

5 Trigonometric Mechanics Feb 2019 (You may use Calculators)

3 pts 1. A cell tower is 100 m high. A guy wire that makes a 60° angle with level ground must be fastened to the tower 90 m above ground level. What length of wire is needed? Add $\frac{1}{2}$ meter on each end to attach a cable clamp. Give exact answer or rounded to hundredths.

Ans. _____

4 pts 2. A hill is inclined 20° from the horizontal. A pole stands vertically on the side of the hill with 35 ft. of pole standing above ground. How much wire will it take to reach a point 2 ft. from the top of the pole to a point on the ground 27 ft. downhill from the base of the pole? Round to nearest foot or to four decimal places.

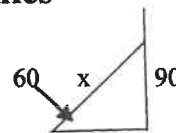
Ans. _____

5 pts 3. The sides of a (regular) pentagonal building are each 76 ft. in length. What area does the base of the building cover?

Ans. _____

Trigonometric Mechanics

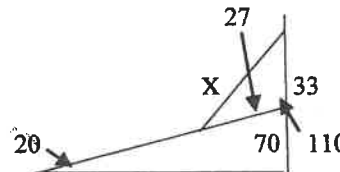
1. $\sin 60 = \frac{90}{x}$, $x = \frac{90}{\sin 60} = \frac{90}{\frac{\sqrt{3}}{2}} = \frac{180}{\sqrt{3}} = 60\sqrt{3}$.



104.92
 Ans. $60\sqrt{3} + 1$
 Approx 102.92

2. Using cosine law:

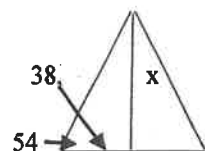
$x^2 = 27^2 + 33^2 - 2(27)(33)\cos 110$. $x^2 = 2427.48$.



Ans. 49.2695

3. Using one of the triangles to find the apothem.

Each angle is $180 - 360/5 = 108$. The base angle for the triangle is 54° .



$\tan 54 = \frac{x}{38}$, $x = 38 \tan 54$. Area = $\frac{1}{2} ap = \frac{1}{2} (38 \tan 54) 5(76) = 9937.47775$ Ans. 9937.47775

5 Trigonometric Mechanics Feb 2018 (You may use calculators)

3 pts 1. A wire is attached to a telephone pole 20 ft above the ground. If the angle between the pole and the wire is 35° , how far from the pole, on level ground, is the wire secured to the ground? The pole is straight up. Give answer in inches only, to nearest inch.

Ans. _____

4 pts 2. What is the area of a triangular plot of land, one of whose angles $84^\circ 37'$, if it is included between two sides which have lengths of 64 m and 87m?

Ans. _____

5 pts 3. From one side of a river, at point A, the angle of elevation to the top of a tree, point B, at the water's edge, on the other side of the river is $10^\circ 25'$. The base of the tree is point C. Point D is 270 feet downstream from A. The river is straight between A and D. If the measure of $\angle CAD$ is $76^\circ 42'$ and the measure of $\angle ADC$ is $47^\circ 54'$, find the height BC of the tree to the nearest 10^{th} of a foot.

Ans. _____

Trigonometric Mechanics

1. $\tan 35^\circ = x/240 \rightarrow 240 \tan 35^\circ = x$, so $x = 168.04$, 168 inches to nearest inch. **Ans. 168 in.**

2. $\text{Area} = \frac{1}{2}(64)(87) \sin 84^\circ 37' = 2771.720604$.

Ans. 2771.7206

3. In the figure, we are looking for the height of the tree BC.

Drop a perpendicular from D to E on \overline{AC} . $\cos 76^\circ 42' = \frac{AE}{270} \rightarrow$

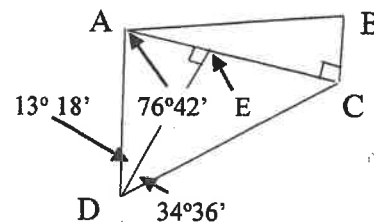
$AE = 270 \cos 76^\circ 42' = 62.1134$. $\sin 76^\circ 42' = \frac{DE}{270} \rightarrow$

$DE = 270 \sin 76^\circ 42'$. $m\angle ADE = 13^\circ 18'$, so $m\angle CDE = 34^\circ 36'$.

