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Approximation (Rounding Off)

Suppose, 86375 people attended a football match. To get a rough idea of the number of spectators, we may remember the first two digits from the left and put zeros in places of the other digits. Thus, it can be reported that approximately 86000 people attended the match. This is called **rounding off**. Here, we have rounded off 86375 to the nearest thousand. Similarly, we can round off numbers to the nearest ten, hundred, ten thousand, lakh, million, etc.

Rounding off whole numbers

Consider the number 3264. Suppose you want to round it off to the nearest ten. You find that 3264 is nearer to 3260 than to 3270. So, 3264 rounded off to the nearest ten is 3260.

Now suppose you want to round off 3264 to the nearest hundred. 3264 is nearer to 3300 than to 3200. So, you round it off to 3300.

The general rule for rounding off a whole number to the nearest **hundred** is as follows.

Rule If the digit in the **tens place** is less than 5, write 0 in the tens place as well as in the units place and keep the digits in the other places as they are.

If the digit in the **tens place** is 5 or more than 5, write 0 in the tens place as well as in the units place and add 1 to the digit in the hundreds place.

Examples (i) 3826 rounded off to the nearest hundred is 3800 as the digit in the tens place = $2 < 5$.

(ii) 4283 rounded off to the nearest hundred is 4300 as the digit in the tens place = $8 > 5$.

Similarly, a whole number can be rounded off to the nearest thousand, ten thousand, etc.

(i) 4763 is rounded off to 5000 (nearest thousand).

(ii) 23625 is rounded off to 20000 (nearest ten thousand).

Rounding off decimal fractions

Decimal fractions can be rounded off to the nearest one, tenth, hundredth, thousandth, etc.

The general rule for rounding off decimals is as follows.

Rule First, find the answer to one more place than you need.

If the digit in the extra place is 5 or more, add 1 to the digit in the place just before it.

If the digit in the extra place is less than 5, leave the digit in the place just before it as it is.

- Examples** (i) 43.7 rounded off to the nearest unit is 44 because the digit in the first decimal place is $7 > 5$.
- (ii) 43.78 rounded off to 1 decimal place is 43.8 because the digit in the second decimal place is $8 > 5$.
- (iii) 43.783 rounded off to 2 decimal places is 43.78 because the digit in the third decimal place is $3 < 5$.

Significant figures

The digits used to express a number to a specified degree of accuracy are the **significant figures**.

Finding significant figures of a number

Method Ignore the decimal point and read the number from left to right. The first significant figure is the first nonzero digit. All digits after that are also significant.

Examples 3.246 has 4 significant figures—3, 2, 4 and 6. The number 0.0004057 also has 4 significant figures—4, 0, 5 and 7. The zeros before the digit 4 are not significant but the zero after 4 is significant.

The number 243.57 has 5 significant figures—2, 4, 3, 5 and 7.

In the number 243.57, the digit 2 is the most significant figure as it has a place value of 200, while the digit 7 is the least significant figure as it has a place value of $\frac{7}{100}$.

Rounding off to significant figures

Method First, find the answer to one more significant figure than you need. If the extra digit is 5 or more than 5, add 1 to the digit just before it. If the extra digit is less than 5, leave the digit just before it as it is.

Examples 243.528 correct to 5 significant figures = 243.53.

As the sixth significant figure = $8 > 5$, we add 1 to the fifth significant figure, that is, 2.

243.528 correct to 4 significant figures = 243.5

as the fifth significant figure = $2 < 5$.

Solved Examples

EXAMPLE 1 Round off the following.

(i) 0.016297 to two significant figures and to two decimal places

(ii) 3.5792 to three significant figures and to three decimal places

Solution

- (i) $0.016297 = 0.016$, rounded off to two significant figures
 $= 0.02$, rounded off to two decimal places.

- (ii) $3.5792 = 3.58$, rounded off to three significant figures
 $= 3.579$, rounded off to three decimal places.

EXAMPLE 2 Round off the following.

