3 APPROXIMATION AND ESTIMATION

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LEARNING OBJECTIVES

In this topic, we will learn to:
- round off numbers to a required number of decimal places or significant figures and estimate the results of computation

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3.1 ROUNDING OFF NUMBERS TO DECIMAL PLACES

◀ WORKED EXAMPLE 1 ▶

Evaluate the following.
Round off the following decimals to 1 decimal place.
(a) 1.35   (b) 4.54   (c) 9.98

Worked Solution:

(a) $1.35 \approx 1.4$
   $= \mathbf{1.4}$ (1 dec. pl.)

(b) $4.54 \approx 4.5$
   $= \mathbf{4.5}$ (1 dec. pl.)

(c) $9.98 \approx 10.0$
   $= \mathbf{10.0}$ (1 dec. pl.)

◀ WORKED EXAMPLE 2 ▶

Round off the following decimals to 2 decimal places.
(a) 0.984   (b) 7.557   (c) 11.996

Worked Solution:

(a) $0.984 \approx \mathbf{0.98}$
   $= \mathbf{0.98}$ (2 dec. pl.)

(b) $7.557 \approx \mathbf{7.56}$
   $= \mathbf{7.56}$ (2 dec. pl.)

(c) $11.996 \approx \mathbf{12.00}$
   $= \mathbf{12.00}$ (2 dec. pl.)

Note:
11.996 after rounding off becomes 12. But when the question asks for the answer to be given in 2 decimal places, the answer is 12.00. 12 on the other hand is a wrong answer.

3.2 ROUNDING OFF NUMBERS TO SIGNIFICANT FIGURES

WORKED EXAMPLE 3

Round off the following numbers to 3 significant figures.
(a) 67 542 (b) 14.024
(c) 0.041 54

Worked Solution:

(a) 67 542 = **67 500** (3 sig. fig.) (b) 14.024 = **14.0** (3 sig. fig.)

(c) 0.041 54 = **0.041 5** (3 sig. fig.)

3.3 ESTIMATION

WORKED EXAMPLE 4

Estimate each of the following correct to 1 significant figure.

(a) 50.2 × 1.24 (b) 60.5 ÷ 1.21

(c) $\sqrt{63.5}$

Worked Solution:

(a) 50.2 × 1.24 ≈ 50 × 1.2 (b) 60.5 ÷ 1.21 ≈ 60 ÷ 1.2
           = **60** (1 sig. fig.)   = 600 ÷ 12
                                                   = **50** (1 sig. fig.)

(c) $\sqrt{63.5} \approx \sqrt{64}$
           = **8** (1 sig. fig.)

PRACTICE QUESTIONS

1. Round off the following decimals to 1 decimal place.

    (a) 0.43   (b) 0.59
    (c) 1.32   (d) 1.78
    (e) 2.67   (f) 3.92
    (g) 4.134   (h) 5.249
    (i) 10.052   (j) 15.255
    (k) 19.992   (l) 21.389

2. Round off the following decimals to 2 decimal places.

    (a) 0.457   (b) 0.884
    (c) 1.973   (d) 4.193
    (e) 5.813   (f) 9.317
    (g) 10.848   (h) 11.898
    (i) 12.339   (j) 24.408
    (k) 35.335   (l) 39.995

3. Round off the following decimals to 3 decimal places.

    (a) 0.248 2   (b) 0.994 8
    (c) 1.295 1   (d) 1.764 7
    (e) 4.972 5   (f) 5.558 8
    (g) 9.984 5   (h) 10.481 8
    (i) 13.098 2   (j) 15.001 5
    (k) 29.481 9   (l) 30.097 5

4. Round off the following numbers to 2 significant figures.

    (a) 2.1421   (b) 124
    (c) 1 260 124   (d) 0.012 45
    (e) 0.145   (f) 1447.124

5. Round off the following numbers to 3 significant figures.
    (a) 482.01   (b) 1 025 476
    (c) 11 224   (d) 124.145
    (e) 542.14   (f) 1854.14

6. Estimate each of the following correct to 1 significant figure.
    (a) 19.2×4.2 (b) $5.8 \times 6.12 \times 1.01$

    (c) $\dfrac{65.2 \times 101.1}{78.9}$ (d) $\sqrt{24.99} \times 2.99$

    (e) $\dfrac{1}{50.21}$ (f) $2.14 + 50.124 \times 40.1$