$\tan 34^\circ 36' = \frac{CE}{DE} = \frac{CE}{270 \cos 76^\circ 42'} \rightarrow CE = 270 \tan 34^\circ 36' \cos 76^\circ 42' = 181.2648$. Thus $AC =$

243.3782 . $\tan 10^\circ 25' = \frac{BC}{243.3782}$, so $BC = 243.3782 \tan 10^\circ 25' = 44.7414$. By sin law:

$\frac{AC}{\sin 47^\circ 42'} = \frac{270}{\sin 55^\circ 24'}$. $\tan 10^\circ 25' = \frac{BC}{AC}$, $BC = \frac{270 \sin 47^\circ 42' \tan 10^\circ 25'}{\sin 55^\circ 24'} = 44.7414$. **Ans. 44.7 ft**



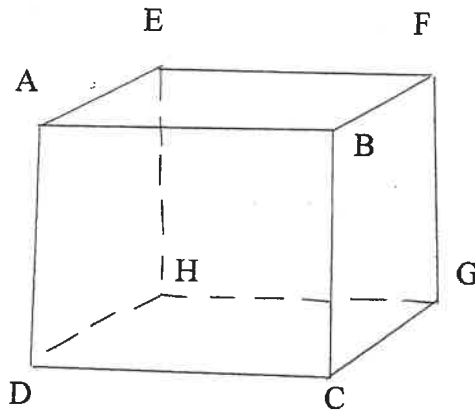
5 Trigonometric Mechanics Feb 2016-17 (You may use calculators)

3 pts 1. The table below lists the horizontal distances to four different white pine trees and the angles of elevation from the level ground to the tops of the trees. Using the letters A, B, C, D rank the trees from tallest to shortest.

Tree	Horizontal Distance to the tree	Angle of Elevation to top of Tree
A	146 feet	36.0°
B	206 feet	26.8°
C	98 feet	47.5°
D	106 feet	44.2°

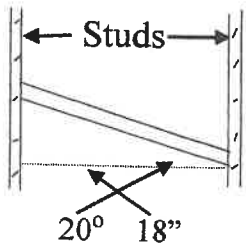
Ans. _____

4 pts 2. For this cube find the measure of angle FDC in degrees, minutes and seconds to the nearest second.

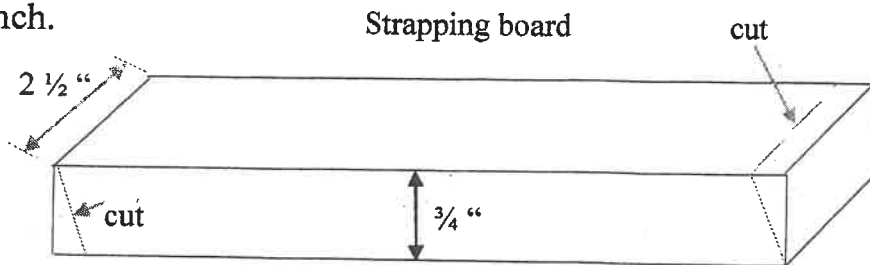


Ans. _____

5 pts 3. You are working an internship with a carpenter who tells you to get a $\frac{3}{4}$ inch by $2\frac{1}{2}$ inch strapping board from stock. The required board must be cut to run between two studs 18 inches apart at 20 degrees, as shown. What minimum length of board must be brought to then cut out angles on both ends and still fit the specs required? Give answer feet and inches rounded to nearest 16th of an inch.



Placement



Ans. _____

Trigonometric Mechanics

1. $A = 146 \tan 36 = 106$; $B = 206 \tan 26.8 = 104$; $C = 98 \tan 47.5 = 107$;
 $D = 106 \tan 44.2 = 103$. Largest to smallest: C, A, B, D.

