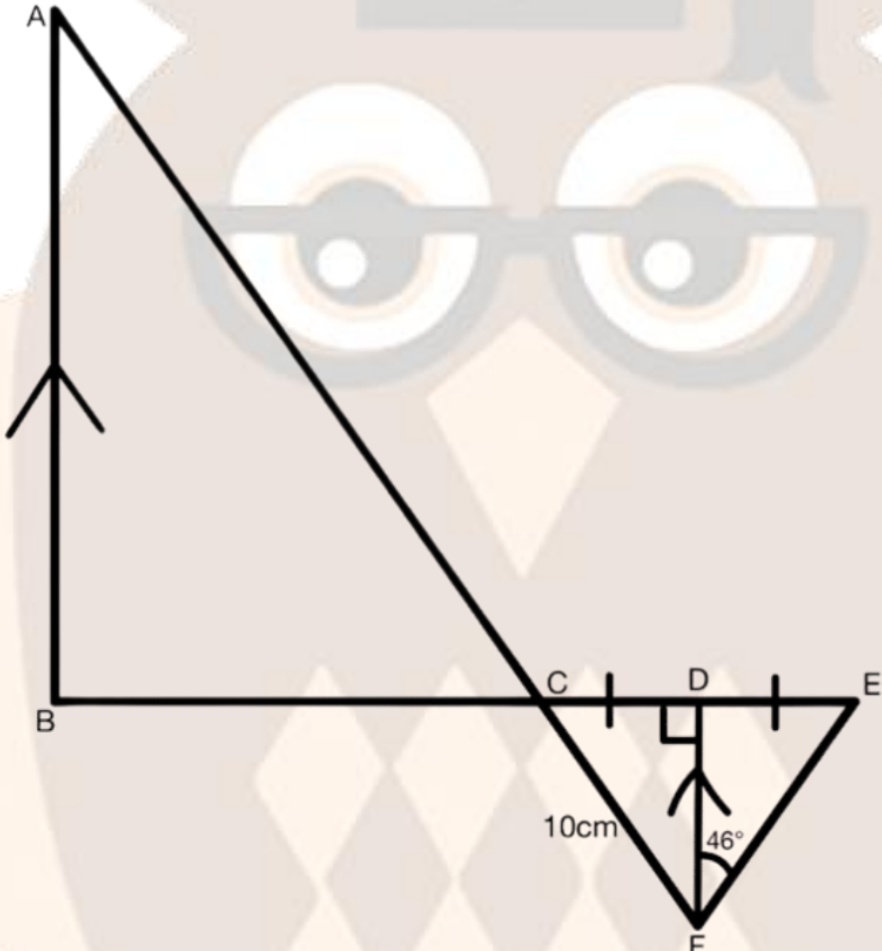
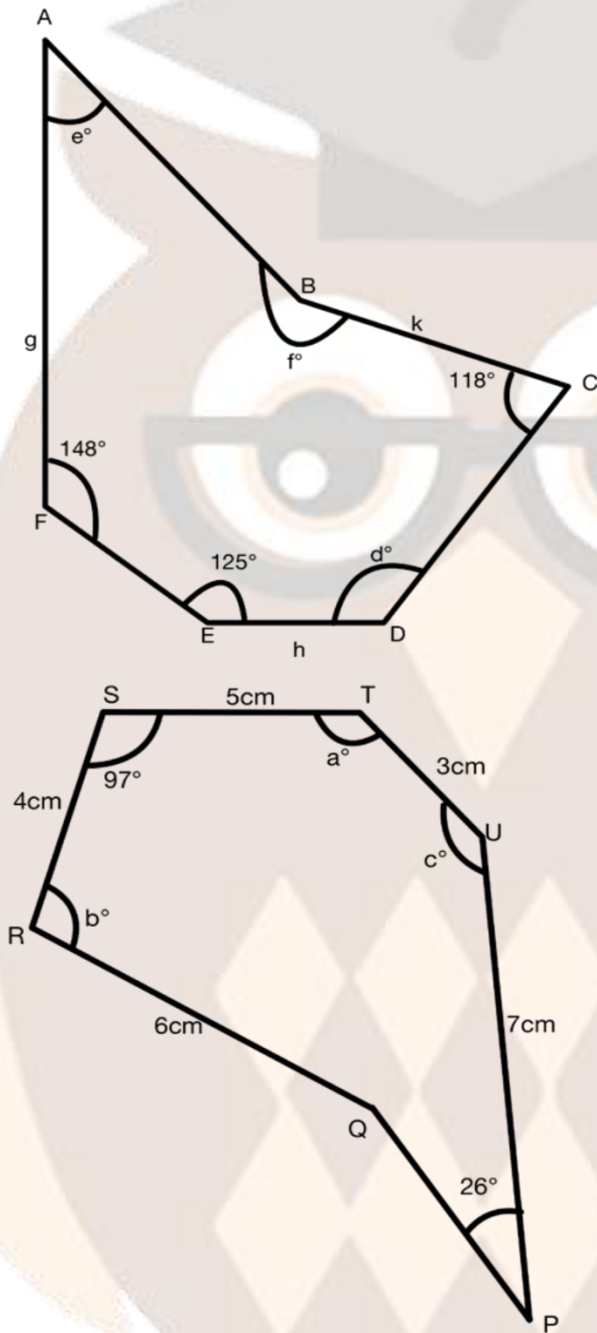


