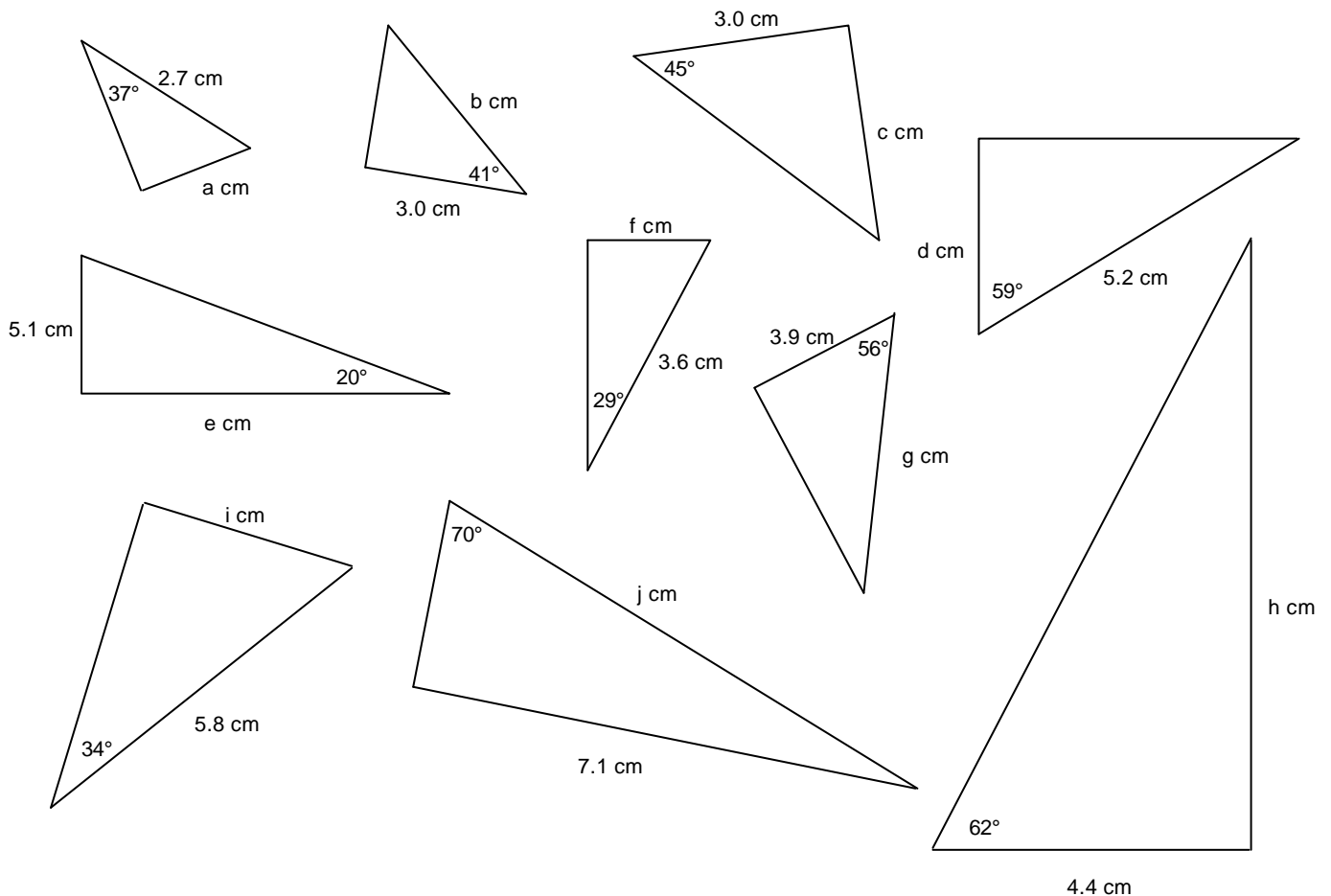
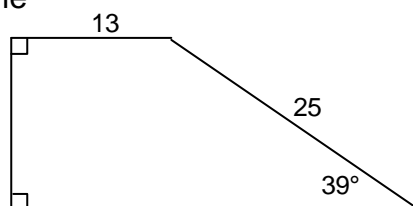


