I.G.C.S.E. Similarity

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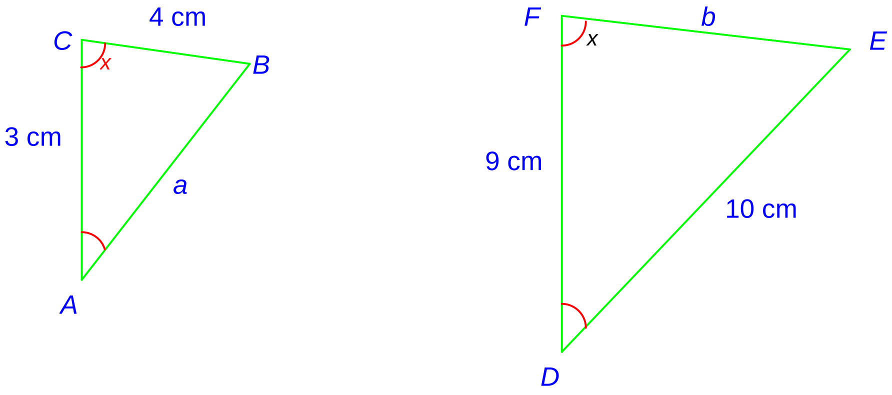
You can access the solutions from the end of each question

Question 1

1. Find the sides marked with letters.



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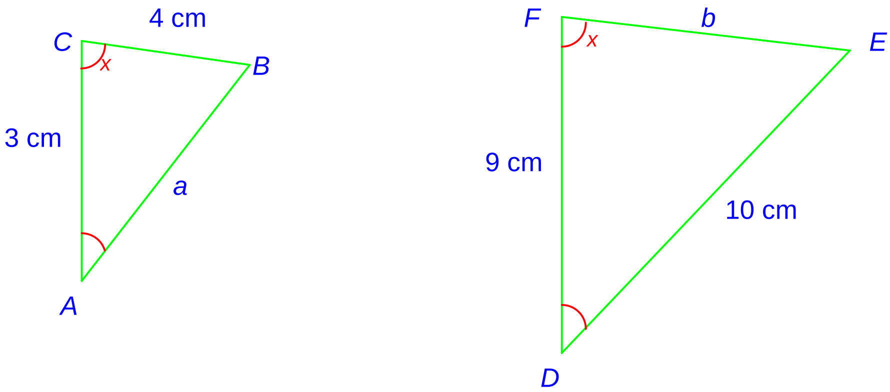
Solution to question 1

Consider $\triangle ABC$ and $\triangle DEF$.



We have $\hat{A} = \hat{D}$

$\hat{B} = \hat{E}$

$\hat{C} = \hat{F}$

Hence $\dfrac{AB}{DE} = \dfrac{BC}{EF} = \dfrac{CA}{FD}$

$$\frac{a}{10} = \frac{4}{b} = \frac{3}{9}$$

$$\Rightarrow \frac{a}{10} = \frac{3}{9} \Rightarrow \frac{a}{10} = \frac{1}{3} \quad \Rightarrow a = \frac{10}{3} = 3\frac{1}{2}\text{ cm}$$

$$\Rightarrow \frac{4}{b} = \frac{3}{9} \Rightarrow \frac{4}{b} = \frac{1}{3} \quad \Rightarrow b = 12\text{ cm}$$

