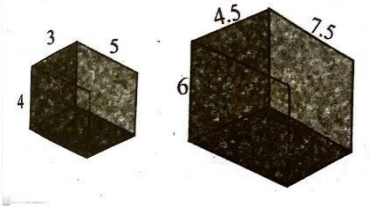
# 9th class Math Exercise 9.1

Q. 1 Find whether the solids are similar. All lengths are in cm .




Solution:

Let $L_1$, $W_1$ and $h_1$ are length, width and height of smaller cuboid. $L_2$, $W_2$ and $h_2$ are length, width and height of larger cuboid. The ratios of corresponding sides:

$\frac{L_1}{L_2} = \frac{5}{7.5} = \frac{2}{3}$ ----------(i)

Now, $\frac{W_1}{W_2} = \frac{3}{4.5} = \frac{2}{3}$ ----------(ii)

Now, $\frac{h_1}{h_2} = \frac{4}{6} = \frac{2}{3}$ ----------(iii)

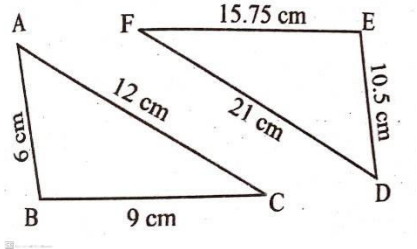


From (i), (ii) and (iii)

$$\frac{L_1}{L_2} = \frac{W_1}{W_2} = \frac{h_1}{h_2}$$

Since ratios of corresponding sides are equal so the given solids (cuboid) are similar.

Q. 2 In triangle ABC , the sides are given as $m\overline{AB} = 6$ cm, $m\overline{BC} = 9$ cm and $m\overline{CA} = 12$ cm. In triangle DEF , the sides are given as $m\overline{DE} = 10.5$ cm, $m\overline{EF} = 15.75$ cm , and $mFD = 21$ cm. Prove that the triangles are similar.




Solution:

In $\triangle ABC$,

$$m\overline{AB} = 6 \text{ cm}, m\overline{BC} = 9 \text{ cm}, m\overline{CA} = 12 \text{ cm}$$

In $\triangle DEF$.

$$\mathrm{m}\overline{\mathrm{DE}} = 10.5\ \mathrm{cm},\ \mathrm{m}\overline{\mathrm{EF}} = 15.75\ \mathrm{cm},\ \mathrm{m}\overline{\mathrm{FD}} = 21\ \mathrm{cm}$$

Now, take ratios of corresponding sides:

$$\frac{\mathrm{m}\overline{\mathrm{AB}}}{\mathrm{mDE}} = \frac{6\ \mathrm{cm}}{10.5\ \mathrm{cm}} = \frac{60}{105} = \frac{4}{7}$$ ----------(i)

$$\frac{\mathrm{m}\overline{\mathrm{BC}}}{\mathrm{m}\overline{\mathrm{EF}}} = \frac{9\ \mathrm{cm}}{15.75\ \mathrm{cm}} = \frac{900}{1575} = \frac{4}{7}$$ ----------(ii)

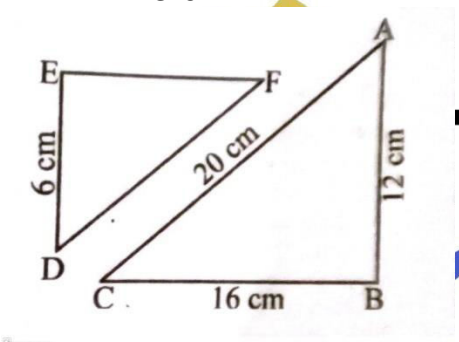
$$\frac{\mathrm{mAC}}{\mathrm{mACD}} = \frac{12\ \mathrm{cm}}{21\ \mathrm{cm}} = \frac{4}{7}$$ ----------(iii)

From (i), (iii) and (iii)

$$\frac{\mathrm{m}\overline{\mathrm{AB}}}{\mathrm{mDE}} = \frac{\mathrm{m}\overline{\mathrm{BC}}}{\mathrm{mEF}} = \frac{\mathrm{m}\overline{\mathrm{CA}}}{\mathrm{mFD}}$$

Since, ratios of corresponding sides are equal which proves that triangles are similar.