11 Mathematics B Review - Trigonometry

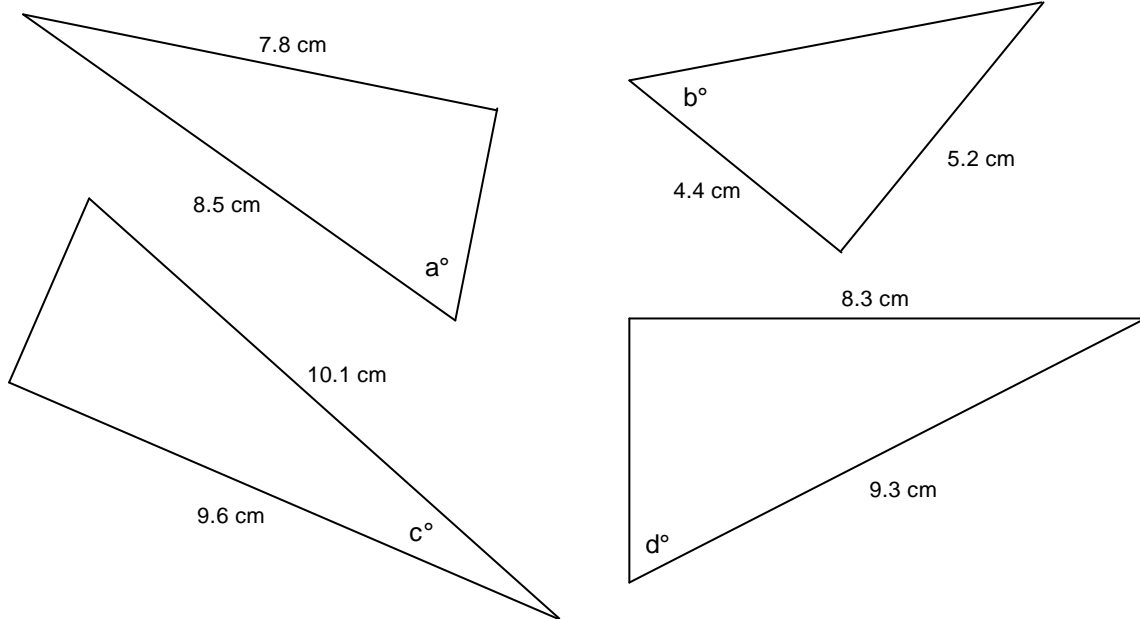
- Write the following accurate to 5 decimal places $\sin 40^\circ$, $\cos 7^\circ 26'$, $\tan \frac{p}{12}$.
- Convert the following angles from degrees to radians:
 $180^\circ, 360^\circ, 90^\circ, 45^\circ, 60^\circ, 30^\circ, 135^\circ, 120^\circ, 150^\circ, 225^\circ, 300^\circ, 330^\circ, 22^\circ, 385^\circ$
- Convert the following angles from radians to degrees:
 $\frac{4p}{3}, \frac{p}{8}, \frac{2p}{9}, \frac{7p}{10}, \frac{3p}{5}, 3$
- Without using a calculator, state which of the following is the same as $\cos 235^\circ$?
 $\cos 35^\circ, -\cos 35^\circ, \cos 55^\circ, -\cos 55^\circ$
- Without using a calculator, state which of the following is the same as $\sin 142^\circ$?
 $\sin 38^\circ, -\sin 38^\circ, \sin 52^\circ, -\sin 52^\circ$
- Without using a calculator, state which of the following is the same as $\tan 336^\circ$?
 $\tan 24^\circ, -\tan 24^\circ, \tan 66^\circ, -\tan 64^\circ$
- Find the marked side in the following right angled triangles.