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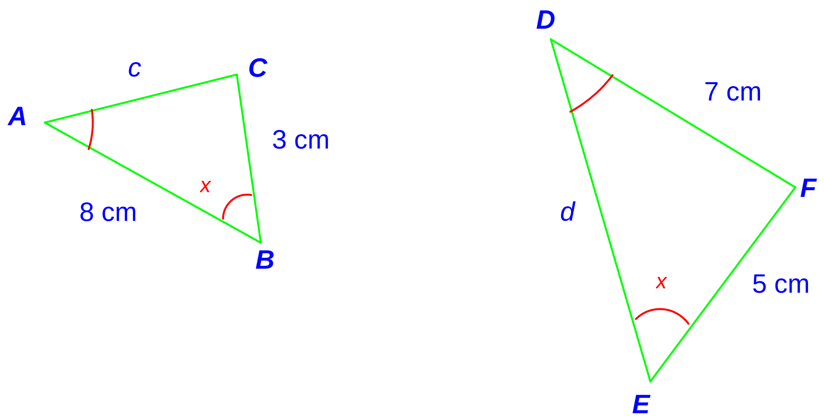
Question 2

Find the sides marked with letters.



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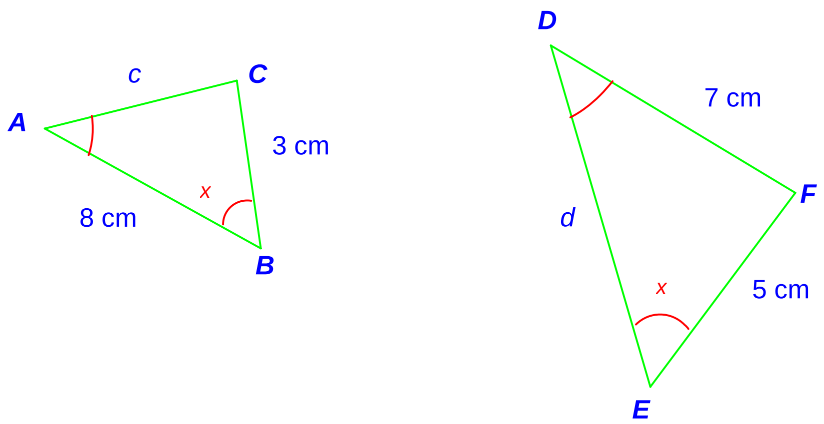
Solution to question 2

Consider $\triangle ABC$ and $\triangle DEF$.



We have $\hat{A} = \hat{D}$

$\hat{B} = \hat{E}$

$\hat{C} = \hat{F}$

Hence $\dfrac{AB}{DE} = \dfrac{BC}{EF} = \dfrac{CA}{FD}$

$$\frac{8}{d} = \frac{3}{5} = \frac{6}{7}$$

$$\Rightarrow \frac{c}{7} = \frac{3}{5} \Rightarrow 5c = 21 \quad \Rightarrow c = \frac{21}{5} = 4\frac{1}{5}\text{ cm}$$

$$\Rightarrow \frac{8}{d} = \frac{3}{5} \Rightarrow 40 = 3d \quad \Rightarrow b = \frac{40}{3} = 13\frac{1}{3}\text{ cm}$$

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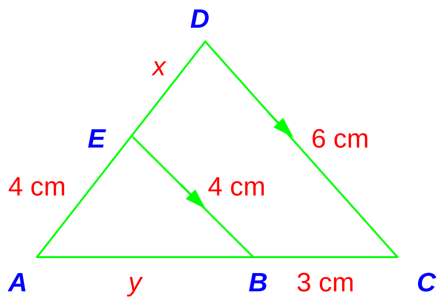
Question 3

Find the sides marked with letters.