Q. 3 In the figure below, $\triangle ABC \sim \triangle DEF$. $\mathrm{mAB} = 12\ \mathrm{cm}, \mathrm{mAC} = 20\ \mathrm{cm}$ and $\mathrm{mBC} = 16\ \mathrm{cm}$. In $\triangle \mathrm{DEF}$, $\mathrm{mADE} = 6\ \mathrm{cm}$. Find mDF and mEF .






Solution:

In $\triangle \mathrm{ABC}$, $\mathrm{m}\overline{\mathrm{AB}} = 12\ \mathrm{cm}$, $\mathrm{m}\overline{\mathrm{BC}} = 16\ \mathrm{cm}$, $\mathrm{m}\overline{\mathrm{AC}} = 20\ \mathrm{cm}$ In $\triangle \mathrm{DEF}$,

$$\mathrm{mDE} = 6\ \mathrm{cm}, \mathrm{mEF} = x, \mathrm{mDF} = y$$

Since $\triangle \mathrm{ABC} \sim \triangle \mathrm{DEF}$ (Given)

So ratios of corresponding sides are equal i.e.

$$\frac{\text{mAB}}{\text{mDE}} = \frac{\text{mBC}}{\text{mBF}} = \frac{\text{m}\overline{\text{AC}}}{\text{mDI}}$$

$$\frac{12}{6} = \frac{16}{x} = \frac{20}{\text{y}}$$

$$\Rightarrow \frac{12}{6} = \frac{16}{x} \text{ and } \frac{12}{6} = \frac{20}{\text{y}}$$

$$\Rightarrow 2 = \frac{16}{x}, \quad 2 = \frac{20}{\text{y}}$$

$$2x = 16, \quad 2y = 20$$

$$x = \frac{16}{2}, \quad y = \frac{20}{2}$$

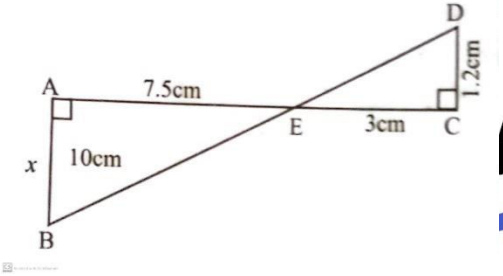
$$x = 8, \quad y = 10$$

Thus $\text{m}\overline{\text{EF}} = 8 \text{ cm}$ and $\text{m}\overline{\text{DF}} = 10 \text{ cm}$

Q. 4 Find the value of $x$ in each of the following.

(i)

Solution:






In the given diagram we can see two similar triangles $\triangle \text{ABE}$ and $\triangle \text{EDC}$. This is because $\angle \text{BAE} = \angle \text{DEC} = 90°$ and $\angle \text{AEB} = \angle \text{DCE}$ (vertically opposite angles). The ratios of corresponding sides of similar triangles are equal:

$$\frac{\text{m}\overline{\text{AB}}}{\text{mDC}} = \frac{\text{m}\overline{\text{AE}}}{\text{mEC}}$$

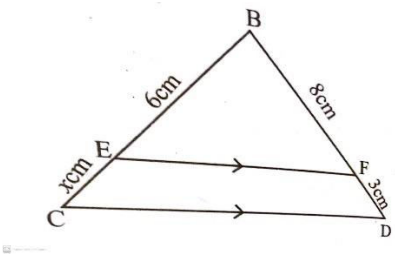
$$\frac{x}{1.2} = \frac{7.5}{3}$$

$$x = \frac{7.5}{3} \times 1.2$$

$$x = 2.5 \times 1.2$$

$$x = 3 \text{ cm}$$

(ii) Solution:




$$\text{mBC} = (6 + x)\text{cm}$$
$$\text{mBD} = (8 + 3)\text{cm} = 11 \text{ cm}$$

