1 Basic Arithmetic

Key Terms

- addition
- subtraction
- multiplication
- division
- sum
- difference
- product
- dividend
- divisor
- quotient
- remainder
- mixed operations
- bracket
- integer/whole number
- multiple
- factor
- prime number
- composite number
- common multiple
- lowest common multiple
- common factor
- highest common factor
- fraction bar
- numerator
- denominator
- proper fraction
- improper fraction
- mixed fraction
- complex fraction

1.1 Four Basic Arithmetic Operations

(a)

Basic operation	Example
Addition	$3 + 9 = 12$ sum
Subtraction	$13 - 5 = 8$ difference
Multiplication	$2 \times 7 = 14$ product
Division	dividend $29 \div 6 = 4 \cdots 5$ remainder divisor quotient

(b) In performing **mixed operations**, we should follow the order of operations below:

(i) Perform multiplication (×) and division (÷) first, then addition (+) and subtraction (−).

e.g. **(1)** $30 - 6 \times 3$
$= 30 - 18$
$= \underline{\underline{12}}$

(2) $5 + 14 \div 7$
$= 5 + 2$
$= \underline{\underline{7}}$

(ii) When there are only addition / subtraction (or only multiplication / division) in an expression, perform the operations from LEFT to RIGHT.

e.g. **(1)** $\overrightarrow{34 - 15 + 5}$
$= 19 + 5$
$= \underline{\underline{24}}$

(2) $\overrightarrow{28 \div 4 \times 3}$
$= 7 \times 3$
$= \underline{\underline{21}}$

(iii) When there are **brackets** in an expression, perform the operations inside the brackets first.

e.g. $24 \div (4 \times 2) - 2$
$= 24 \div 8 - 2$
$= 3 - 2$
$= \underline{\underline{1}}$

Example ① Calculate the following.

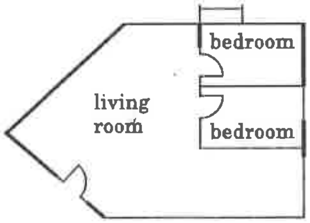
(a) $8 \times 2.5 - 51 \div 3$

(b) $35 \div (16 - 3 \times 2) + 1.5$

Solution **(a)** $8 \times 2.5 - 51 \div 3$
$= 20 - 17$
$= \underline{\underline{3}}$

(b) $35 \div (16 - 3 \times 2) + 1.5$
$= 35 \div (16 - 6) + 1.5$
$= 35 \div 10 + 1.5$
$= 3.5 + 1.5$
$= \underline{\underline{5}}$

Example ② In each flat of a building, there are a living room with area 50 m^2 and two bedrooms with area 10 m^2 each.



(a) Find the total area of the flat.

(b) If the building has 21 flats, find the sum of the areas of these flats.

Solution **(a)** $\text{Total area} = 10 + 10 + 50$

$= \underline{\underline{70\ (m^2)}}$

(b) $\text{Sum of areas} = 70 \times 21$

$= \underline{\underline{1\ 470\ (m^2)}}$

Let's Try 1.1

Calculate the following. **[Nos. 1–4]**

1. $28 - 19 + 7$

$=$

2. $14 + 8 \times 12 - 55$

$= 14 + \boxed{} - 55$

$=$

3. $16 - (24 - 5 \times 3)$

$= \boxed{} - (\boxed{} - \boxed{})$

$= \boxed{} - \boxed{}$

$=$

4. $(8 - 5.4) \div 13 \times 2$

$=$

5. Mr Wong orders 3 hot dogs and 2 cans of coke in a fast food shop. The coke is sold at \$5 per can and Mr Wong pays \$46 in total. Find the price of a hot dog.

1.2 Multiples and Factors

(a) Multiples

$6 \times 1 = 6$

$6 \times 2 = 12$ ← Multiples of 6

$6 \times 3 = 18$

$\vdots$

∴ The first 3 multiples of 6 are 6, 12 and 18.

(b) Factors

(i) Consider the following expression.

$8 \div 2 = 4$

Remainder is 0.

4 is an **integer**.

∴ 8 is divisible by 2.

(ii) Consider the following expression.

$12 \div 3 = 4$ ◄ 12 is divisible by 3.

∴ 3 is a **factor** of 12.

e.g. $12 = 1 \times 12$

$= 2 \times 6$

$= 3 \times 4$

∴ Factors of 12 are 1, 2, 3, 4, 6 and 12.