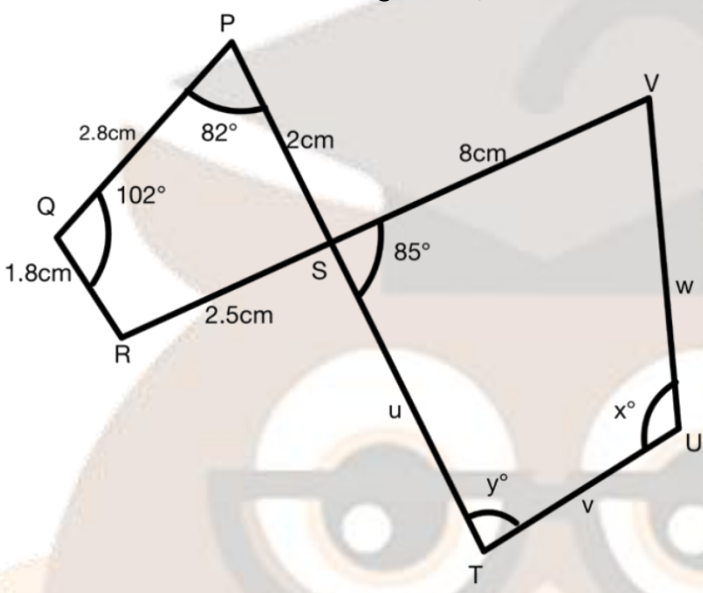
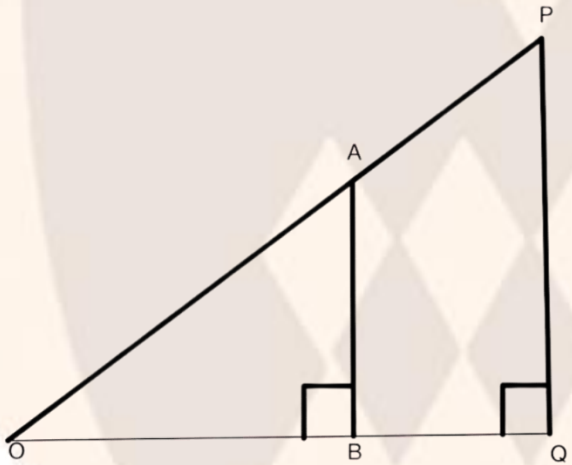
7 ESSENTIAL QUESTIONS TO MASTER CONGRUENCE & SIMILARITY