- Peter stands on the top of a 60 metre high cliff watching a fishing boat sail directly away from him. When first seen, the angle of depression of the boat is 12° . After 7 minutes, the angle of depression of the boat is 3° . What is the speed of the boat?
- Find the perimeter and area of the shape below (measurements in centimetres).

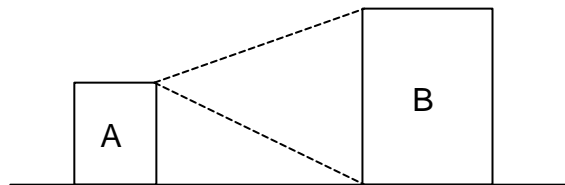
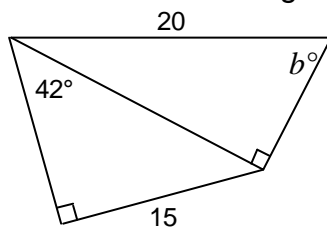


10) Find the marked angle in the following right angled triangles.



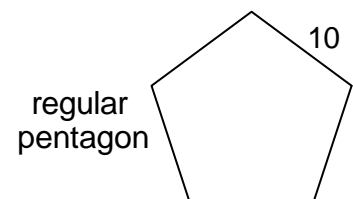
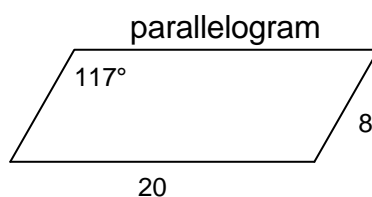
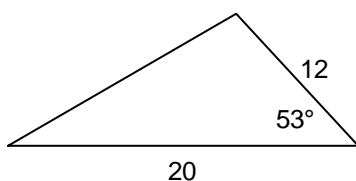
11) A ship sails 7 km west followed by 12 km south. What is the distance and bearing of the ship's finishing position from the starting position? What is the bearing of the starting position from the finishing position?

12) What is the value of b in the diagram below?

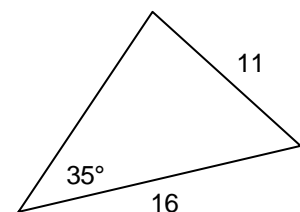
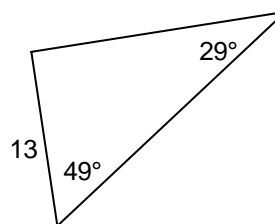
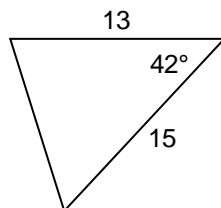
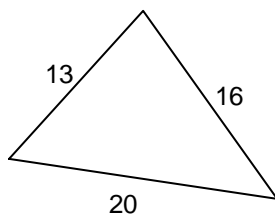


13) Susan stands on the top of a building A looking at a taller building B. The height of building A is 38 metres. The angle of elevation of the top of B is 23° and the angle of depression of the base of B is 27° . Find the height of building B.

14) Calculate the area of each of the following shapes (measurements in metres).



15) Which of the following triangles represents the ambiguous case? For each triangle, calculate the values of the missing sides and angles. In the ambiguous case, find the values for both triangles.



16) A plane travels 200 km on a bearing of 160° followed by 150 km on a bearing of 255° . What is the distance and bearing of the plane's finishing position from the starting position?

17) Susan is walking west along a straight track at a speed of 6 km/h. At 10.30 am she observes Mt. Mathematics on a bearing of 334° . At 2.15 pm, the bearing has changed to 048° . What is the shortest distance between the mountain and the track?

