are all zero. Therefore, we'll move to the first decimal place. When comparing the digits we find that the second number has the largest one.

Therefore, 0.3 is the largest number given our choices.

Problem 16:

Which of the following numbers is the smallest?

0.097 0.3 0.103 0.023

Again, let's arrange the number vertically and add zeros to the end of some numbers so that all numbers have three digits.

0.097
0.300
0.103
0.023

The whole number parts are all zero. Therefore, we'll move to the first decimal place.

When comparing the digits we find that the first and the fourth numbers have the smallest one. However, when comparing the digits in the second decimal place we note that the one in the fourth number is smaller.

Therefore, 0.023 is the smallest number given our choices.

Problem 17:

On four tests, a student had the grades of 78, 89, 45, and 80. What is her **average or mean** grade?

To find the average or mean of a group of numbers you must do the following:

- **Add the numbers.**
- **Divide the sum by the number of addends.**

In our case, let's find the sum $78 + 89 + 45 + 80 = 292$

Since we added 4 numbers we must divide 292 by 4. This equals 73.

Therefore, the student's average or mean grade is a 73.

Problem 18:

Find the **median** of the following numbers: 8.7, 2.7, 3, 9.85, and 4.5.

To find the median of a group of numbers you must do the following:

- **Arrange the numbers in order from the smallest to the largest.**
- **The median number is the value for which half the numbers are larger and half are smaller. If there are two middle numbers, the median is the mean of the two middle numbers.**

In our case, let's arrange the numbers in order from the smallest to the largest: 2.7, 3, 4.5, 8.7, 9.85

We find that 4.5 is the middle number and, therefore, is the median.

Problem 19:

Find the **median** of the following numbers: 9, 4, 13, 2, 11, 7, 16, 6, 4, 11.

In our case, let's arrange the numbers in order from the smallest to the largest: 2, 4, 4, 6, 7, 9, 11, 11, 13, 16

We find that both 7 and 9 are middle numbers. Their mean is $(7 + 9)/2 = 16/2 = 8$.

We find the mean to be 8.

Problem 20:

Which of the following fractions is the smallest?

$$\frac{3}{4}, \frac{5}{12}, \frac{2}{3}$$

In order to compare the numbers, we will have to first change the fractions into equivalent fractions all having the same denominator.

Let's find the LCD:

$$4 = 2 \cdot 2$$

$$12 = 2 \cdot 2 \cdot 3$$

$$3 = 3$$

Therefore, the LCD must be $2 \cdot 2 \cdot 3 = 12$.

Now we can change the fractions to equivalent fractions as follows:

$$\frac{3}{4} = \frac{3 \left(\frac{3}{3} \right)}{4 \left(\frac{3}{3} \right)} = \frac{9}{12} \quad \text{and} \quad \frac{5}{12} \quad \text{and} \quad \frac{2}{3} = \frac{2 \left(\frac{4}{4} \right)}{3 \left(\frac{4}{4} \right)} = \frac{8}{12}$$

In order to find the smallest fraction, we only need to compare the numerators. We find

that $\frac{5}{12}$ is the smallest fraction.

Problem 21:

Which of the following fractions is the smallest?

$$\frac{87}{100}, \frac{27}{32}, \frac{4}{5}$$

Let's find the LCD:

$$32 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$$

$$5 = 5$$

$$100 = 2 \cdot 2 \cdot 5 \cdot 5$$

Therefore, the LCD must be $2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 5 \cdot 5 = 800$.

Now we can change the fractions to equivalent fractions as follows:

$$\frac{87}{100} = \frac{87}{100} \left(\frac{8}{8} \right) = \frac{696}{800} \quad \text{and} \quad \frac{27}{32} = \frac{27}{32} \left(\frac{25}{25} \right) = \frac{675}{800} \quad \text{and} \quad \frac{4}{5} = \frac{4}{5} \left(\frac{160}{160} \right) = \frac{640}{800}$$

When comparing the numerators we find that $\frac{4}{5}$ is the smallest fraction.