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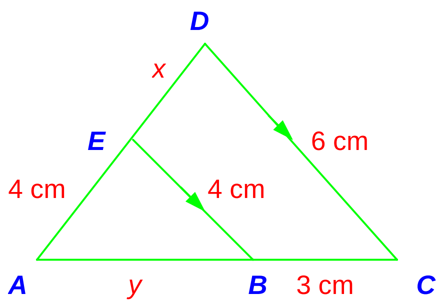
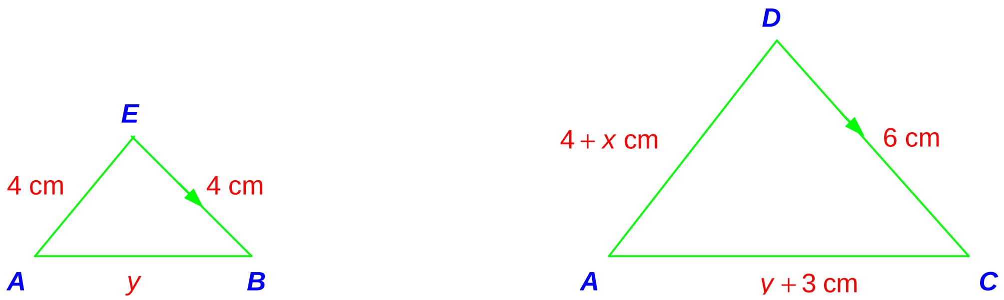
Solution to question 3



$\triangle ABE$ and $\triangle ACD$ are similar



We have $\hat{A} = \hat{A}$ (same angle in both triangles)

$\hat{B} = \hat{C}$ (corresponding angles)

$\hat{E} = \hat{D}$ (corresponding angles)

Hence $\dfrac{AB}{AC} = \dfrac{BE}{CD} = \dfrac{EA}{DA}$ $\quad \dfrac{y}{y+3} = \dfrac{4}{6} = \dfrac{4}{4+x}$

$$\Rightarrow \frac{4}{6} = \frac{4}{4+x} \Rightarrow \frac{2}{3} = \frac{4}{4+x}$$

$$\Rightarrow 2(4+x) = 12 \Rightarrow 8 + 2x = 12 \Rightarrow 2x = 4 \quad \Rightarrow x = 2 \text{ cm}$$

$$\Rightarrow \frac{4}{6} = \frac{y}{y+3} \Rightarrow 4(y+3) = 6y \Rightarrow 4y + 12 = 6y \Rightarrow 12 = 2y \quad \Rightarrow y = 6 \text{ cm}$$

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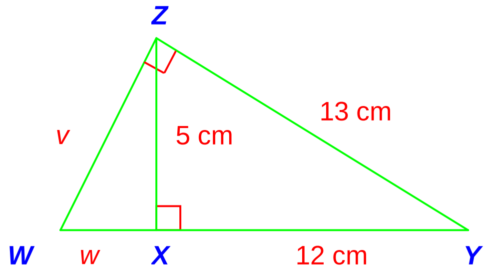
Question 4

Find the sides marked with letters.



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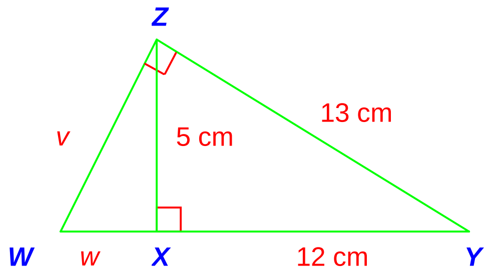
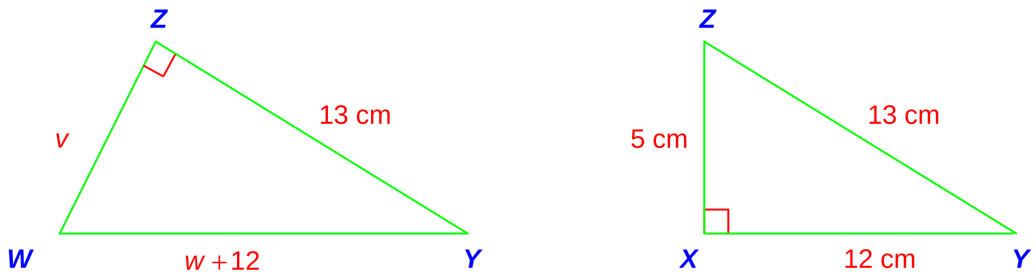
Solution to question 4



