**1. Simplify**

a) $5\sqrt{3} + 2\sqrt{3}$

b) $9\sqrt{6} - \sqrt{6}$

c) $3\sqrt{5} - \sqrt{20}$

d) $2\sqrt{8} - \sqrt{18} + 3\sqrt{2}$

e) $5\sqrt{7} - \sqrt{63} + 2\sqrt{28}$

f) $\dfrac{\sqrt{15} \times \sqrt{3}}{3\sqrt{5}} = \dfrac{\sqrt{45}}{3\sqrt{5}}$

**2. Expand and simplify:**

a) $(\sqrt{2} + 3)(\sqrt{2} - 5)$

b) $(\sqrt{7} - \sqrt{3})^2$

c) $(2\sqrt{3} - 1)(2\sqrt{3} + 1)$

d) $(\sqrt{7} - 2\sqrt{2})(\sqrt{7} + 2\sqrt{2})$

**3. Rationalise the denominator. Simplify where possible:**

a) $\dfrac{9}{\sqrt{3}}$

b) $\dfrac{2}{5\sqrt{2}}$

c) $\dfrac{5}{5 - \sqrt{2}}$

d) $\dfrac{\sqrt{10} - \sqrt{5}}{5\sqrt{10}}$

e) $\dfrac{5 - \sqrt{2}}{2\sqrt{2} + \sqrt{3}}$

4. Convert the following:

a) $2000 \text{ mL} = \underline{\hspace{2cm}} \text{ cm}^3$

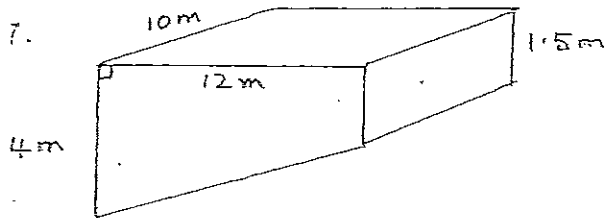b) $5.37 \text{m}^3 = \underline{\hspace{2cm}} \text{ L}$

c) $27.3 \text{ m}^2 = \underline{\hspace{2cm}} \text{ cm}^2$

5. The surface area of a cube is $843.648 \text{ cm}^2$. What is the length of the side edge?

6. Find the volume and surface area of a sphere with radius of 4 cm. (answers to 1 d.p.)
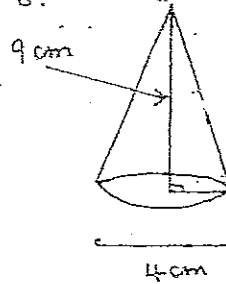
Volume =

Surface area =

7.



10m
12m
1·5m
4m

Find the:

(a) volume

(b) capacity in litres.

8.



9 cm
4 cm

Find:

(a) volume

(b) surface area

9. An aluminum can has a diameter of 7cm and a height of 15cm. How many square centimetres do we need to make the can? What is the capacity of the can?

10. Write as powers of 5

(a) $125$

(b) $25^m$

(c) $\dfrac{1}{25}$

(d) $\sqrt{5} \times 25$

11. Simplify

(a) $(m^7)^3$

(b) $\dfrac{x^{13}}{x^4 \times x^3}$

(c) $2^{101} \div 2^{21}$

(d) $(4x^2)^3$

(e) $5x^0$

(f) $2^{m-3} \times 8^{2m+1}$

12. Evaluate

(a) $49^{-\frac{1}{2}}$

(b) $16^{\frac{3}{4}}$

(c) $\left(6\frac{1}{4}\right)^{\frac{1}{2}}$

13. Write in index form

(a) $\sqrt[3]{b^2}$

(b) $\dfrac{1}{x^4}$

(c) $\dfrac{1}{\sqrt[5]{y^3}}$

1. Simplify

a) $5\sqrt{3} + 2\sqrt{3} = 7\sqrt{3}$   ✓ 1

b) $9\sqrt{6} - \sqrt{6} = 8\sqrt{6}$   ✓ 1

c) $3\sqrt{5} - \sqrt{20} = 3\sqrt{5} - 2\sqrt{5} = \sqrt{5}$   ✓ 1

d) $2\sqrt{8} - \sqrt{18} + 3\sqrt{2}$
$4\sqrt{2} - 3\sqrt{2} + 3\sqrt{2} = 4\sqrt{2}$   ✓ 2

