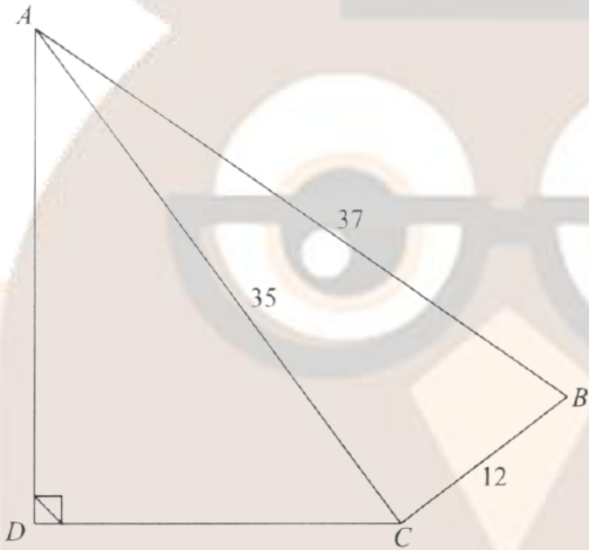
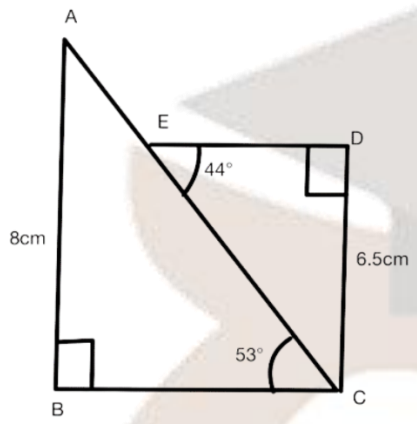
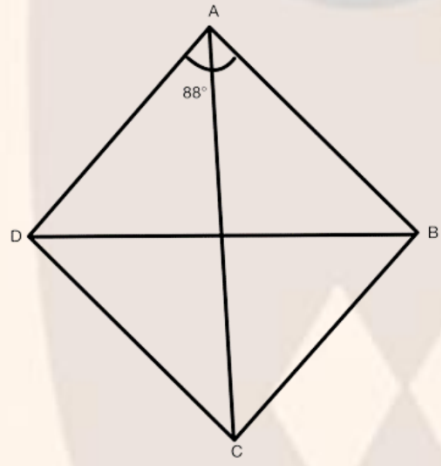
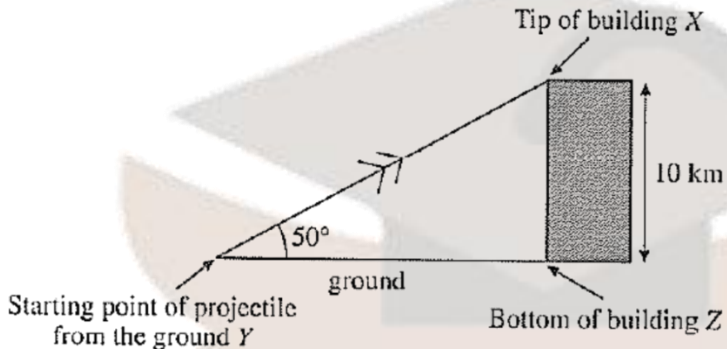
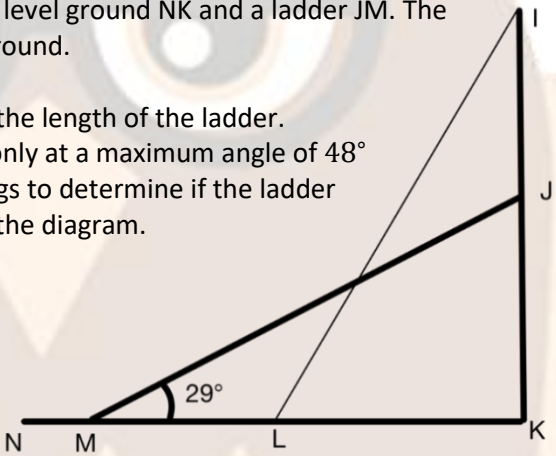


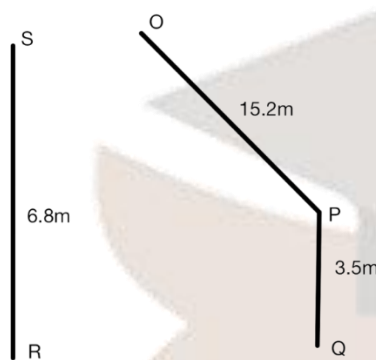
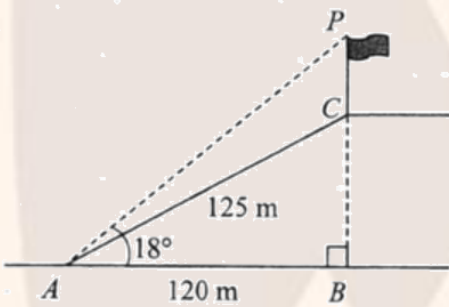
8 ESSENTIAL QUESTIONS TO MASTER