18) Extra practice Ex 6.2, 6.3, 6.4, 6.6, 6.7, 6.9, 6.10, 6.11

Answers

- 1) 0.64279, 0.99160, 0.26795 2) $p, 2p, \frac{p}{2}, \frac{p}{4}, \frac{p}{3}, \frac{p}{6}, \frac{3p}{4}, \frac{2p}{3}, \frac{5p}{6}, \frac{5p}{4}, \frac{5p}{3}, \frac{11p}{6}, 0.384, 6.720$
- 3) $240^\circ, 22\frac{1}{2}^\circ, 40^\circ, 126^\circ, 108^\circ, 171.9^\circ$ 7) 2.0, 4.0, 3.0, 2.7, 14.0, 1.7, 7.0, 8.3, 3.2, 7.6
- 8) 7.4 km/h 9) 86.2 cm, 357.4 cm² 10) 66.6, 49.8, 18.1, 63.2 11) 13.9 km, 210.3°, 033.3°
- 12) 63.7 13) 70 m 14) 95.8 m², 142.6 m², 172.0 m² 15) ambiguous case (11,16,35°)
86.6°, 53.0°, 40.5° and 79.5°, 58.5°, 10.2 and 102°, 26.2, 20,2 and ?, ?, ?
- 16) 239.3 km, 198.6° 17) 14.1 km