$\triangle WYZ$ and $\triangle ZYX$ are similar



We have $\hat{W} = \hat{Z}$

$\hat{Y} = \hat{Y}$ (same angle in both triangles)

$\hat{Z} = \hat{X}$ (both right-angles)

Hence $\dfrac{WY}{ZY} = \dfrac{YZ}{YX} = \dfrac{ZW}{XZ}$ $\quad \dfrac{w+12}{13} = \dfrac{13}{12} = \dfrac{v}{5}$

$$\Rightarrow \frac{13}{12} = \frac{v}{5} \Rightarrow 65 = 12v \quad \Rightarrow v = \frac{65}{12} = 5\frac{5}{12} \text{ cm}$$

$$\Rightarrow \frac{w+12}{13} = \frac{13}{12} \Rightarrow 12(w+12) = 169 \Rightarrow 12w + 144 = 25 \Rightarrow 12w = 25$$

$$\Rightarrow w = \frac{25}{12} = 2\frac{1}{12} \text{ cm}$$

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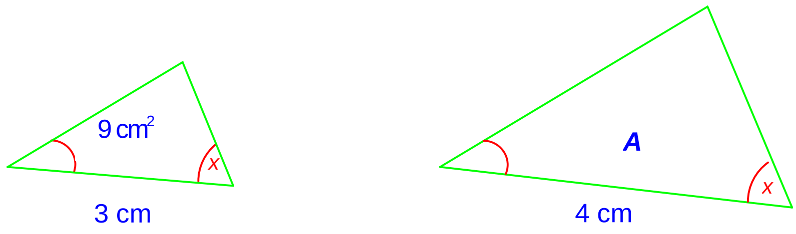
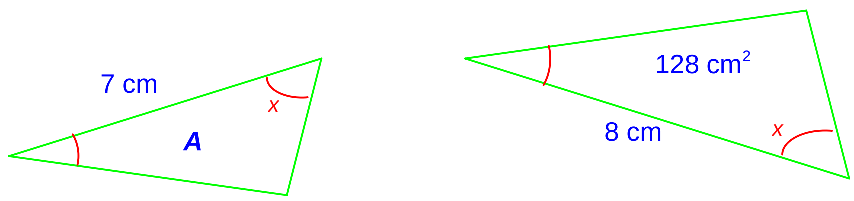
Question 5

Find the missing area in each of the following similar triangles.

a.



b.



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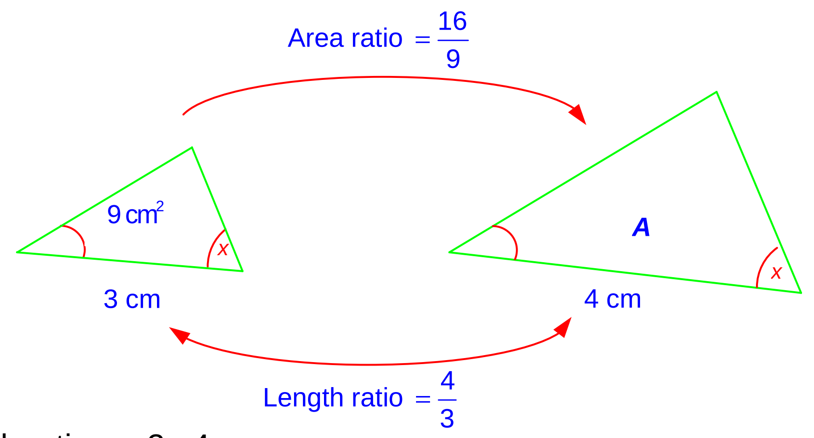
Solution to question 5

a.