Ans. C, A, B, D

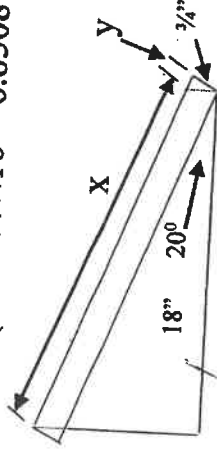
2. Let $DC = 1$, then $CF = \sqrt{2}$. Since $\angle DCF$ is a right angle, then $\tan \angle FDC = \sqrt{2}$ and
 $m \angle FDC = 54^{\circ}44'8''$

Ans. $54^{\circ}44'8''$

3. Length of piece needed for placement: $\cos 20 = 18/x \rightarrow 18/\cos 20$. Length of piece cut off
 from end of strapping board for proper angle of placement board: $\tan 20 = \frac{y}{3/4} \rightarrow \frac{3}{4} \tan 20$.

Two lengths added: $\frac{3}{4} \tan 20 + \frac{18}{\cos 20} = 19.428177 = 1 \text{ ft } 7 \text{ in} + (.428177 \times 16 = 6.8508 \text{ or rounded}$

$7/16$ of an inch.) Thus $1 \text{ ft } 7 \frac{7}{16} \text{ in}$. Refer to figure.



Ans. $1 \text{ ft. } 7 \frac{7}{16} \text{ in.}$

5 Trig Mechanics Feb 2016 (You may use calculators)

3 pts 1. A tree snapped in high winds and bent over so that its top made an angle of 37° with the ground. If the top touched the ground 26 feet from the center of its base, how tall was the tree before it snapped and bent over? Give answer to nearest tenth of a foot.

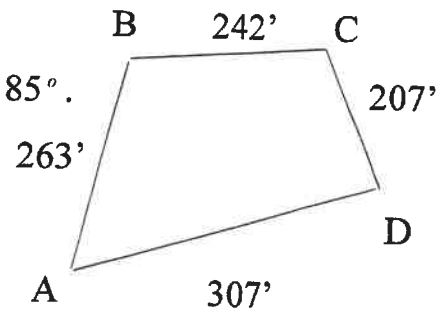
Ans. _____

4 pts 2. Two buildings of the same height are 72 feet apart. From a window in one of the buildings the angle of depression to the base of the other is $13^\circ 26'$ and the angle of elevation to the top is $11^\circ 33'$. How tall is each building to the nearest 100^{th} of a foot.

Ans. _____

5 pts 3. The plot of land at right has measurements as indicated.

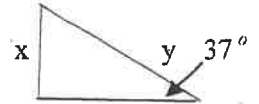
Find the measure of $\angle ABC$ to the nearest minute, if $m\angle BAD = 85^\circ$.



Ans. _____

Trig Mechanics

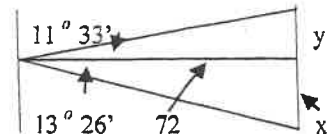
1. We need $x + y$ in the figure. $\tan 37^\circ = \frac{x}{26}$, so $x = 26 \tan 37^\circ = 19.592$



$\cos 37^\circ = \frac{26}{y}$, so $y = 26 / \cos 37^\circ = 32.556$. $x + y = 52.148$. Rounded: 52.1

Ans. 52.1

2. In the figure at right, $\tan 11^\circ 33' = \frac{y}{72}$, and $\tan 13^\circ 26' = \frac{x}{72}$.

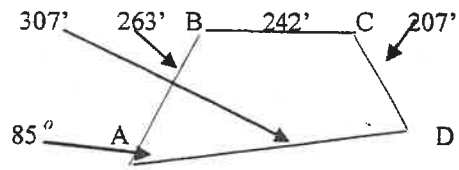


$x + y = 72(\tan 11^\circ 33' + \tan 13^\circ 26') = 31.91$.

