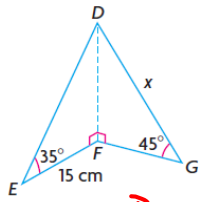
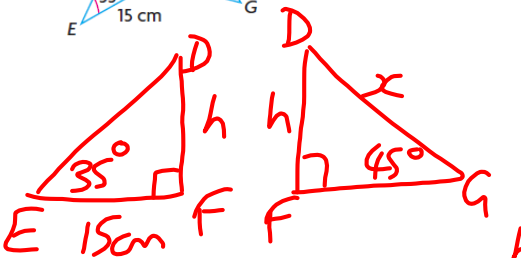
Solutions

3. Determine the value of x to the nearest centimetre and θ to the nearest degree. Explain your reasoning for each step of your solution.

a)





$\tan 35 = \frac{h}{15}$

$15\tan 35 = h$

$h = 10.5\text{cm}$

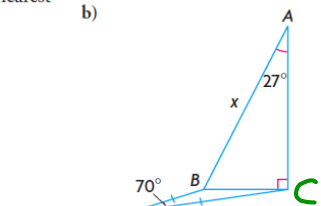
$\sin 45 = \frac{h}{x}$

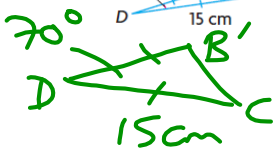
$x = \frac{h}{\sin 45}$

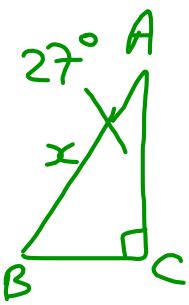
$x = \frac{10.5}{\sin 45}$

$x = 15\text{cm}$

b)







$\angle B' = \frac{180-70}{2}$

$= \frac{110}{2} = 55°$

$\frac{B'C}{\sin 70} = \frac{15}{\sin 55}$

$B'C = \frac{15\sin 70}{\sin 55}$

$B'C = 17.2\text{cm}$

$B'C = BC$

$\Rightarrow BC = 17.2\text{cm}$

$\sin 27 = \frac{17.2}{x}$

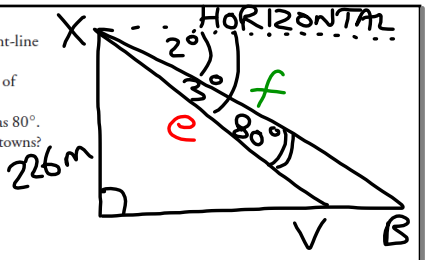
$x = \frac{17.2}{\sin 27}$

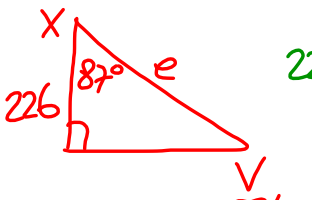
$x = 37.9$

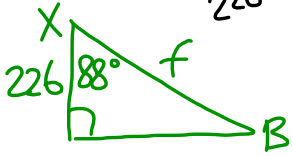
$x = 38\text{cm}$

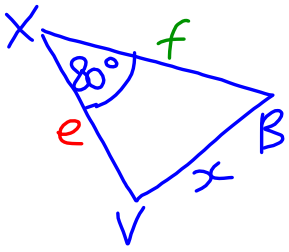
5. While Travis and Bob were flying a hot-air balloon from Beamsville to Vineland in southwestern Ontario, they decided to calculate the straight-line distance, to the nearest metre, between the two towns.
   - From an altitude of 226 m, they simultaneously measured the angle of depression to Beamsville as 2° and to Vineland as 3°.
   - They measured the angle between the lines of sight to the two towns as 80°.

Is there enough information to calculate the distance between the two towns? Justify your reasoning with calculations.









$\cos 87 = \frac{226}{e}$

$e = \frac{226}{\cos 87}$

$e = 4318\text{ m}$

$\cos 88 = \frac{226}{f}$

$f = \frac{226}{\cos 88}$

$f = 6476\text{m}$

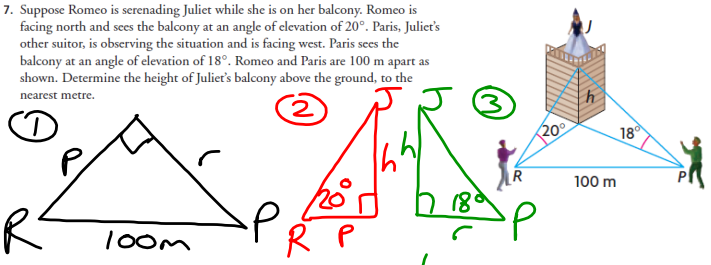
Using cosine law $x^2 = e^2 + f^2 - 2ef\cos X$

$x^2 = 4318^2 + 6476^2 - 2(4318)(6476)\cos 80$

$x^2 = 50872124.21$

$x = \sqrt{ANS} = 7132\text{ metres}$

7. Suppose Romeo is serenading Juliet while she is on her balcony. Romeo is facing north and sees the balcony at an angle of elevation of 20°. Paris, Juliet's other suitor, is observing the situation and is facing west. Paris sees the balcony at an angle of elevation of 18°. Romeo and Paris are 100 m apart as shown. Determine the height of Juliet's balcony above the ground, to the nearest metre.



$\tan 20 = \frac{h}{p}$

$p\tan 20 = h$

$\tan 18 = \frac{h}{r}$

$r\tan 18 = h$

$\Rightarrow p\tan 20 = r\tan 18$

$p = \frac{r\tan 18}{\tan 20}$

Sub into ①

Use Pythagorean Theorem to solve for "r"

$\left(\frac{r\tan 18}{\tan 20}\right)^2 + r^2 = 100^2$

$0.7969r^2 + r^2 = 10000$

$\frac{1.7969r^2}{1.7969} = \frac{10000}{1.7969}$

$r^2 = 5565.046116$

$r = \sqrt{ANS} = 74.6\text{m}$

Sub into ③

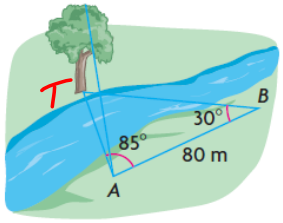
$r\tan 18 = h$

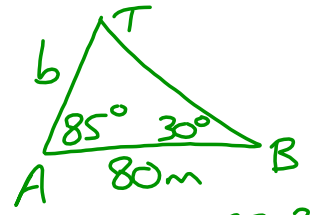
$74.6\tan 18 = h$

$h = 24.2$

$h = 24\text{ metres}$

11. Bert wants to calculate the height of a tree on the opposite bank of a river. To do this, he lays out a baseline 80 m long and measures the angles as shown at the left. The angle of elevation from A to the top of the tree is 28°. Explain if this information helps Bert to calculate the height of the tree to the nearest metre. Justify your reasoning with calculations.





$\angle T = 180 - 85 - 30$

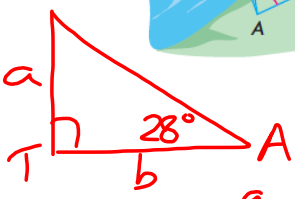
$\angle T = 65°$

SINE LAW to solve for b

$\frac{b}{\sin 30} = \frac{80}{\sin 65}$

$b = \frac{80 \sin 30}{\sin 65}$

$b = 44.1\text{m}$



$\tan A = \frac{a}{b}$

$\tan 28 = \frac{a}{44.1}$

$44.1 \tan 28 = a$

$a = 23.47$

$a = 23$ metres