

## ARITHMETIC (Q 1, PAPER 1)

### LESSON NO. 3: MORE PERCENTAGES

**2005**

- 1 (b) (i) The approximation  $50 \times 80$  was used for the calculation  $51 \times 79$ .  
Find the percentage error, correct to one decimal place.
- 1 (c) At the start of the year 2000 the population of a particular town was  $P$ .  
During the year 2000, the population of the town increased by 10%.
- (i) Express, in terms of  $P$ , the population of the town at the end of the year 2000.
- (ii) During the year 2001 the population of the town increased by 4%.  
During the year 2002 the population increased by 2%.  
Find the total percentage increase in the population of the town over the three years.
- (iii) The actual increase in the population was 8344. Find the value of  $P$ .

#### SOLUTION

**1 (b) (i)** FINDING THE PERCENTAGE ERROR

##### STEPS

1. Find the absolute error: Absolute error =  $|\text{True value} - \text{Estimate}|$

2. Find the fractional error: Fractional error =  $\frac{\text{Absolute Error}}{\text{True Value}}$

3. Find the percentage error: % Error =  $\frac{\text{Absolute Error}}{\text{True Value}} \times 100\%$

1. True value:  $51 \times 79 = 4029$       Estimate:  $50 \times 80 = 4000$

$$\text{Absolute Error} = |4029 - 4000| = 29$$

2. Fractional error =  $\frac{29}{4029}$

3. % error =  $\frac{29}{4029} \times 100\% = 0.7\%$

$$\% \text{ Error} = \frac{\text{Absolute Error}}{\text{True Value}} \times 100\%$$

2

**1 (c)**

(i) Multiply  $P$  by 1.1.

$$\text{Population at end of 2000} = 1.1P$$

(ii) Population after 3 years =  $1.1P \times 1.04 \times 1.02 = 1.16688P$

To find the percentage increase from this result, follow the steps to increase a quantity by a percentage backwards.

$$1.16688 - 1 = 0.16688 = 16.688\%$$

(iii) % increase =  $16.688\% = 0.16688$

$$\therefore P = \frac{8344}{0.16688} = 50,000$$

### 2003

- 1 (c) (i) When using a calculator to add 1.7 and 2.2, a student strikes the multiplication key instead of the addition key.  
Calculate the percentage error in the result, correct to one decimal place.

#### SOLUTION

##### FINDING THE PERCENTAGE ERROR

###### STEPS

1. Find the absolute error: Absolute error =  $|\text{True value} - \text{Estimate}|$
2. Find the fractional error: Fractional error =  $\frac{\text{Absolute Error}}{\text{True Value}}$
3. Find the percentage error: % Error =  $\frac{\text{Absolute Error}}{\text{True Value}} \times 100\%$

$$\% \text{ Error} = \frac{\text{Absolute Error}}{\text{True Value}} \times 100\% \quad \dots\dots \textcircled{2}$$

1. True value =  $1.7 + 2.2 = 3.9$       Estimated value =  $1.7 \times 2.2 = 3.74$   
Absolute error =  $|3.9 - 3.74| = 0.16$
2. Fractional error =  $\frac{0.16}{3.9}$
3. % error =  $\frac{0.16}{3.9} \times 100\% = 4.1\%$

### 2002

- 1 (b) Four telephone calls cost €3.85, €7.45, €8.40 and €11.55.
- (i) John estimates the total cost of the four calls by ignoring the cent part in the cost of each call. Calculate the percentage error in his estimate.
  - (ii) Anne estimates the total cost of the four calls by rounding the cost of each call to the nearest euro. Calculate the percentage error in her estimate.

#### SOLUTION

##### FINDING THE PERCENTAGE ERROR

###### STEPS

1. Find the absolute error: Absolute error =  $|\text{True value} - \text{Estimate}|$
2. Find the fractional error: Fractional error =  $\frac{\text{Absolute Error}}{\text{True Value}}$
3. Find the percentage error: % Error =  $\frac{\text{Absolute Error}}{\text{True Value}} \times 100\%$

$$\% \text{ Error} = \frac{\text{Absolute Error}}{\text{True Value}} \times 100\% \quad \dots\dots \textcircled{2}$$

CONT...

**1 (b) (i)**

1. True value = €3.85 + €7.45 + €8.40 + €11.55 = €31.25

Estimated value = €3 + €7 + €8 + €11 = €29

Absolute error =  $|31.25 - 29| = 2.25$

2. Fractional error =  $\frac{2.25}{31.25}$

3. % error =  $\frac{2.25}{31.25} \times 100\% = 7.2\%$

**1 (b) (ii)**

1. True value = €3.85 + €7.45 + €8.40 + €11.55 = €31.25

Estimated value = €4 + €7 + €8 + €12 = €31

Absolute error =  $|31.25 - 31| = 0.25$

2. Fractional error =  $\frac{0.25}{31.25}$

3. % error =  $\frac{0.25}{31.25} \times 100\% = 0.8\%$

**2001**

1 (b) (i) The answer to  $3.58 + 2.47$  was given as 6.50.

What was the percentage error correct to one decimal place?

**SOLUTION**

FINDING THE PERCENTAGE ERROR

**STEPS**

1. Find the absolute error: Absolute error =  $|\text{True value} - \text{Estimate}|$

2. Find the fractional error: Fractional error =  $\frac{\text{Absolute Error}}{\text{True Value}}$

3. Find the percentage error: % Error =  $\frac{\text{Absolute Error}}{\text{True Value}} \times 100\%$

$$\% \text{ Error} = \frac{\text{Absolute Error}}{\text{True Value}} \times 100\% \dots\dots 2$$

1. True value =  $3.58 + 2.47 = 6.05$       Estimated value = 6.50

Absolute error =  $|6.50 - 6.05| = 0.45$

2. Fractional error =  $\frac{0.45}{6.05}$

3. % error =  $\frac{0.45}{6.05} \times 100\% = 7.4\%$

**1996**

- 1 (c) (ii) Calculate the percentage error if 5 is taken as an approximation for 4.95.  
Give your answer correct to two places of decimals.

**SOLUTION**

FINDING THE PERCENTAGE ERROR

**STEPS**

1. Find the absolute error: Absolute error = |True value – Estimate|
2. Find the fractional error: Fractional error =  $\frac{\text{Absolute Error}}{\text{True Value}}$
3. Find the percentage error: % Error =  $\frac{\text{Absolute Error}}{\text{True Value}} \times 100\%$

$$\% \text{ Error} = \frac{\text{Absolute Error}}{\text{True Value}} \times 100\% \dots\dots \textcircled{2}$$

1. True value = 4.95    Estimated value = 5

$$\text{Absolute error} = |4.95 - 5| = 0.05$$

2. Fractional error =  $\frac{0.05}{4.95}$

3. % error =  $\frac{0.05}{4.95} \times 100\% = 1.01\%$