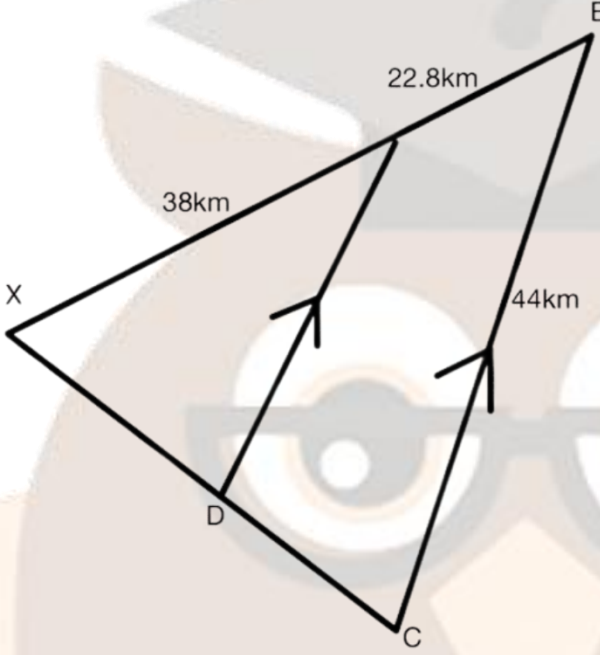
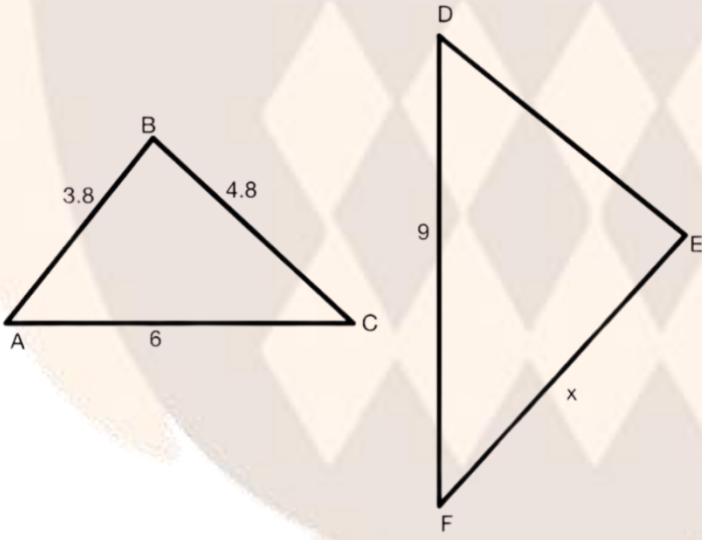
1	In the figure below, BCDE and ACF are straight lines.  The length of CE is $\frac{1}{2}$ the length of BC. (a) What can you conclude about $\angle FCD$ and $\angle FED$? Explain your answer. (b) Hence, show that $\angle ACB = 44^\circ$ (c) What can you conclude about $\angle FCD$ and $\angle ACB$? Explain your answer. (d) Hence, find the length of AC.	
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2

Find the value of each unknown.



3	Given that RSV and PST are straight lines, find the value of each unknown. 	
4	The diagram below shows a light source placed at O. When a person, AB, stands between the light source and a wall, a shadow, PQ, is cast on the wall. The person is 7.2 m from the light source and the light source is 12 m from the base of the wall, Q.  $\triangle OAB$ and $\triangle OPQ$ are similar triangles. (a) If the shadow cast on the wall is 2.75 m, find the height of the person. (b) If the person moves 0.6 m nearer to the light source, find the new height of the shadow cast on the wall.	

5	The diagram below shows towns A, B, C, and D. X is a gas station. Town A is 38 km from the gas station and 22.8 km from town B. Town B is 44 km from town C.  $\triangle ADX$ and $\triangle BCX$ are similar triangles. (a) Find the distance between town A and town D. (b) Town C is 52.8 km from the gas station. Find the distance between town C and town D.	
6	In the diagram, $\triangle ABC$ and $\triangle DEF$ are similar. Calculate the value of x. The dimensions given are in m. 	

7	In the figure below, TUV is a straight line. The ratio of the length of UW to that of TW is 3:1. Find the ratio of (i) the area of $\triangle TVW$ to that of $\triangle UVW$ (ii) the area of $\triangle SVU$ to that of $\triangle STU$ 	
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Answer Key:

1	(a) $CD = ED$ FD is common $\angle CDF = \angle EDF = 90^\circ$ $\triangle FCD \cong \triangle FED$ (b) Since $\triangle FCD \cong \triangle FED$, $\angle CFD = \angle EFD = 46^\circ$ $\angle CDF + \angle CFD + \angle DCF = 180^\circ$ (angle sum of a triangle) $90^\circ + 46^\circ + \angle DCF = 180^\circ$ $\angle DCF = 180^\circ - 90^\circ - 46^\circ = 44^\circ$ $\angle ACB = \angle DCF$ (vert. opp. angles) $= 44^\circ$ (shown) (c) $\angle ACB = \angle FCD = 44^\circ$ (vert. opp. angles) $\angle ABC = \angle FDC = 90^\circ$ (alt. angles, $BA \parallel FD$) $\angle BAC = \angle DFC = 46^\circ$ (alt. angles, $BA \parallel FD$) $\triangle FCD$ and $\triangle ACB$ are of the same shape.	
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	The size of $\triangle FCD$ is smaller than that of $\triangle ACB$. $\triangle FCD$ and $\triangle ACB$ are similar. (d) Given that $CE = \frac{1}{2}BC$, $CD = \frac{1}{2}CE = \frac{1}{2}\left(\frac{1}{2}BC\right) = \frac{1}{4}BC$ $\frac{CD}{BC} = \frac{1}{4}$ $\frac{FC}{AC} = \frac{CD}{BC}$ $\frac{10}{AC} = \frac{1}{4}$ $AC = 10 \times 4 = 40 \text{ cm}$	
2	From the figure, since $ABCDEF \cong PQRSTU$, $\angle STU = \angle DEF$ $a^\circ = 125^\circ$ $a = 125$ $\angle QRS = \angle BCD$ $b^\circ = 118^\circ$ $b = 118$ $\angle PUT = \angle AFE$ $c^\circ = 148^\circ$ $c = 148$ $\angle CDE = \angle RST$ $d^\circ = 97^\circ$ $d = 97$ $\angle BAF = \angle QPU$ $e^\circ = 26^\circ$ $e = 26$ $\angle ABC = \angle PQR$ $f^\circ = (4 \times 180^\circ) - (97^\circ + 26^\circ + 125^\circ + 118^\circ + 148^\circ)$ $= 720^\circ - 514^\circ$ $= 206^\circ$ $f = 206$ $AF = PU$ $g = 7 \text{ cm}$ $DE = ST$ $h = 5 \text{ cm}$ $BC = QR$ $k = 6 \text{ cm}$	
3	From the figure, PQRS and VUTS are similar. $\angle PSR = \angle VST$ (vert. opp. $\angle$s) $= 85^\circ$ Since $\angle PSR = \angle VST$,	