TRIGONOMETRIC FUNCTIONS

1	In the diagram, $BC=12\text{cm}$, $AC=35\text{cm}$ and $AB=37\text{cm}$  (a) Show that $\angle ACB=90^\circ$ (b) Write down the exact value of $\tan BAC$ (c) Given that $\cos CAD=0.8$, find the length of AD (d) Find $\angle BAD$ (e) Find the shortest distance from D to AC	
2	The diagram below shows $\triangle ABC$ and $\triangle CDE$. Given that $AB = 8\text{cm}$, $CD = 6.5\text{cm}$, $\angle ACB = 53^\circ$ and $\angle CED = 44^\circ$, find the lengths of (a) BC (b) DE (c) AE	

		
3	The diagram shows a rhombus ABCD in which $\angle BAD = 88^\circ$ and its perimeter is 32 cm. Find the lengths of (a) AC (b) BD 	
4	Refer to the diagram below, and solve the following:	

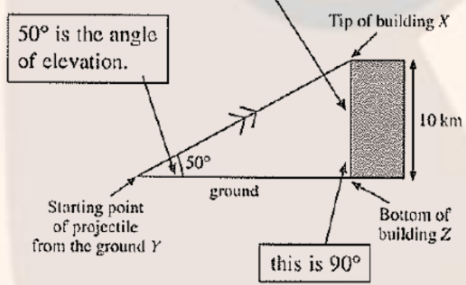
	 A projectile is shot upwards with at an angle of elevation of 50°. Calculate the following: (a) The distance YZ. (b) The distance XY The building is at 90° to the ground.	
5	The diagram shows a wall IK of height 6 m, level ground NK and a ladder JM. The ladder JM forms an angle of 29° with the ground. (a) Given that the distance MK is 7 m, find the length of the ladder. (b) Knowing that the ladder will be stable only at a maximum angle of 48° with the ground, show appropriate workings to determine if the ladder will be stable to reach point I, as shown in the diagram. 	
6	The diagram shows a crane OPQ with vertical base PQ of 3.5 m and boom OP of 15.2 m. There is a building SR of height 6.8 m nearby as well. (a) Given that the crane operator can only move the angle that OP makes to the horizontal, calculate the horizontal distance that the base of the crane must be from the building in order to place an object on top of the building exactly. (b) Calculate the angle that OP makes with the horizontal at the distance calculated in (a).	

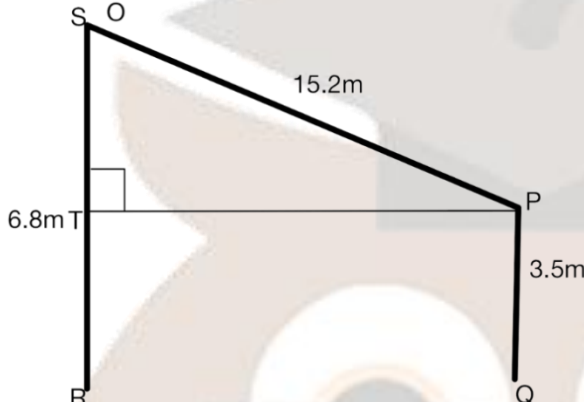
		
7	A boat is moving with regards to 2 checkpoints A and B at sea. The boat is 72 km from B and is moving at a bearing of 146° towards point B. Points A and B are 120 km apart, and the bearing of point A is 228° from point B. Find: (a) the distance of A from the boat. (b) the bearing of A from the boat.	
8	The diagram below shows a vertical flagpole PC placed at the top of the hill. B is vertically below C and angle $ABC = 90^\circ$, angle $PAB = 18^\circ$, $AB = 120$ m and $AC = 125$ m.  Find the height of the flagpole.	

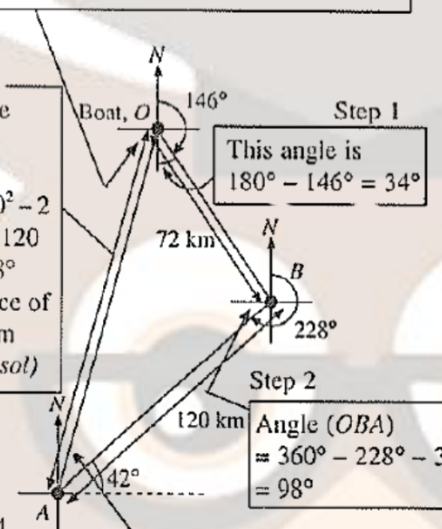
Answer Key:

1	(a) Calculate AB^2: $AB^2 = 37^2 = 1369$ Calculate $AC^2 + BC^2$: $AC^2 + BC^2 = 35^2 + 12^2 = 1225 + 144 = 1369$ Since $AB^2 = AC^2 + BC^2$, the $\triangle ABC$ satisfies the condition of the converse of the Pythagorean theorem. Therefore, $\angle ACB = 90^\circ$ and $\triangle ABC$ is a right-angled triangle. (b) $\frac{12}{35}$	
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	(c) $\frac{AD}{35} = 0.8$ $AD = 28$ (d) $\angle CAD = \cos^{-1}(0.8) = 36.869^\circ$ $\angle BAC = \cos^{-1}\left(\frac{35}{37}\right) = 18.924^\circ$ $\angle BAD = 55.8^\circ$ (e) Let the shortest distance from D to AC be h cm. $\sin 36.869^\circ = \frac{h}{28} \text{ --- (FT their CAD)}$ $h = 28 \sin 36.869 = 16.8$	
2	(a) In $\triangle ABC$, $\tan 53^\circ = \frac{8}{BC}$ Therefore $BC = \frac{8}{\tan 53^\circ}$ $= 6.03 \text{ cm (3 sig. fig.)}$ (b) In $\triangle CDE$, $\tan 44^\circ = \frac{6.5}{DE}$ Therefore $DE = \frac{6.5}{\tan 44^\circ} = 6.73 \text{ cm (3 sig. fig.)}$ (c) In $\triangle ABC$, $\sin 53^\circ = \frac{8}{AC}$ Therefore $AC = \frac{8}{\sin 53^\circ}$ $\approx 10.02 \text{ cm}$ In $\triangle CDE$, $\sin 44^\circ = \frac{6.5}{CE}$ Therefore $CE = \frac{6.5}{\sin 44^\circ}$ $= 9.357 \text{ cm}$ Therefore $AE = AC - CE$ $= 10.02 - 9.357$ $= 0.663 \text{ cm (3 sig. fig.)}$	
3	Part (a)	

	$\angle DAX = 88^\circ \div 2 = 44^\circ$ $AD = 32 \div 4 = 8 \text{ cm}$ In $\triangle ADX$: $\cos 44^\circ = \frac{AX}{8}$ $\therefore AX = 8 \cos 44^\circ = 5.755 \text{ cm}$ $\therefore AC = 5.755 \times 2 = 11.5 \text{ cm (3 sig. fig.)}$ Part (b) In $\triangle ADX$: $\sin 44^\circ = \frac{DX}{8}$ $\therefore DX = 8 \sin 44^\circ = 5.557 \text{ cm}$ $\therefore BD = 5.557 \times 2 = 11.1 \text{ cm (3 sig. fig.)}$	
4	(b) In this right angle triangle, then: $\frac{10}{XY} = \sin 50^\circ \rightarrow XY = 13.1 \text{ km (sol)}$  (a) In this right angle triangle, then: $\frac{10}{YZ} = \tan 50^\circ \rightarrow YZ = 8.4 \text{ km (sol)}$	
5	(a) $\cos 29^\circ = \frac{7}{JM}$ $\cos 29^\circ \times JM = 7$ $JM = \frac{7}{\cos 29^\circ}$ $= 8.0035 \text{ m (5 s.f.)}$ $= 8.00 \text{ m (3 s.f.)}$ (b) $\sin \angle ILK = \frac{6}{8.0035}$ $\angle ILK = \sin^{-1} \frac{6}{8.0035}$	

	$= 48.6^\circ$ (1 d.p.) Therefore, the ladder will not be stable as the angle is greater than 48° .	
6	 (a) $ST = 6.8 - 3.5 = 3.3$ m $TP^2 + 3.3^2 = 15.2^2$ $TP^2 = 15.2^2 - 3.3^2 = 231.04 - 10.89 = 220.15$ $TP = \sqrt{220.15} \approx 14.837$ m (5 s.f.) $TP \approx 14.8$ m (3 s.f.) (b) $\sin \angle OPT = \frac{3.3}{15.2}$ $\angle OPT = \sin^{-1}\left(\frac{3.3}{15.2}\right) \approx 12.5^\circ$ (1 d.p.)	

7	Step 5 This angle is $28.7^\circ + 42^\circ = 70.7^\circ \rightarrow$ bearing of A from the boat = $270^\circ - 70.7^\circ$ $= 199.3^\circ \approx 199^\circ$ Step 3 Using the cosine rule, in triangle OAB: $OA^2 = 72^2 + 120^2 - 2 \times 72 \times 120 \times \cos 98^\circ$ $\rightarrow OA = \text{distance of the boat from A} = 148.3 \text{ km (sol)}$ Step 1 This angle is $180^\circ - 146^\circ = 34^\circ$ Step 2 Angle (OBA) $\approx 360^\circ - 228^\circ - 34^\circ = 98^\circ$ Step 4 In triangle OAB, using the sine rule, $\frac{148.3}{\sin 98^\circ} = \frac{72}{\sin (\text{angle OAB})} \rightarrow$ $\text{Angle OAB} = \sin^{-1} \left(\frac{7.2 \times \sin 98^\circ}{148.3} \right) \rightarrow$ Angle OAB = 28.7° 	
8	$\tan 18^\circ = \frac{PB}{120}$ $PB = 120 \times \tan 18^\circ$ $= 38.990 \text{ (5 s.f.)}$ By the Pythagoras Theorem, $125^2 = 120^2 + BC^2$ $BC^2 = 125^2 - 120^2$ $BC = \sqrt{125^2 - 120^2}$ $= 35$ Height of flagpole = $38.990 - 35$ $= 3.990$ $= 3.99 \text{ m (3 s.f.)}$	