Since, $\triangle \text{BEF} \sim \triangle \text{BCD}$

So corresponding sides are proportional.

$$\frac{m\overline{BE}}{m\overline{BC}} = \frac{m\overline{BF}}{m\overline{BD}}$$
$$\frac{6}{6+x} = \frac{8}{11}$$
$$\Rightarrow 11 \times 6 = 8(6 + x)$$
$$66 = 48 + 8x$$
$$66 - 48 = 8x$$
$$18 = 8x$$
$$\frac{18}{8} = x$$
$$\frac{9}{4} = x$$
$$\Rightarrow x = 2.25 \text{ cm}$$

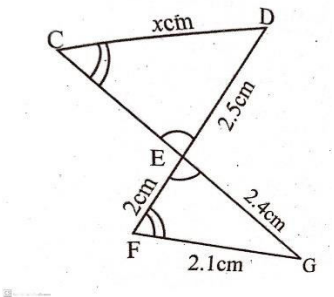


Alternate method

Since $\overline{\text{EF}} \| \overline{\text{CD}}$, so by proportion.

$$\frac{\text{mBE}}{\text{mEC}} = \frac{\text{mBF}}{\text{mFD}}$$
$$\frac{6}{x} = \frac{8}{3}$$
$$6 \times 3 = 8x$$
$$\frac{18}{8} = x$$
$$2.25 = x$$
$$x = 2.25 \text{ cm}$$

(iii) Solution:




In the given triangles,

$\mathrm{m}\angle \mathrm{C} = \mathrm{m}\angle \mathrm{F}$

$\mathrm{m}\angle \mathrm{E} = \mathrm{m}\angle \mathrm{E}$

In two triangles of two angles are equal the third angle must also be equal.

$\mathrm{m}\angle \mathrm{D} = \mathrm{m}\angle \mathrm{G}.$

So $\triangle \mathrm{CDE} \sim \triangle \mathrm{FGE}$

In similar triangles, the ratios of corresponding sides are equal.

corresponding sides are equal.

$$\frac{\mathrm{mCD}}{\mathrm{mFG}} = \frac{\mathrm{mDE}}{\mathrm{mGE}}$$

$$\frac{x}{2.1} = \frac{2.5}{2.4}$$

$$x = \frac{2.5}{2.4} \times 2.1$$

$$x = \frac{5.25}{2.4}$$

$$x = 2.1875$$

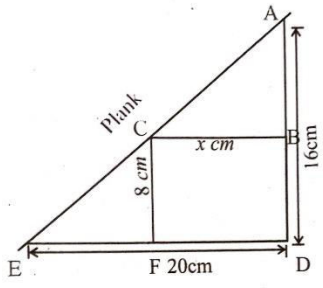
$$\Rightarrow x = 2.19 \text{ cm}$$



Q. 5 A plank is placed straight upstairs that 20 cm wide and 16 cm deep. A rectangular box of height 8 cm and width $x$ cm is placed on a stair under the plank. Find the value of x .

Solution:

First we lable the figure as A,B,C,D,E, F as shown in fig.




Here $\mathrm{m}\overline{\mathrm{CF}} = 8 \text{ cm}$

In rectangle opposite sides are equal

$$m\overline{BD} = m\overline{CF} = 8 \text{ cm}$$
$$\Rightarrow m\overline{BD} = 8 \text{ cm}$$
$$m\overline{AB} = m\overline{AD} - m\overline{BD}$$
$$m\overline{AB} = 16 \text{ cm} - 8 \text{ cm}$$
$$m\overline{AB} = 8 \text{ cm}$$

Since, $\triangle ABC \sim \triangle ADE$, So their corresponding sides are proportional, i.e.