	$\angle VUT = \angle PQR$ $x^\circ = 102^\circ$ $x = 102$ $\angle QRS = 360^\circ - 102^\circ - 82^\circ - 85^\circ = 91^\circ$ $\angle STU = \angle SRQ$ $y^\circ = 91^\circ$ $y = 91$ $\frac{VU}{PQ} = \frac{VS}{PS}$ $\frac{w}{2.8} = \frac{8}{2}$ $w = 4 \times 2.8$ $w = 11.2 \text{ cm}$ $\frac{ST}{SR} = \frac{SV}{SP}$ $\frac{u}{2.5} = \frac{8}{8}$ $\frac{2.5}{2} = \frac{8}{8}$ $u = 4 \times 2.5$ $= 10 \text{ cm}$ $\frac{TU}{RQ} = \frac{SV}{SP}$ $\frac{v}{1.8} = \frac{8}{8}$ $\frac{1.8}{2} = \frac{8}{8}$ $v = 4 \times 1.8$ $= 7.2 \text{ cm}$	
4	(a) $\frac{AB}{PQ} = \frac{OB}{OQ}$ $\frac{AB}{2.75} = \frac{7.2}{12}$ $AB = \frac{7.2}{12} \times 2.75$ $= 1.65 \text{ m}$ Height of person = 1.65m (b) Let the new height of the shadow cast on the wall be P'Q. $OB = 7.2 - 0.6$ $= 6.6 \text{ m}$ $\frac{AB}{P'Q} = \frac{OB}{OQ}$	

	$\frac{1.65}{P'Q} = \frac{6.6}{12}$ $P'Q = \frac{1.65 \times 12}{6.6}$ $= 3 \text{ m}$ New height of the shadow cast on the wall = 3m	
5	(a) $XB = 38 + 22.8 = 60.8 \text{ km}$ $\frac{AD}{BC} = \frac{XA}{XB}$ $\frac{44}{AD} = \frac{60.8}{38}$ $AD = \frac{38}{60.8} \times 44 = 27.5 \text{ km}$ Distance between Town A & Town B is 27.5km. (b) $\frac{XD}{XC} = \frac{XA}{XB}$ $\frac{XD}{52.8} = \frac{38}{60.8}$ $XD = \frac{38}{60.8} \times 52.8$ $= 33 \text{ km}$ Distance between Town C and Town D $= 52.8 - 33 = 19.8 \text{ km}$	
6	$\frac{EF}{BC} = \frac{DF}{AC}$ $\frac{x}{4.8} = \frac{9}{6}$ $x = \frac{3}{2} \times 4.8 = 7.2$	
7	(i) Ratio of areas of $\triangle TVW$ to $\triangle UVW$ Understanding the Relationship: Triangles TVW and UVW share the same height (the perpendicular distance from V to line TU). The ratio of their areas is therefore equal to the ratio of their bases.	

Using the Given Ratio: We know $UW : TW = 3 : 1$. Finding the Ratio: Therefore, the ratio of the area of $\triangle TVW$ to the area of $\triangle UVW$ is $TW : UW = 1 : 3$ (ii) Ratio of areas of $\triangle SVU$ to $\triangle STU$ Understanding the Relationship: Triangles SVU and STU share the same height (the perpendicular distance from S to line TU). The ratio of their areas is therefore equal to the ratio of their bases. Using the Given Ratio: We know $UW : TW = 3 : 1$, which means $TU : TW = 4 : 1$, and $UW : TU = 3 : 4$ Finding the Ratio: Therefore, the ratio of the area of $\triangle SVU$ to the area of $\triangle STU$ is $UV : TU = 3 : 4$	
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