(c) Prime Numbers and Composite Numbers

(i) Numbers having only two factors (1 and itself) are called **prime numbers**.

e.g. Prime numbers up to 20 are 2, 3, 5, 7, 11, 13, 17 and 19.

(ii) Numbers having 3 or more factors (including 1) are called **composite numbers**.

e.g. Composite numbers up to 10 are 4, 6, 8, 9 and 10.

Number	*Factor*	*Prime Numbers*	*Composite Numbers*
1	1	✗	✗
2	1, 2	✓	✗
3	1, 3	✓	✗
4	1, 2, 4	✗	✓
5	1, 5	✓	✗
6	1, 2, 3, 6	✗	✓

(d) Lowest Common Multiple (L.C.M.)

Multiples of 6 are 6, 12, ⑱, 24, 30, ㊱, ⋯

Multiples of 9 are 9, ⑱, 27, ㊱, 45, ⋯

The circled numbers 18 and 36 are called the **common multiples** of 6 and 9.
The smallest common multiple is called the **lowest common multiple** (abbreviated as L.C.M.).

∴ The L.C.M. of 6 and 9 is 18.

(e) Highest Common Factor (H.C.F.)

Factors of 18 are ①, ②, ③, ⑥, 9, 18

Factors of 24 are ①, ②, ③, 4, ⑥, 8, 12, 24

The circled numbers 1, 2, 3 and 6 are called the **common factors** of 18 and 24.
The largest common factor is called the **highest common factor** (abbreviated as H.C.F.).

∴ The H.C.F. of 18 and 24 is 6.

Example ③ Write down the factors of 12 and 32. Hence, find the H.C.F. of 12 and 32.

Solution Factors of 12 are 1, 2, 3, 4, 6 and 12.
Factors of 32 are 1, 2, 4, 8, 16 and 32.

∴ The H.C.F. of 12 and 32 is 4.

Example ④ Write down the first 5 multiples of 16 and 20. Hence, find the L.C.M. of 16 and 20.

Solution The first 5 multiples of 16 are 16, 32, 48, 64 and 80.

The first 5 multiples of 20 are 20, 40, 60, 80 and 100.

∴ The L.C.M. of 16 and 20 is 80.

Let's Try 1.2

1. Write down the factors of 14 and 35. Hence, find the H.C.F. of 14 and 35.

Solution Factors of 14 are ________, ________, ________, ________.

Factors of 35 are ________, ________, ________, ________.

∴ The H.C.F. of 14 and 35 is ________.

2. Write down the first 5 multiples of 8 and 10. Hence, find the L.C.M. of 8 and 10.

Solution The first 5 multiples of 8 are ____________________.

The first 5 multiples of 10 are ____________________.

∴ The L.C.M. of 8 and 10 is ________.

3. Write down all the prime numbers from 20 to 30.

Solution The prime numbers from 20 to 30 are ____________________.

1.3 Fractions

(a) Types of Fractions

$$\textbf{fraction bar} \longrightarrow \frac{3}{5}\begin{array}{l}\longleftarrow \textbf{numerator}\\ \longleftarrow \textbf{denominator}\end{array}$$

The following are 3 common types of fractions:

Type	*Meaning*	*Example*
Proper fraction	a fraction with a numerator less than the denominator	$\frac{1}{4}$, $\frac{2}{7}$, $\frac{8}{15}$
Improper fraction	a fraction with a numerator greater than or equal to the denominator	$\frac{7}{7}$, $\frac{11}{6}$, $\frac{10}{4}$
Mixed fraction	a sum of a natural number and a proper fraction	$1\frac{2}{7}$, $3\frac{1}{5}$, $12\frac{3}{8}$

Note: In a fraction, if the numerator, denominator or both contain a fraction, the fraction is called a **complex fraction**.

$\dfrac{\frac{3}{5}}{\frac{9}{10}}$ is a complex fraction and $\dfrac{\frac{3}{5}}{\frac{9}{10}} = \dfrac{3}{5} \div \dfrac{9}{10}$

(b) Operations with Fractions

(i) Addition or subtraction:

Expand the fractions to make their denominators the same first, then add or subtract the numerators.

Example ⑤ Calculate $\frac{1}{2} - \frac{2}{7}$.