$$(7) \quad \sin 37^\circ = \frac{a}{2.7}$$

$$a = 2.7 \sin 37^\circ$$

$$a \approx 1.6$$

$$\cos 41^\circ = \frac{3.0}{b}$$

$$b = \frac{3.0}{\cos 41^\circ}$$

$$b \approx 4.0$$

$$\tan 45^\circ = \frac{c}{3.0}$$

$$c = 3.0 \tan 45^\circ$$

$$c = 3.0$$

$$\cos 59^\circ = \frac{d}{5.2}$$

$$d = 5.2 \cos 59^\circ$$

$$d \approx 2.7$$

$$\tan 20^\circ = \frac{5.1}{e}$$

$$e = \frac{5.1}{\tan 20^\circ}$$

$$e \approx 14.0$$

$$\sin 29^\circ = \frac{f}{3.6}$$

$$f = 3.6 \sin 29^\circ$$

$$f \approx 1.7$$

$$\cos 56^\circ = \frac{3.9}{g}$$

$$g = \frac{3.9}{\cos 56^\circ}$$

$$g \approx 7.0$$

$$\tan 62^\circ = \frac{h}{4.4}$$

$$h = 4.4 \tan 62^\circ$$

$$h \approx 8.3$$

$$\sin 34^\circ = \frac{i}{5.8}$$

$$i = 5.8 \sin 34^\circ$$

$$i \approx 3.2$$

$$\sin 70^\circ = \frac{7.1}{j}$$

$$j = \frac{7.1}{\sin 70^\circ}$$

$$j \approx 7.6$$

$$(8) \tan 12^\circ = \frac{60}{AB}$$

$$AB = \frac{60}{\tan 12^\circ}$$

$$\tan 3^\circ = \frac{60}{AC}$$

$$AC = \frac{60}{\tan 3^\circ}$$

distance moved by the boat

$$= AC - AB$$

$$= \frac{60}{\tan 3^\circ} - \frac{60}{\tan 12^\circ}$$

$$= 862.5903947 \text{ m.}$$

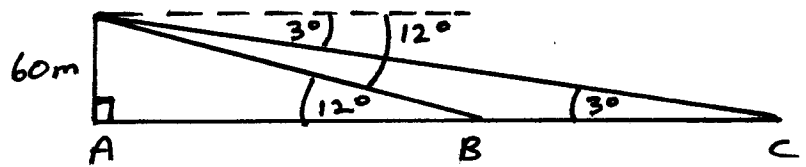
Speed of boat

$$= \frac{862.5903947}{7} \text{ m/min}$$

$$= 123.2271992 \text{ m/min}$$

$$= 123.2271992 \times \frac{60}{1000} \text{ km/h}$$

$$= 7.4 \text{ km/h}$$



$$(9) \sin 39^\circ = \frac{z}{25}$$

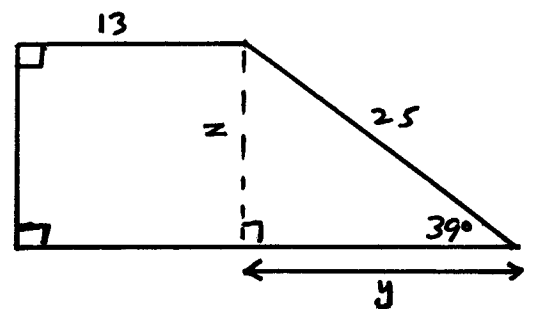
$$z = 25 \sin 39^\circ$$

$$z = 15.73300978$$

$$\cos 39^\circ = \frac{y}{25}$$

$$y = 25 \cos 39^\circ$$

$$y = 19.42864904$$



perimeter

$$= 25 + (2 \times 13) + 15.73300978 + 19.42864904$$

$$= 86.2$$

area

$$= \frac{1}{2} (13 + [13 + 19.42864904]) \times 15.73300978$$

$$= 357.4$$

$$(10) \quad \sin a^\circ = \frac{7.8}{8.5}$$

$$a^\circ = \sin^{-1}\left(\frac{7.8}{8.5}\right)$$

$$a \approx 66.6$$

$$\cos c^\circ = \frac{9.6}{10.1}$$

$$c^\circ = \cos^{-1}\left(\frac{9.6}{10.1}\right)$$

$$c \approx 18.1$$

$$\tan b^\circ = \frac{5.2}{4.4}$$

$$b^\circ = \tan^{-1}\left(\frac{5.2}{4.4}\right)$$

$$b \approx 49.8$$

$$\sin d^\circ = \frac{8.3}{9.3}$$

$$d^\circ = \sin^{-1}\left(\frac{8.3}{9.3}\right)$$

$$d \approx 63.2$$

(11)

$$\tan \theta^\circ = \frac{12}{7}$$

$$\theta = 59.7$$

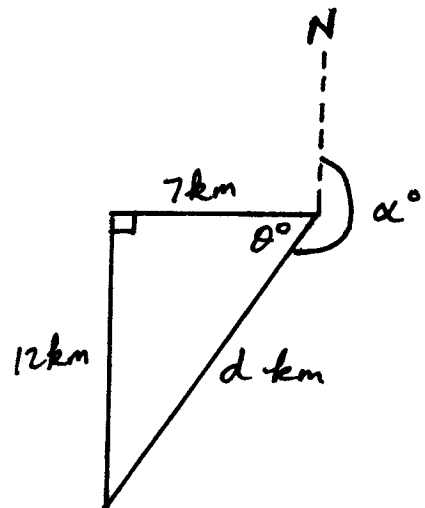
$$\alpha = 270 - 59.7 = 210.3$$

by Pythagoras' Theorem:

$$d^2 = 7^2 + 12^2$$

$$d = 13.9$$

\therefore The distance and bearing of the finishing point from the starting point are 13.9 km and 210.3° .



The bearing of the starting point from the finishing point is $210.3^\circ - 180^\circ$ or 030.3° .

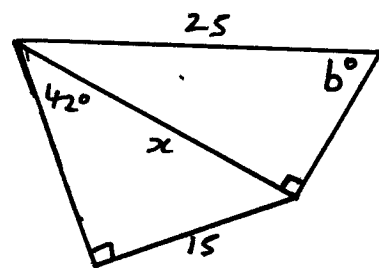
$$(12) \quad \sin 42^\circ = \frac{15}{x}$$

$$x = \frac{15}{\sin 42^\circ}$$

$$\sin b^\circ = \frac{x}{25}$$

$$\sin b^\circ = \frac{15}{25 \sin 42^\circ}$$

$$b = 63.7$$



(13)