- (i) ₹ 7835284 to the nearest ₹ 10000
 (ii) Rs 25.634 to the nearest paise
 (iii) 21.78 m to the nearest 10 cm
 (iv) 38.523 cm to the nearest mm
 (v) 3.5672 kg to the nearest g

Solution

- (i) ₹ 7835284 is closer to ₹ 7840000 than to ₹ 7830000.
 \therefore ₹ 7835284 = ₹ 7840000, to the nearest ₹ 10000.
- (ii) Rs 25.634 = 2563.4 p, which is closer to 2563 p (that is, Rs 25.63) than to 2564 p.
 \therefore Rs 25.634 = Rs 25.63, to the nearest paise.
- (iii) 21.78 m = 2178 cm, which is closer to 2180 cm (that is, 21.80 m) than to 2170 cm.
 \therefore 21.78 m = 21.80 m, to the nearest 10 cm.
- (iv) 38.523 cm = 385.23 mm, which is closer to 385 mm (that is, 38.5 cm) than to 386 mm.
 \therefore 38.523 cm = 38.5 cm, to the nearest mm.
- (v) 3.5672 kg = 3567.2 g, which is closer to 3567 g (that is, 3.567 kg) than to 3568 g.
 \therefore 3.5672 kg = 3.567 kg, to the nearest g.

EXAMPLE 3 Express $\frac{2}{171}$ as a decimal number correct to (i) three decimal places, (ii) three significant figures.**Solution**

$$2 \div 171.$$

$$\begin{array}{r} 171 \overline{) 2.00} \quad (0.01169 \\ \underline{- 171} \\ 290 \\ \underline{- 171} \\ 1190 \\ \underline{- 1026} \\ 1640 \\ \underline{- 1539} \\ 101 \end{array}$$

- (i) $\frac{2}{171} = 0.012$, correct to three decimal places (as 6 is the fourth decimal place and $6 > 5$).
- (ii) $\frac{2}{171} = 0.0117$, correct to three significant figures (as 9 is the fourth significant digit and $9 > 5$).

EXERCISE

5

- Express 1489357.65 rounded off to the nearest
 - unit
 - ten
 - hundred
 - thousand
 - ten thousand
- Round off 264.87356 to the nearest
 - unit
 - ten
 - hundred
 - tenth
 - hundredth
 - thousandth
 - ten thousandth
- Express 7.39247 correct to
 - the fourth decimal place
 - the third decimal place
 - four significant figures
 - three significant figures
- Round off the following.
 - 248976 to the nearest thousand
 - ₹ 67394 to the nearest ₹ 10
 - Rs 28487 to the nearest hundred rupees
 - Rs 12.453 to the nearest paisa
 - 2.168 m to the nearest cm
 - 38.67 m to the nearest 10 cm
 - 2.351 cm to the nearest mm
 - 0.0258 kg to the nearest g
- Write (a) $\frac{22}{7}$, (b) $\frac{1}{13}$ correct to
 - four places of decimal
 - four significant figures
 - three places of decimal
 - three significant figures

ANSWERS

- (i) 1489358 (ii) 1489360 (iii) 1489400 (iv) 1489000 (v) 1490000
- (i) 265 (ii) 260 (iii) 300 (iv) 264.9 (v) 264.87 (vi) 264.874 (vii) 264.8736
- (i) 7.3925 (ii) 7.392 (iii) 7.392 (iv) 7.39
- (i) 249000 (ii) ₹ 67390 (iii) Rs 28500 (iv) Rs 12.45 (v) 2.17 m (vi) 38.70 m (vii) 2.4 cm (viii) 0.026 kg
- (a) (i) 3.1429 (ii) 3.143 (iii) 3.143 (iv) 3.14 (b) (i) 0.0769 (ii) 0.07692 (iii) 0.077 (iv) 0.0769