Solution

$$\begin{aligned} &\frac{1}{2} - \frac{2}{7} \\ &= \frac{7-4}{14} \\ &= \underline{\underline{\frac{3}{14}}} \end{aligned}$$

The L.C.M. of 2 *and* 7 *is* 14.

$$\therefore \quad \frac{1}{2} = \frac{1 \times 7}{2 \times 7} = \frac{7}{14}$$

$$\frac{2}{7} = \frac{2 \times 2}{7 \times 2} = \frac{4}{14}$$

(ii) Multiplication or division:

Convert all mixed fractions into improper fractions first, then cancel out all the common factors in the numerators and the denominators.

Example ⑥ Calculate the following.

(a) $\dfrac{\frac{2}{3}}{\frac{4}{9}}$

(b) $\frac{1}{6} \times \frac{3}{4} + \frac{5}{6} \div 1\frac{1}{3}$

Solution **(a)**

$$\begin{aligned} &\dfrac{\frac{2}{3}}{\frac{4}{9}} \\ &= \frac{2}{3} \div \frac{4}{9} \\ &= \frac{2}{3} \times \frac{9}{4} \\ &= \frac{3}{2} \\ &= \underline{\underline{1\frac{1}{2}}} \end{aligned}$$

To divide a fraction by another, turn the divisor upside down and convert '÷' into '×'.

(b) $\frac{1}{6} \times \frac{3}{4} + \frac{5}{6} \div 1\frac{1}{3}$

$= \frac{1}{6} \times \frac{3}{4} + \frac{5}{6} \div \frac{4}{3}$

Convert into improper fraction first.

$= \frac{1}{6} \times \frac{3}{4} + \frac{5}{6} \times \frac{3}{4}$

$= \frac{1}{8} + \frac{5}{8}$

$= \frac{6}{8}$

$= \underline{\underline{\frac{3}{4}}}$

Simplify the answer. $\frac{\cancel{6}^{3}}{\cancel{8}_{4}}$

Let's Try 1.3

Calculate the following.

1. $\frac{4}{9} + \frac{5}{12}$

$= \frac{\square}{\square}$

$=$

2. $2\frac{4}{7} - 1\frac{1}{3}$

$=$

3. $2\frac{5}{8} \times 1\frac{2}{7}$

$=$

4. $\frac{\frac{2}{5}}{\frac{14}{45}} = \frac{2}{5} \div \square$

$=$

5. $1 - 1\frac{1}{5} \div 12$

$= 1 - \square \times \square$

$= 1 - \square$

$=$

6. $\frac{7}{9} \times 3 + 3\frac{1}{2} \div 14$

$= \frac{7}{9} \times 3 + \square \times \square$

$= \square + \square$

$=$

Exercise 1

Calculate the following. **[Nos. 1–8]**

1. $15 \times 5 \div 3$

$=$

2. $2.5 - 1.4 + 3 \times 0.3$

$=$

3. $50 - 9.2 \times 5 + 13$

$=$

4. $(5.2 + 4.3) \div 5$

$=$

5. $\dfrac{\frac{3}{7}}{\frac{5}{21}}$

$=$

6. $\left(2\frac{1}{2} - 3 \times \frac{2}{3}\right) \div \frac{1}{2}$

$=$

7. $\left(8\frac{2}{7} - 4\frac{1}{5} \times \frac{10}{7}\right) \div \frac{7}{12}$

$=$

8. $3\frac{1}{2} \times \left(2\frac{1}{2} + \frac{5}{6}\right) \div \left(\frac{1}{6} \times \frac{1}{3}\right)$

$=$

9. Write down the factors of 15 and 30. Hence, find the H.C.F. of 15 and 30.

Solution Factors of 15 are ________, ________, ________, ________.

Factors of 30 are ________, ________, ________, ________,

________, ________, ________, ________.

∴ The H.C.F. of 15 and 30 is ________.

10. Write down the first 8 multiples of 12 and 28. Hence, find the L.C.M. of 12 and 28.

Solution The first 8 multiples of 12 are ____________________________.

The first 8 multiples of 28 are ____________________________.

∴ The L.C.M. of 12 and 28 is ________.

11. Write down all the composite numbers from 31 to 59.

Solution Composite numbers from 31 to 59 are ____________________________

____.

Fill in the □ with '+', '−', '×' or '÷' to make the both sides of the following expressions equal. **[Nos. 12–13]**

12. $\frac{1}{11} \square 8 \square \frac{10}{11} \times \frac{1}{8} = \frac{1}{8}$

13. $\left(\frac{1}{2} \square \frac{1}{3} + \frac{1}{6}\right) \square 36 = 12$

14. Taxi Fare Table

First 2 km	$22.00
Every subsequent 0.2 km	$1.60
Every piece of baggage	$5.00

City A and city B are 4 km apart. City B and city C are 13.2 km apart. Paco took a taxi from A to C via B without any baggage. How much taxi fare should he pay?