e) $5\sqrt{7} - \sqrt{63} + 2\sqrt{28}$
$5\sqrt{7} - 3\sqrt{7} + 4\sqrt{7} = 6\sqrt{7}$   ✓ 2

f) $\dfrac{\sqrt{15} \times \sqrt{3}}{3\sqrt{5}} = \dfrac{\sqrt{45}}{3\sqrt{5}} = \dfrac{3\sqrt{5}}{3\sqrt{5}} = 1$   ✓
2

2. Expand and simplify:

a) $(\sqrt{2} + 3)(\sqrt{2} - 5)$

$2 - 5\sqrt{2} + 3\sqrt{2} - 15$   ✓
$= -13 - 2\sqrt{2}$   ✓   ✓2

b) $(\sqrt{7} - \sqrt{3})^2$

$7 - 2\sqrt{21} + 3$   ✓
$= 10 - 2\sqrt{21}$   ✓   ✓2

c) $(2\sqrt{3} - 1)(2\sqrt{3} + 1)$

$12 - 1 = 11$   ✓✓   ✓2

d) $(\sqrt{7} - 2\sqrt{2})(\sqrt{7} + 2\sqrt{2})$

$7 - \boxed{8} = -1$

3. Rationalise the denominator. Simplify where possible.

a) $\dfrac{9}{\sqrt{3}} \times \dfrac{\sqrt{3}}{\sqrt{3}} = \dfrac{9\sqrt{3}}{3} \checkmark = \dfrac{3\sqrt{3}}{1} = 3\sqrt{3}$   ②

b) $\dfrac{2}{5\sqrt{2}} \times \dfrac{\sqrt{2}}{\sqrt{2}} = \dfrac{2\sqrt{2}}{10} = \dfrac{\sqrt{2}}{5}$   ✓ ②

c) $\dfrac{5}{5 - \sqrt{2}} \times \dfrac{(5 + \sqrt{2})}{(5 + \sqrt{2})} = \dfrac{25 + 5\sqrt{2}}{25 - 2} = \dfrac{25 + 5\sqrt{2}}{23}$   ②

d) $\dfrac{\sqrt{10} - \sqrt{5}}{5\sqrt{10}} \times \dfrac{\sqrt{10}}{\sqrt{10}} = \dfrac{10 - \sqrt{50}}{50} = \dfrac{10 - 5\sqrt{2}}{50}$
$= \dfrac{5(2 - \sqrt{2})}{50}$
$= \dfrac{2 - \sqrt{2}}{10}$

e) $\dfrac{5 - \sqrt{2}}{2\sqrt{2} + \sqrt{3}}$

$\dfrac{5 - \sqrt{2}}{2\sqrt{2} + \sqrt{3}} \times \dfrac{(\sqrt{8} - \sqrt{3})}{(\sqrt{8} - \sqrt{3})} = \dfrac{10\sqrt{2} - 5\sqrt{3} - 4 + \sqrt{6}}{5}$   ✓   $\dfrac{2}{2}$

4. Convert the following:

a) $2000\ mL = \underline{2000}\ cm^3$ ✓

b) $5.37\ m^3 = \underline{5370}\ L$ ✓

c) $27.3\ m^2 = \underline{273000}\ cm^2$ ✓

5. The surface area of a cube is $843.648\ cm^2$. What is the length of the side edge?

$$\frac{843.648}{6} = 140.608 \quad ✓ \quad 2$$
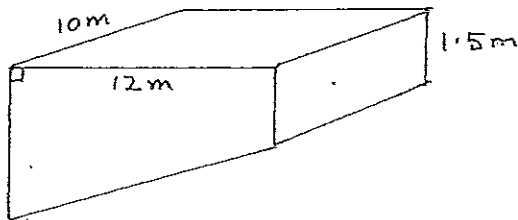
$$\sqrt{140.608} = 11.86\ cm \overset{\text{length}}{} (\text{to } 2\ dp)$$ ✓