Revision Exercise 2

1. Arrange the fractions in descending order in each of the following.

(i) $\frac{7}{24}, \frac{13}{36}, \frac{29}{48}, \frac{17}{56}, \frac{19}{60}$

(ii) $\frac{9}{10}, \frac{14}{15}, \frac{27}{35}, \frac{43}{60}, \frac{29}{45}, \frac{59}{75}$

2. Find the HCF and the LCM of the following.

(i) $\frac{4}{7}, \frac{9}{14}$ and $\frac{26}{63}$

(ii) $\frac{2}{5}, \frac{7}{10}, \frac{14}{16}$ and $\frac{36}{65}$

3. Insert three fractions between $\frac{17}{25}$ and $\frac{35}{41}$.

4. Simplify the following.

(i) $\frac{6}{35}$ of $\left[1\frac{1}{4} \div \left\{ \frac{1}{2} + \left(\frac{6}{7} \div \frac{1}{4} + \frac{5}{12} \right) \right\} \right]$

(ii) $\frac{1}{4} \div 3\frac{1}{5}$ of $\frac{3}{4} - \frac{\frac{1}{3} - \frac{1}{5}}{\frac{1}{3} + \frac{1}{5}} \times 1\frac{1}{3} + \frac{11}{15}$

5. Raman gives $\frac{1}{4}$ of his sum of money to Aftab, $\frac{3}{10}$ of the remaining to Nikhil and distributes the rest among his two daughters equally. If he had initially Rs 20000, find the amount received by each of his daughters.

6. Find the following.

(i) $[2.5342 + 3.142 - 1.98] \times 2.35$

(ii) $\left[5 \times (6.5 \times 7.5 - 8.3 \times 3.1) + \frac{9}{10} \right] \div 0.29$

7. Convert the following recurring decimals into fractions.

(i) $0.1\dot{7}$

(ii) $0.\overline{17}$

(iii) $0.\overline{107}$

8. Express 98345297.78 rounded off to the nearest

(i) unit

(ii) ten

(iii) hundred

(iv) thousand

(v) ten thousand

9. Express 358.69483 rounded off to the nearest

(i) unit

(ii) ten

(iii) hundred

(iv) tenth

(v) hundredth

(vi) thousandth

(vii) ten thousandth

10. Express 253.76289 correct to

(i) the fourth decimal place

(ii) the third decimal place

(iii) four significant figures

(iv) three significant figures

11. Round off the following.

(i) Rs 12783549 to the nearest Rs 10000

(ii) Rs 48.349 to the nearest paisa

(iii) 38.72 m to the nearest 10 cm

(iv) 112.645 cm to the nearest mm

(v) 18.3405 kg to the nearest g

ANSWERS

1. (i) $\frac{29}{48}, \frac{13}{36}, \frac{19}{60}, \frac{17}{56}, \frac{7}{24}$ (ii) $\frac{14}{15}, \frac{9}{10}, \frac{59}{75}, \frac{27}{35}, \frac{43}{60}, \frac{29}{45}$

2. (i) $\frac{1}{126}, \frac{468}{7}$ (ii) $\frac{1}{1040}, 252$

Approximation (Rounding Off)

3. $\frac{43}{58}$, $\frac{26}{33}$, $\frac{61}{74}$ (other solutions are also possible)

5. Rs 5250

6. (i) 8.68607 (ii) 400

4. (i) $\frac{3}{25}$ (ii) $\frac{121}{240}$

7. (i) $\frac{8}{45}$ (ii) $\frac{17}{99}$ (iii) $\frac{107}{999}$

8. (i) 98345298 (ii) 98345300 (iii) 98345300 (iv) 98345000 (v) 98350000

9. (i) 359 (ii) 360 (iii) 400 (iv) 358.7 (v) 358.69 (vi) 358.695 (vii) 358.6948

10. (i) 253.7629 (ii) 253.763 (iii) 253.8 (iv) 254

11. (i) Rs 12780000 (ii) Rs 48.35 (iii) 38.70 m (iv) 112.6 cm (v) 18.341 g