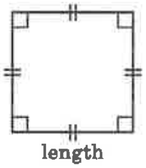
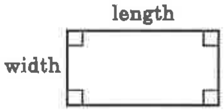
6 Perimeter, Area and Volume

Key Terms

- length
- width/breadth
- base
- height
- upper base
- lower base
- splitting method
- filling method
- capacity
- container
- dimensions
- depth
- maximum

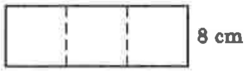
6.1 Perimeters of Simple Plane Figures

(a) Perimeter of a plane figure = sum of the **lengths** of all its sides

Plane figure	*Perimeter*
	Perimeter of a square = length × 4
	Perimeter of a rectangle = (length + **width**) × 2

(b) mm, cm, m and km are common measuring units of lengths.

Example ① The figure shows a rectangle formed by 3 squares with side 8 cm. Find the perimeter of the rectangle.



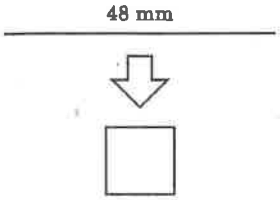
Solution Length of the rectangle = 8 × 3

$= 24$ (cm)

∴ Perimeter of the rectangle = (24 + 8) × 2

$= \underline{\underline{64 \text{ (cm)}}}$

Example ② Andy uses a wire of 48 mm long to form a square. Find the length of the square.



Solution Let x mm be the length of the square.

$$4x = 48$$

$$\frac{4x}{4} = \frac{48}{4}$$

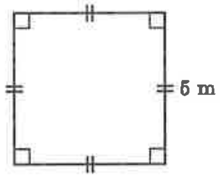
$$x = 12$$

∴ The length of the square is 12 mm.

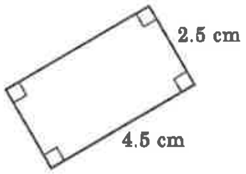
Let's Try 6.1

Find the perimeters of the following figures. **[Nos. 1–4]**

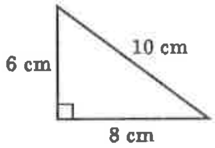
1.



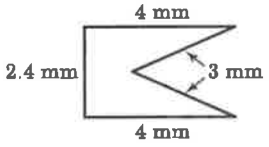
2.



3.



4.



5. The perimeter of a rectangle is 110 cm. If the length is 42 cm, find the width.

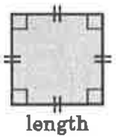
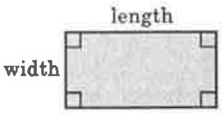
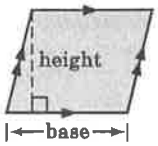
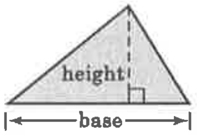
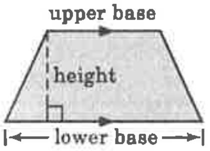
Solution Let y cm be the width.

(□ + □) × □ = □

∴ The width is □ cm.

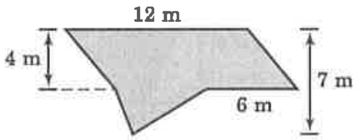
6.2 Areas of Simple Plane Figures

(a)

Plane figure	*Area*
	Area of a square = length × length
	Area of a rectangle = length × width
	Area of a parallelogram = **base** × **height**
	Area of a triangle = $\frac{1}{2}$ × base × height
	Area of a trapezium = $\frac{1}{2} \times \left(\text{upper base} + \text{lower base}\right) \times \text{height}$

(b) mm^2, cm^2, m^2 and km^2 are common measuring units of areas.

Example 3 The polygon on the right is formed by a parallelogram and a triangle. Find the area of the polygon.



Solution Area of the parallelogram = 12 × 4

= 48 (m^2)

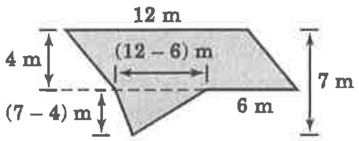
Area of the triangle

$= \frac{1}{2} \times (12 - 6) \times (7 - 4)$

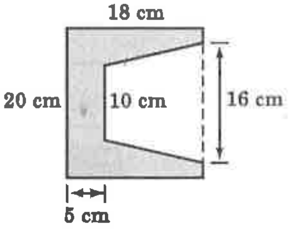
$= \frac{1}{2} \times 6 \times 3$

= 9 (m^2)

∴ Area of the polygon = 48 + 9 = <u>57 (m^2)</u>



Example ④ In the figure, John cuts out a trapezium from a piece of rectangular paper. What is the area of the remaining part?