$$\tan 27^\circ = \frac{38}{d}$$

$$d = \frac{38}{\tan 27^\circ}$$

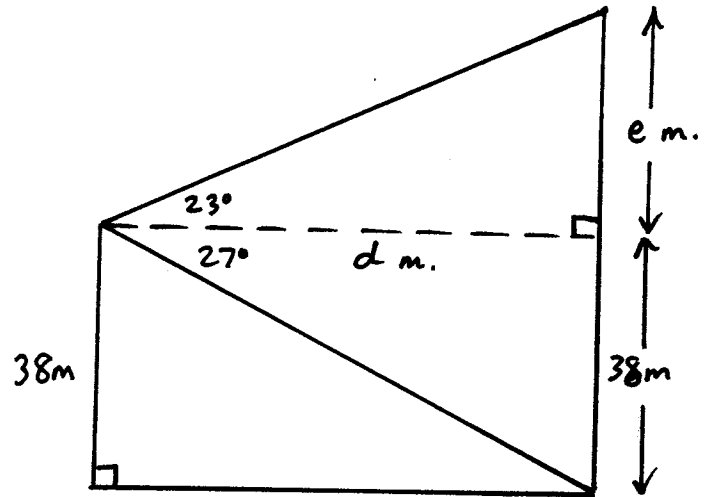
$$d = 74.57919921$$

$$\tan 23^\circ = \frac{e}{d}$$

$$e = 74.57919921 \tan 23^\circ$$

$$e = 31.65699188$$

$$\begin{aligned} \therefore \text{height of building B} \\ &= 38 + 31.65699188 \text{ m} \\ &= 70 \text{ m.} \end{aligned}$$



(14) area of triangle
 $= \frac{1}{2} ab \sin C$
 $= \frac{1}{2} \times 20 \times 12 \times \sin 53^\circ$
 $= 95.8$

area of parallelogram
 $= 2 \times \frac{1}{2} ab \sin C$
 $= 2 \times \frac{1}{2} \times 20 \times 8 \times \sin 117^\circ$
 $= 142.6$

Consider regular pentagon as five isosceles triangles one of which is shown opposite.

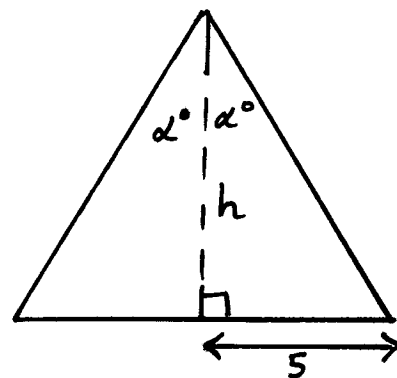
$$\alpha = \frac{360}{10} = 36$$

$$\tan 36^\circ = \frac{5}{h}$$

$$h = \frac{5}{\tan 36^\circ}$$

$$h = 6.881909602$$

$$\begin{aligned} \therefore \text{area of pentagon} \\ &= 5 \times \left(\frac{1}{2} \times 10 \times 6.881909602 \right) \\ &= 172.0 \end{aligned}$$



(15) using Cosine Rule:

$$\cos \alpha^\circ = \frac{13^2 + 20^2 - 16^2}{2 \times 13 \times 20}$$

$$\alpha = 53.0$$

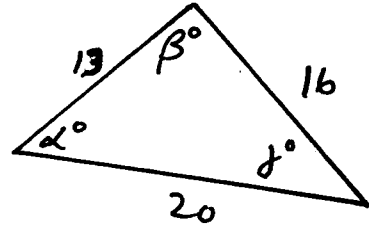
$$\cos \beta^\circ = \frac{13^2 + 16^2 - 20^2}{2 \times 13 \times 16}$$

