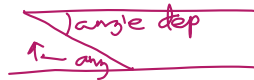
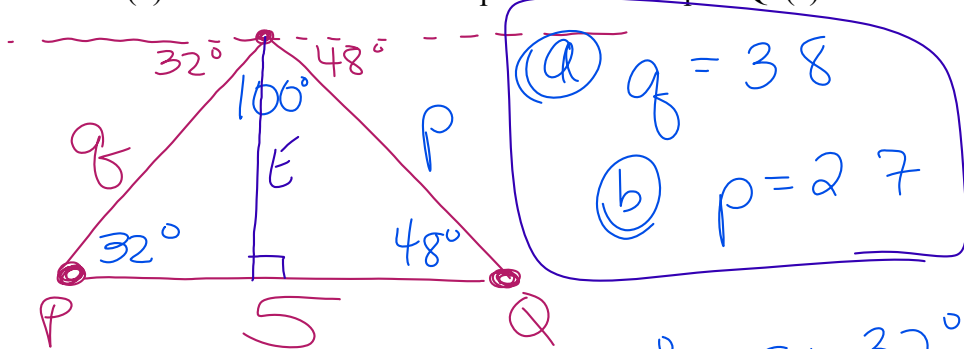


Intro to Law of Cosines and Word Problem Notes

Flight of a Plane



- 1) A pilot is flying over a straight highway. He determines the angles of depression to two mileposts, P and Q, 5 miles apart, to be 32° and 48° , respectively. (a) Find the distance of the plane from milepost P. (b) Find the distance of the plane from milepost Q. (c) What is the elevation of the plane?



(a) $q = 3.8$
 (b) $p = 2.7$

$$\sin 48^\circ = \frac{E}{2.7}$$

$$E = 2.7 \sin 48^\circ$$

(c) $E = 2$

$$\frac{\sin 100^\circ}{5} = \frac{\sin 48^\circ}{q}$$

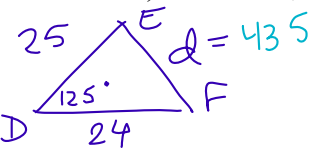
$$\frac{\sin 100^\circ}{5} = \frac{\sin 32^\circ}{p}$$

$$q = \frac{5 \sin 48^\circ}{\sin 100^\circ}$$

$$p = \frac{5 \sin 32^\circ}{\sin 100^\circ}$$

Solve each triangle. Round your answers to the nearest tenth.