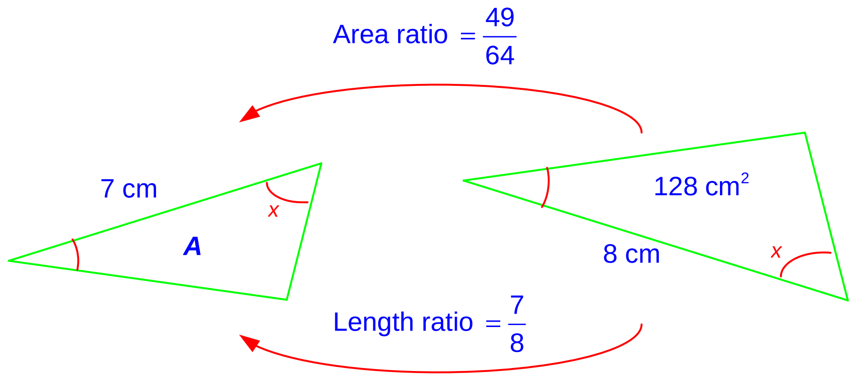
Length ratio 3 : 4

Area ratio $3^2 : 4^2 = 9 : 16$

$$\text{Area of the larger triangle} = \frac{16}{9} \text{ area of the smaller triangle}$$

$$A = \frac{16}{9} \times 9 = 16\,\text{cm}^2$$

b.



Length ratio 7 : 8

Area ratio $7^2 : 8^2 = 49 : 64$

$$\text{Area of the smaller triangle} = \frac{49}{64} \text{ area of the larger triangle}$$

$$A = \frac{49}{64} \times 128 = 98\,\text{cm}^2$$

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Question 6

Two spheres have radii of 3 cm and 5 cm respectively. If the volume of the smaller sphere is $27\,cm^3$, find the volume of the larger sphere.

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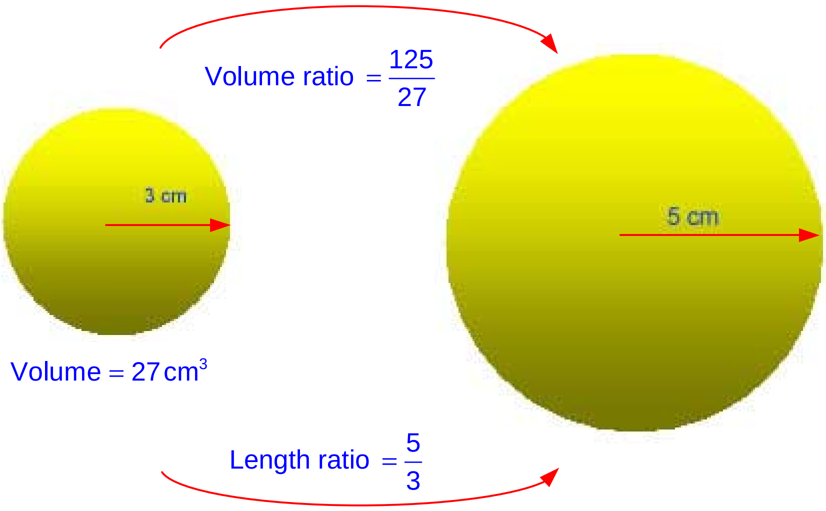
Solution to question 6



Length ratio   3 : 5
Area ratio $3^3 : 5^3 = 27 : 125$

Volume of the larger sphere $= \dfrac{125}{27}$ volume of the smaller triangle

$$V = \frac{125}{27} \times 27 = 125\,\text{cm}^3$$

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Question 7

Two similar jugs have volumes of 54 cm^3 and 1024 cm^3 respectively. If the height of the larger jug is 64 cm, find the height of the smaller jug.