$$\beta = 86.6$$

$$\cos \gamma^\circ = \frac{20^2 + 16^2 - 13^2}{2 \times 20 \times 16}$$

$$\gamma = 40.5$$

\therefore Angles are $53.0^\circ, 86.6^\circ, 40.5^\circ$



by Cosine Rule:

$$x^2 = 13^2 + 15^2 - 2 \times 13 \times 15 \times \cos 42^\circ$$

$$x = 10.2065429$$

by Sine Rule:

$$\frac{\sin \alpha^\circ}{15} = \frac{\sin 42^\circ}{10.2065429}$$

$$\sin \alpha^\circ = \frac{15 \sin 42^\circ}{10.2065429}$$

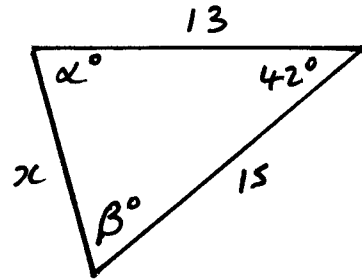
$$\alpha = 79.5409159$$

β

$$= 180 - 42 - 79.5409159$$

$$= 58.4590841$$

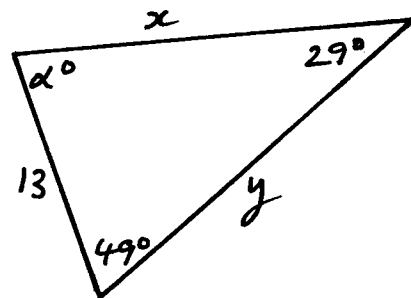
\therefore The missing measurements are $10.2 \text{ cm}, 79.5^\circ, 58.5^\circ$.



α

$$= 180 - 49 - 29$$

$$= 102$$



by Sine Rule :

$$\frac{x}{\sin 49^\circ} = \frac{13}{\sin 29^\circ}$$

$$x = \frac{13 \sin 49^\circ}{\sin 29^\circ}$$

$$x = 20.2372728$$

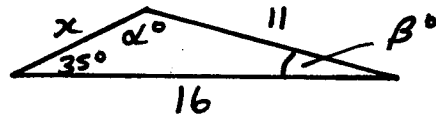
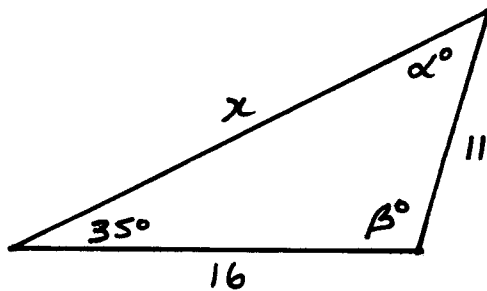
by Sine Rule :

$$\frac{y}{\sin 102^\circ} = \frac{13}{\sin 29^\circ}$$

$$y = \frac{13 \sin 102^\circ}{\sin 29^\circ}$$

$$y = 26.22868499$$

∴ The missing measurements are 20.2cm, 26.2cm, 102°



by Sine Rule :

$$\frac{\sin \alpha^\circ}{16} = \frac{\sin 35^\circ}{11}$$

$$\sin \alpha^\circ = \frac{16 \sin 35^\circ}{11}$$

$$\alpha = 56.54229196$$

$$\text{or } 180 - 56.54229196$$

$$\alpha = 56.54229196$$

$$\text{or } 123.457708$$

If $\alpha = 56.54229196$;