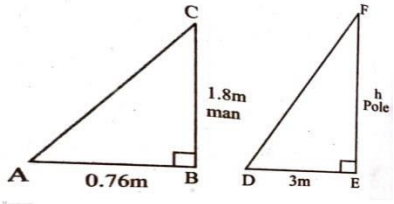
$$\frac{\text{mAB}}{\text{mAD}} = \frac{\text{mBC}}{\text{mDE}}$$
$$\frac{8 \text{ cm}}{16 \text{ cm}} = \frac{x}{20 \text{ cm}}$$
$$\frac{8}{16} \times 20 \text{ cm} = x$$
$$\frac{160 \text{ cm}}{16} = x$$
$$10 \text{ cm} = x$$
$$\Rightarrow x = 10 \text{ cm}$$



Q. 6 A man who is 1.8 m tall cats a shadow of a 0.76 m in length. If at this same time a telephone pole casts a 3 m shadow, find the height of the pole. 09309011

Solution:

Since, $\triangle ABC \sim \triangle DEF$



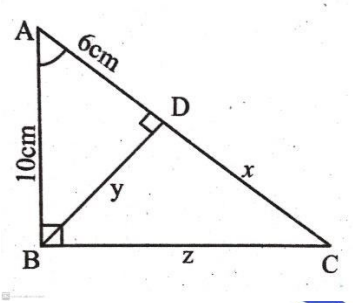

So ratios of corresponding sides are equal.

$$\frac{\text{m}\overline{\text{AB}}}{\text{mDE}} = \frac{\text{m}\overline{\text{BC}}}{\text{mEF}}$$
$$\frac{0.76\ \text{m}}{3\ \text{m}} = \frac{1.8\ \text{m}}{\text{h}}$$
$$\Rightarrow \frac{3}{0.76} = \frac{\text{h}}{1.8}$$
$$\Rightarrow \frac{3}{0.76} \times 1.8 = \text{h}$$
$$\Rightarrow \frac{5.4}{0.76} = \text{h}$$
$$\Rightarrow \text{h} = 7.11\ \text{m}$$

This height of pole is 7.11 m .

Q. 7 Find the values of $x, y$ and $z$ of the given figure.

Solution:






In right-angled $\triangle ABD$, by Pythagoras theorem $(m\overline{AB})^2 = (m\overline{BD})^2 + (m\overline{AD})^2$

$$(10\ \text{cm})^2 = y^2 + (6\ \text{cm})^2$$
$$100\ \text{cm}^2 = y^2 + 36\ \text{cm}^2$$
$$100\ \text{cm}^2 - 36\ \text{cm}^2 = y^2$$
$$64\ \text{cm}^2 = y^2$$
$$\Rightarrow \sqrt{y^2} = \sqrt{64\ \text{cm}^2}$$
$$y = 8\ \text{cm}$$

In right-angled $\triangle ABC$,

$$(\text{m}\overline{\text{AC}})^2 = (\text{m}\overline{\text{AB}})^2 + (\text{m}\overline{\text{BC}})^2$$
$$(x+6)^2 = (10)^2 + z^2$$
$$x^2 + 12x + 36 = 100 + z^2 \ \ldots\ldots \text{(i)}$$

Now, in right angled $\triangle BDC$

$$z^2 = x^2 + y^2$$

put it in eq. (i)

$$x^2 + 12x + 36 = 100 + x^2 + y^2$$
$$x^2 + 12x + 36 = 100 + x^2 + 64 \ (\because y = 8 \text{ cm})$$
$$x^2 + 12x + 36 = 164 + x^2$$
$$x^2 + 12x - x^2 = 164 - 36$$
$$12x = 128$$
$$x = \frac{128}{12} = \frac{32}{3}$$
$$x = 10\frac{2}{3} \text{ cm}$$