Solution Area of the rectangle $= 20 \times 18$

$= 360\ (\text{cm}^2)$

Area of the trapezium $= \frac{1}{2} \times (10 + 16) \times (18 - 5)$

$= \frac{1}{2} \times 26 \times 13$

$= 169\ (\text{cm}^2)$

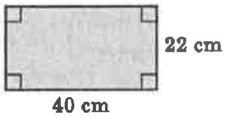
$\therefore$ Area of the remaining part $= 360 - 169$

$= \underline{\underline{191\,(\text{cm}^2)}}$

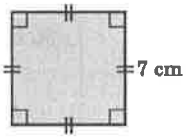
Let's Try 6.2

Find the areas of the following figures.

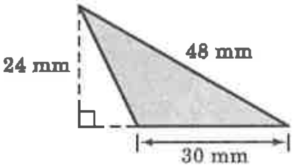
1.



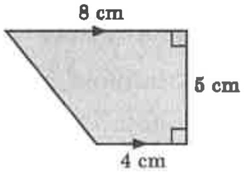
2.



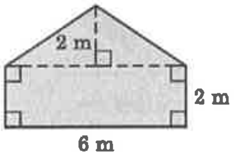
3.



4.



5.



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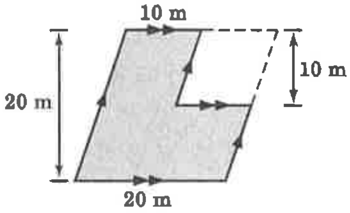
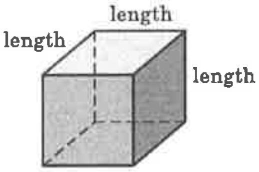
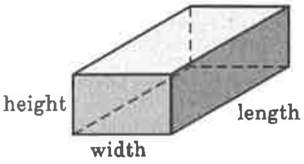


6.3 Volumes of Simple Solid Figures

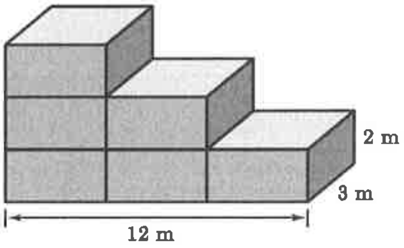
(a)

<table>
<tr><th><i>Solid figure</i></th><th><i>Volume</i></th></tr>
<tr><td>
</td><td>Volume of a cube = length × length × length</td></tr>
<tr><td>
</td><td>Volume of a cuboid = length × width × height</td></tr>
</table>

(b) mm^3, cm^3, m^3 and km^3 are common measuring units of volumes. For the **capacity** of a **container** or volume of liquid, the units mL and L can also be used.

1 mL = 1 cm^3
1 L = 1 000 cm^3

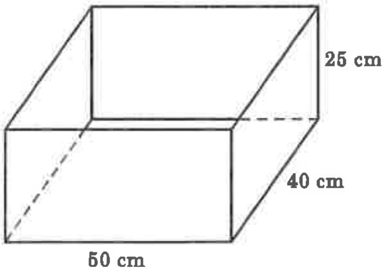
Example ⑤ The solid below is formed by 6 cuboids of the same size. Find the volume of the solid.



Solution

$$\begin{aligned}\text{Length of each cuboid} &= 12 \div 3\\ &= 4\ (\text{m})\\ \text{Volume of each cuboid} &= 4 \times 3 \times 2\\ &= 24\ (\text{m}^3)\\ \therefore\quad \text{Volume of the solid} &= 24 \times 6\\ &= \underline{\underline{144\ (\text{m}^3)}}\end{aligned}$$

Example ⑥ The **dimensions** of the container below are 50 cm × 40 cm × 25 cm. If Dick pours 30 L of water into the container, find the **depth** of water in the container.



Solution Let d cm be the depth of water in the container.