β

$$= 180 - 35 - 56.54229196$$

$$= 88.45770804$$

by Sine Rule :

$$\frac{x}{\sin 88.45770804^\circ} = \frac{11}{\sin 35^\circ}$$

$$x = \frac{11 \sin 88.45770804^\circ}{\sin 35^\circ}$$

$$x = 19.17096718$$

If $\alpha = 123.457708$;

$$\begin{aligned} \beta &= 180 - 35 - 123.457708 \\ &= 21.542292 \end{aligned}$$

by Sine Rule:

$$\frac{x}{\sin 21.542292^\circ} = \frac{11}{\sin 35^\circ}$$

$$x = \frac{11 \sin 21.542292^\circ}{\sin 35^\circ}$$

$$x = 7.041898249$$

∴ The missing measurements are:

$$19.2 \text{ cm}, 56.5^\circ, 88.5^\circ$$

OR

$$7.0 \text{ cm}, 123.5^\circ, 21.5^\circ$$

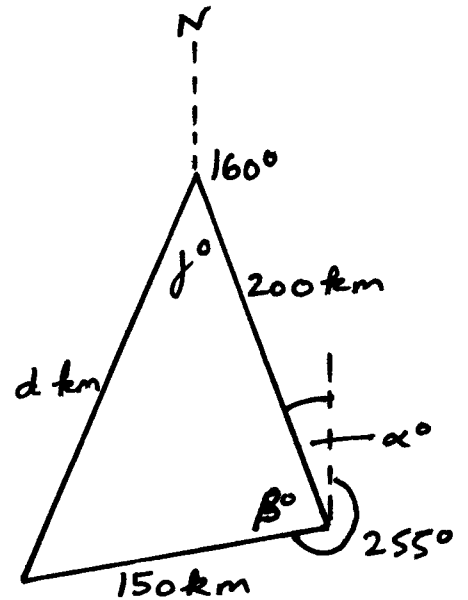
(16) α
 $= 180 - 160$ (co-interior angles)
 $= 20$

β
 $= 360 - 20 - 255$ (angles in a complete turn)
 $= 85$

by Cosine Rule:

$$d^2 = 200^2 + 150^2 - 2 \times 200 \times 150 \times \cos 85^\circ$$

$$d = 239.3128819$$



by Sine Rule:

$$\frac{\sin j^\circ}{150} = \frac{\sin 85^\circ}{239.3128819}$$

$$\sin j^\circ = \frac{150 \sin 85^\circ}{239.3128819}$$

$$j = 38.63884957$$

$$160 + j = 198.63884957$$

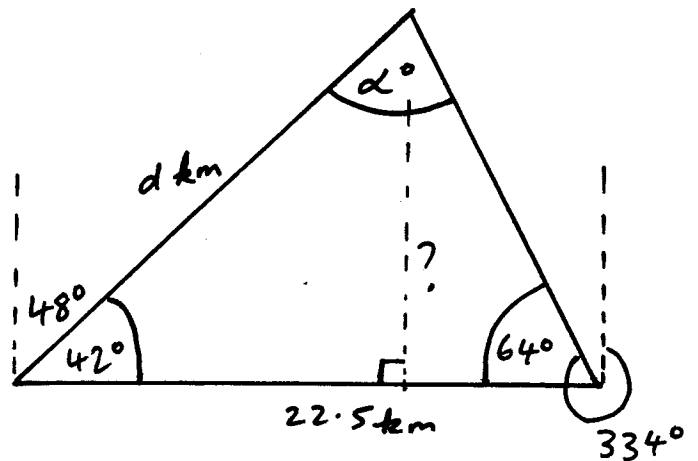
∴ The distance and bearing of finish from the start are 239.3 km and 198.6° .

(17)

time spent walking
= $3\frac{3}{4}$ hours

distance walked
= $3\frac{3}{4} \times 6$ km
= 22.5 km

α
= $180 - 42 - 64$
= 74



by Sine Rule:

$$\frac{d}{\sin 64^\circ} = \frac{22.5}{\sin 74^\circ}$$
$$d = \frac{22.5 \sin 64^\circ}{\sin 74^\circ}$$

$$d = 21.03783613$$

$$\sin 42^\circ = \frac{\text{shortest distance}}{21.03783613}$$

\therefore shortest distance
= $21.03783613 \sin 42^\circ$
= 14.1 km.