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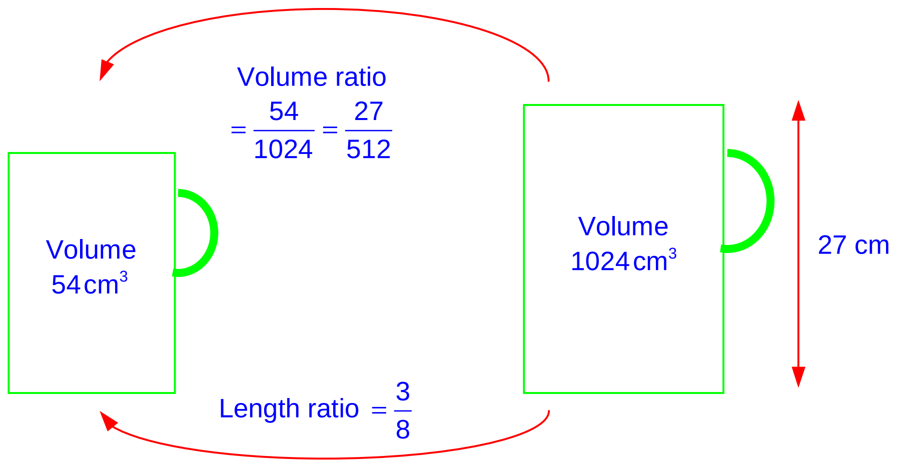
Solution to question 7



Volume ratio $\quad 54 : 1024 = 27 : 512$

Length ratio $\quad \sqrt[3]{27} : \sqrt[3]{512} = 3 : 8$

Height of the smaller jug $= \frac{3}{8}$ of the height of the larger jug.

$$= \frac{3}{8} \times 64 = 24\,cm^3$$

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Question 8

The surface areas of two similar model ships are $4\,\text{m}^2$ and $25\,\text{m}^2$ respectively.

a. If the length of the larger model is 75 m, find the length of the smaller model.

b. If the volume of the smaller model is $32\ \text{m}^3$, find the volume of the larger model.

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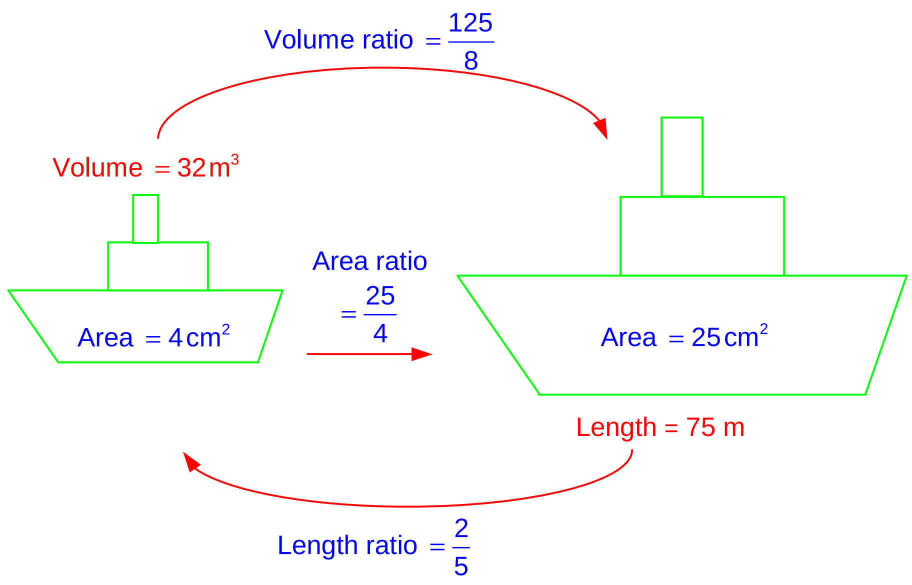
Solution to question 8



Area ratio 4 : 2

a. Length ratio $= \sqrt{4} : \sqrt{25} = 2 : 5$

Length of the smaller model $= \frac{2}{5}$ of the larger model

$$= \frac{2}{5} \times 75 = 30\,m$$

b. Volume ratio $= 2^3 : 5^3 = 8 : 125$

Volume of the larger model $= \frac{125}{8}$ of the smaller model

$$= \frac{125}{8} \times 32 = 500\,m^3$$

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