6. Find the volume and surface area of a sphere with radius of 4 cm. (answers to 1 d.p.)

$$\text{Volume} = \frac{4}{3}\pi r^3 \quad ✓✓ \quad 2$$

$$\frac{4}{3}\times \pi \times 4^3 = 268.1\ cm^3\ (\text{to } 1dp)$$

$$\text{Surface area} = 4\pi r^2 \quad ✓✓ \quad 2$$

$$4\times\pi\times 4^2 = 201.1\ cm^2\ (\text{to } 1dp)$$



10m, 12m, 1.5m, tm

Find the:

(a) volume $\frac{1}{2}h(a+b)\times H$ ✓

$$\frac{1}{2}\times 12(1.5+4)\times 10 \quad ✓ \quad 2$$

$$= 330\ m^3$$

(b) capacity in litres. ✓

$$330\ 000\ L$$

8.                          Find:

9 cm



4 cm

(a) volume

$$\frac{1}{3}\pi r^2 h \quad ①$$

$$\frac{1}{3}\times\pi\times 2^2\times 9$$

$$= 37.7\ cm^3\ (\text{to } 2dp) \quad 2$$

(b) surface area

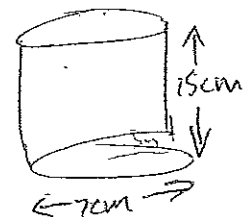$$\pi r^2 + \pi r l \qquad l = \sqrt{9^2 + 2^2}$$

$$\therefore l = \sqrt{85} ✓$$

$$\pi\times 2^2 + \pi\times 2\times\sqrt{85} \quad ✓$$

$$= 70.49\ cm^2\ (\text{to } 2dp) \quad ③$$

$$3$$

9. An aluminum can has a diameter of 7cm and a height of 15cm. How many square centimetres do we need to make the can? What is the capacity of the can?

$$SA = 2(\pi r^2) + 2\pi r h$$



15cm, ←7cm→, $V = \pi r^2 h$

$$2(\pi\times 3.5^2) + 2\times\pi\times 3.5\times 15 \quad ② $$

$$= 406.84\ cm^2\ (\text{to } 2dp)$$

$\therefore$ we need $406.84\ cm^2$ to make the can

$\therefore$ the capacity is $577.27\ mL$ ✓ ②

$$V = \pi\times 3.5^2\times 15$$

$$= 577.27\ cm^3\ (\text{to } 2dp)$$

10. Write as powers of 5

(a) 125.  $5^3$  ✓

(b) $25^m = (5^2)^m = 5^{2m}$

(c) $\dfrac{1}{25} = 5^{-2}$  ✓

(d) $\sqrt{5} \times 25$
$= 5^{1/2} \times 5^{2} = 5^{5/2}$

11. Simplify

(a) $(m^7)^3 = m^{21}$  ✓

(b) $\dfrac{x^{13}}{x^4 \times x^3} = \dfrac{x^{13}}{x^7} = x^6$  ✓

(c) $2^{101} \div 2^{21} = 2^{80}$  ✓

(d) $(4x^2)^3 = 64x^6$  ✓

(e) $5x^0 = 5$  ✓

(f) $2^{m-3} \times 8^{2m+1}$
$= 2^{m-3} \times (2^3)^{2m+1}$
$= 2^{m-3} \times 2^{6m+3}$
$= 2^{7m}$

12. Evaluate

(a) $49^{-\frac{1}{2}}$  $\dfrac{1}{\sqrt{49}} = \dfrac{1}{7}$  ✓

(b) $16^{\frac{3}{4}}$  $\sqrt[4]{16^3} = 8$  ✓

(c) $\left(6\frac{1}{4}\right)^{\frac{1}{2}} = \sqrt{6\frac{1}{4}} = \sqrt{\dfrac{25}{4}}$
$= 2.5$  ✓

13. Write in index form

(a) $\sqrt[3]{b^2} = b^{\frac{2}{3}}$  ✓

(b) $\dfrac{1}{x^4} = x^{-4}$  ✓

(c) $\dfrac{1}{\sqrt[5]{y^3}} = y^{-\frac{3}{5}}$  ✓