- 2) In $\triangle DEF$, $e = 24$, $m\angle D = 125^\circ$, $f = 25$



$$\angle F = 28.2^\circ \text{ or } 28.1^\circ$$

$$d^2 = 24^2 + 25^2 - 2(24)(25)\cos 125^\circ$$

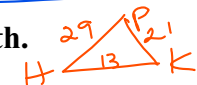
$$d = 43.5$$

$$\angle E = 26.8^\circ \text{ or } 26.9^\circ$$

$$24^2 = (43.5)^2 + (25)^2 - 2(43.5)(25)\cos E$$

$$\frac{24^2 - (43.5)^2 - (25)^2}{(-2)(43.5)(25)} = \cos E$$

- 3) In $\triangle KHP$, $p = 13$, $h = 21$, $k = 29$



$$29^2 = 13^2 + 21^2 - 2(13)(21)\cos K$$

$$\frac{29^2 - 13^2 - 21^2}{(-2)(13)(21)} = \cos K$$

$$\angle K = 115^\circ$$

$$\angle P = 24^\circ$$

$$\angle H = 41^\circ$$

$$\frac{\sin 125^\circ}{43.5} = \frac{\sin E}{24}$$

$$\sin^{-1}\left(\frac{24 \sin 125^\circ}{43.5}\right) = E$$

4) In $\triangle EFD$, $e = 19.9$, $d = 24$, $f = 22.7$

$$24^2 = (22.7)^2 + (19.9)^2 - 2(22.7)(19.9)\cos D$$

$$\frac{24^2 - 22.7^2 - 19.9^2}{(-2 \cdot 22.7 \cdot 19.9)} = \cos D$$

$$\cos^{-1}(\sim 0.371129) = D$$

$$\angle D = 68.2^\circ$$

$$\frac{\sin 68.2}{24} = \frac{\sin E}{19.9}$$

$$\angle E = 50.3^\circ$$

5) In $\triangle RST$, $m\angle R = 92^\circ$, $s = 29$, $t = 28$

$$r^2 = 29^2 + 28^2 - 2(29)(28)\cos 92^\circ$$

$$r = 41$$

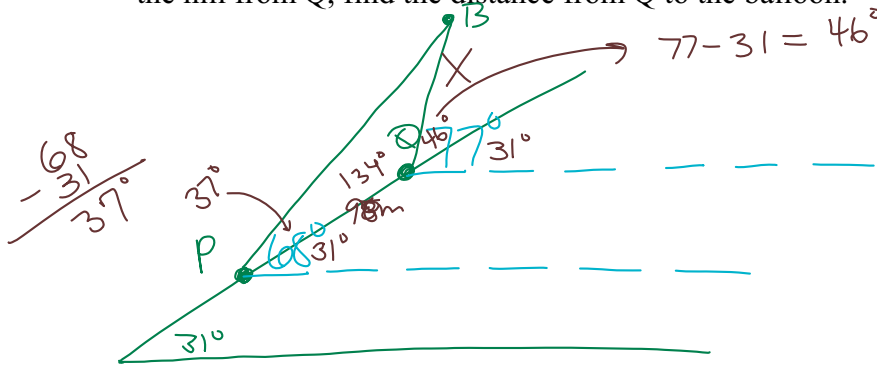
$$\frac{\sin 92^\circ}{41} = \frac{\sin I}{28}$$

$$\angle T = 43^\circ$$

$$\angle S = 45^\circ$$

$$\angle F = 61.4^\circ \text{ or } 61.5^\circ$$

6) Observers at P and Q are located on the side of the hill that is inclined 31° to the horizontal. The observer at P determines the angle of elevation to the hot-air balloon, B, to be 68° . At the same instant, the observer at Q measures the angle of elevation to the balloon to be 77° . If P is 98 m down the hill from Q, find the distance from Q to the balloon.



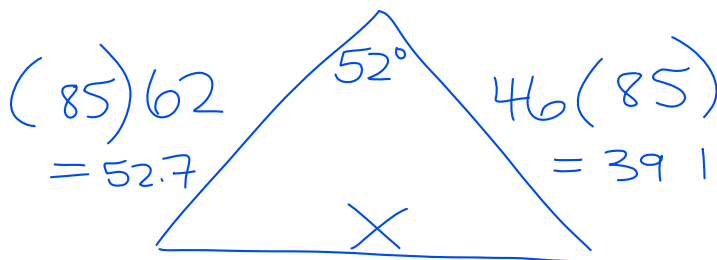
$$\frac{\sin 9^\circ}{98} = \frac{\sin 37^\circ}{x}$$

$$x = \frac{98 \sin 37^\circ}{\sin 9^\circ}$$

$$x = 377 \text{ m}$$

$$\begin{array}{r} 180 \\ - 46 \\ \hline 134 \\ + 37 \\ \hline 171^\circ \end{array} \text{ so } \angle B = 9^\circ$$

7) Two straight roads diverge at an angle of 52° . Two cars leave the intersection at 12:15 P.M., one traveling at 46 mi/hr and the other at 62 mi/hr. How far apart are the cars at 1:06 P.M.?



$$\frac{51 \text{ m}}{60 \text{ m}} = .85$$

$$x = 42.1 \text{ mi}$$

$$X^2 = (39.1)^2 + (52.7)^2 - 2(52.7)(39.1)\cos 52^\circ$$

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(a) 3.77 miles (b) 2.69 miles (c) 2 miles

Solve each triangle. Round your answers to the nearest tenth.

- 2) In $\triangle DEF$, $e = 24$, $m\angle D = 125^\circ$, $f = 25$

$m\angle E = 26.9^\circ$, $m\angle F = 28.1^\circ$, $d = 43.5$

- 3) In $\triangle KHP$, $p = 13$, $h = 21$, $k = 29$

$m\angle K = 115^\circ$, $m\angle H = 41^\circ$, $m\angle P = 24^\circ$

4) In $\triangle EFD$, $e = 19.9$, $d = 24$, $f = 22.7$
 $m\angle E = 50.4^\circ$, $m\angle F = 61.4^\circ$, $m\angle D = 68.2^\circ$

5) In $\triangle RST$, $m\angle R = 92^\circ$, $s = 29$, $t = 28$
 $m\angle S = 45^\circ$, $m\angle T = 43^\circ$, $r = 41$

- 6) Observers at P and Q are located on the side of the hill that is inclined 31° to the horizontal. The observer at P determines the angle of elevation to the hot-air balloon, B, to be 68° . At the same instant, the observer at Q measures the angle of elevation to the balloon to be 77° . If P is 98 m down the hill from Q, find the distance from Q to the balloon.

377 m

- 7) Two straight roads diverge at an angle of 52° . Two cars leave the intersection at 12:15 P.M., one traveling at 46 mi/hr and the other at 62 mi/hr. How far apart are the cars at 1:06 P.M.?

42.1 mi