Now, putting the value of $x$ and $y$ in eq. (ii)

$$z^2 = \left(10\frac{2}{3}\right)^2 + (8)^2$$
$$z^2 = \left(\frac{32}{3}\right)^2 + (8)^2$$
$$z^2 = \frac{1024}{9} + 64$$
$$z^2 = \frac{1024 + 576}{9}$$



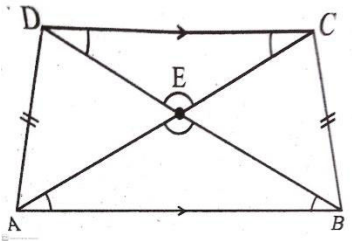
$$\sqrt{z^2} = \sqrt{\frac{1600}{9}}$$
$$z = \frac{40}{3}$$
$$z = 13\frac{1}{3} \text{ cm}$$

Q. 8 Draw an isosceles trapezoid ABCD where $\overline{AB} \| \overline{CD}$ and $m\overline{AB} > m\overline{CD}$.

Draw diagonals $\overline{AC}$ and $\overline{BD}$, intersecting at **E**. Prove that $\triangle ABE$ is similar to $\triangle CDE$. If $m\overline{AB} = 8$ cm, $mCD = 4$ cm, and $mAE = 3$ cm, find the length of $\overline{CE}$.

Solution:

(i) In $\triangle ABE$ and $\triangle CDE, \overline{AB} \| \overline{CD}$.




[vertically opposite angles]

$$\mathrm{m}\angle \mathrm{ECD} = \mathrm{m}\angle \mathrm{EAB}$$

[alternate angles of||lines]

$$\mathrm{m}\angle \mathrm{EDC} = \mathrm{m}\angle \mathrm{EBA}$$

[alternate angles of||lines]

Since three corresponding angles are of triangles are equal which proves that given triangles are similar.

(ii) $\mathrm{m}\overline{\mathrm{AB}} = 8\ \mathrm{cm}$

$$\mathrm{m}\overline{\mathrm{CD}} = 4\ \mathrm{cm}$$
$$\mathrm{m}\overline{\mathrm{AE}} = 3\ \mathrm{cm}$$
$$\mathrm{m}\overline{\mathrm{CE}} = x = ?$$

In similar triangles ratios of corresponding sides are equals.

$$\frac{m\overline{AB}}{m\overline{CD}} = \frac{m\overline{AE}}{m\overline{CE}}$$

$$\frac{8\ \mathrm{cm}}{4\ \mathrm{cm}} = \frac{3\ \mathrm{cm}}{x}$$

$$2 = \frac{3\ \mathrm{cm}}{x}$$

$$\Rightarrow x = \frac{3}{2}\ \mathrm{cm}$$

$$x = 1.5\ \mathrm{cm}$$

Thus $\mathrm{m}\overline{\mathrm{CE}}$ is 1.5 cm .

Q. 9 A regular dodecagon has its side length decreased by a factor of $\frac{1}{\sqrt{2}}$. If the perimeter of the original dodecagon is 72 cm . What is the side length of scaled dodecagon?

Solution:

Perimeter of original dodecagon $= \mathbb{P} = 72\ \mathrm{cm}$ length reducing factor $= \frac{1}{\sqrt{2}}$

We know that regular dodecagon has 12 equal sides, so

$$\text{Perimeter} = 12 \times L$$
$$72 = 12 \times L$$
$$\frac{72}{12} = L$$
$$6 = 1$$
$$\Rightarrow L = 6 \text{ cm}$$

Since length of original dodecagon is reduced by a factor $\frac{1}{\sqrt{2}}$, so,

$$\text{Length of reduced dodecagon} = \frac{1}{\sqrt{2}} \times 6 \text{ cm}$$
$$= \frac{1}{\sqrt{2}} \times 2 \times 3 \text{ cm}$$
$$= \frac{2}{\sqrt{2}} \times 3 \text{ cm}$$
$$= \sqrt{2} \times 3 \text{ cm}$$
$$= 3\sqrt{2} \text{ cm}$$