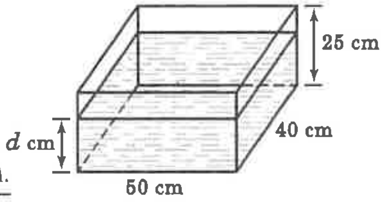
$$50 \times 40 \times d = 30 \times 1\ 000 \quad \blacktriangleleft\ 30\text{ L} = 30 \times 1\ 000\text{ cm}^3$$

$$2\ 000d = 30\ 000$$

$$\frac{2\ 000d}{2\ 000} = \frac{30\ 000}{2\ 000}$$

$$d = 15$$

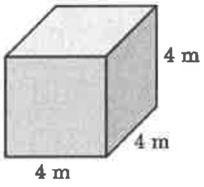
∴ The depth of water in the container is 15 cm.



Let's Try 6.3

Find the volumes of the following solids. **[Nos. 1–2]**

1.



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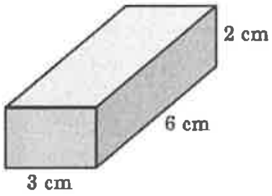
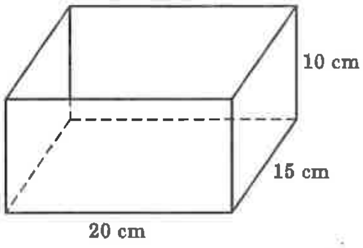
2.



______

3. **(a)** In the figure, the capacity of the container is ______ L.

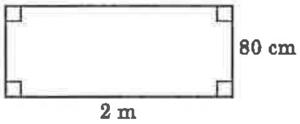
(b) Pansy pours a bottle of 1.5 L orange juice into the container. The depth of orange juice in the container is ______ cm.



Exercise 6

Find the perimeters of the following figures. **[Nos. 1–2]**

1.



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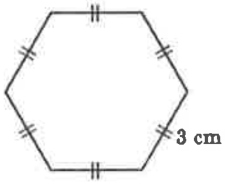
2.



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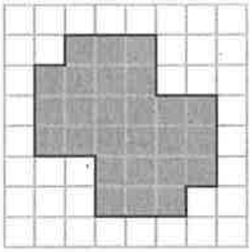
3. In the figure, the length of each small square is 1 cm.

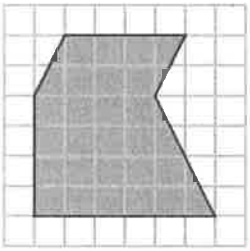
(a) Perimeter of the shaded region is ______________ cm.

(b) Area of the shaded region is ______________ cm^2.



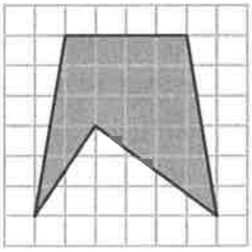
In the following figures, the length of each small square is 1 cm. Find the areas of the shaded regions. **[Nos. 4–5]**

4.



____

5.



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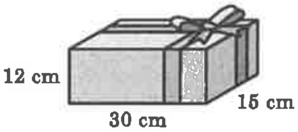
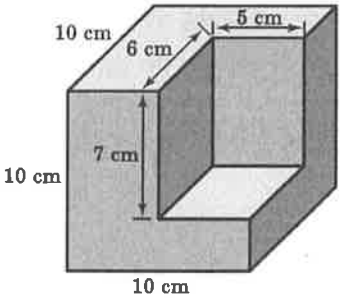
6. The volume of the gift box on the right is ______________ cm^3.



7. The figure shows the remaining part of a cube after a cuboid is cut out. The volume of this remaining part is ______________ cm^3.

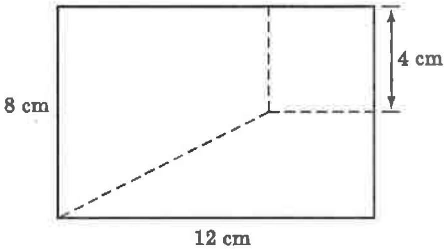


8. David gives a box of candies to Mandy. The box is a cuboid with length 10 cm, width 6 cm and volume 180 cm^3. Find the height of the box.

9. A fence of 200 m is built around a rectangular garden. If the length of the garden is 60 m, find the area of the garden.

10. Jack uses a piece of wire to form an equilateral triangle of side 14 cm. Then, Michelle reforms it to a square. What is the area of the square?

11. The figure shows a rectangle with length 12 cm and width 8 cm. It is cut into one square and two trapeziums of different sizes. If the side of the square is 4 cm, what is the area of the smaller trapezium?



12. There is a box with length 20 cm, width 12 cm and height 10 cm. Find the **maximum** number of blocks as shown on the right can be put into the box.