3. Insert \overline{BD} . Using Cosine Law: $(BD) = \sqrt{263^2 + 307^2 - 2(263)(307) \cos 85} = 386.450$.

$m\angle ABC = m\angle ABD + m\angle CBD$. $\frac{\sin \angle ABD}{307} = \frac{\sin 85^\circ}{386.45} \rightarrow$

$m\angle ABD = 52^\circ 18' 55''$. $\cos \angle CBD = \frac{207^2 - 242^2 - BD^2}{-2(242)BD}$



$m\angle CBD = 28^\circ 03' 30''$. $m\angle ABC = 80^\circ 22' 25''$.

Ans. 80° 22'

5 Trigonometric Mechanics Feb 2015 (You may use Calculators)

3 pts 1. The legs of a right triangle are 2 and $\sqrt{5}$ units long. Let α be the smallest angle of the triangle. To the nearest degree, what is the measure of α ?

Ans. _____

4 pts 2. Two ladders, one twice as long as the other and each having one end resting on the floor, have their opposite ends reaching the same vertical height along a wall. The shorter ladder makes a 60 degree angle with the floor. What angle (to the nearest degree) does the longer ladder make with the floor?

Ans. _____

5 pts 3. From the top of a building, the angle of elevation to the top of the building next to it is $23^\circ 46'$. The angle of depression to the base of the building is $54^\circ 27'$. If the taller building is 60 feet high, what is the distance between the buildings? Give answer correct to 4 decimal places.

Ans. _____

Trigonometric Mechanics

1. $2^2 + (\sqrt{5})^2 = 9$. So hyp. = 3. Smallest angle is opposite 2. $\cos \alpha = \frac{\sqrt{5}}{3}$.

Ans. 42°

2. Use figure at right: $\sin y = \frac{\sqrt{3}}{4}$, so $y = 26^\circ$.

Ans. 26°

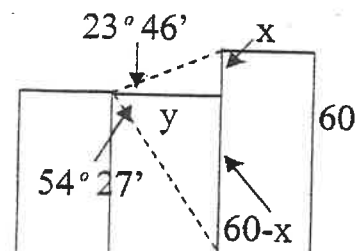
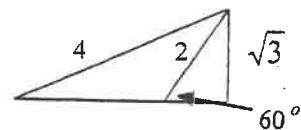
3. In figure at right: $\tan 23^\circ 46' = \frac{x}{y}$, so $y = \frac{x}{\tan 23^\circ 46'}$.

$\tan 54^\circ 27' = \frac{60-x}{y}$, so $y = \frac{60-x}{\tan 54^\circ 27'}$. $\frac{x}{\tan 23^\circ 46'} = \frac{60-x}{\tan 54^\circ 27'}$ →

$x \tan 54^\circ 27' = 60 \tan 23^\circ 46' - x \tan 23^\circ 46'$. Therefore

$x = \frac{60 \tan 23^\circ 46'}{\tan 54^\circ 27' + \tan 23^\circ 46'} = 14.36167$. $y = \frac{x}{\tan 23^\circ 46'} = 32.61363$

Ans. **32.6136**

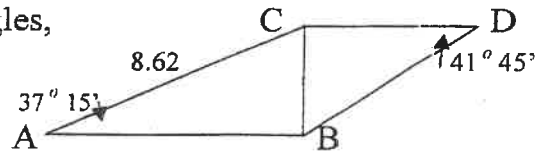


5 Trigonometric Mechanics Feb 2014 (Calculators allowed)

3 pts 1. A water balloon is dropped from point C and hit the ground at point B, 59 ft from point A. If A is 74 ft from C, find the measure of angle ACB to the nearest 10th of a degree. (Assume the ground is flat)

Ans. _____

4 pts 2. In the figure at right, find the length of CD to the nearest 100th. Angles ABC and BCD are right angles, AC = 8.62, m∠A = 37° 15' and m∠D = 41° 45'.



Ans. _____

5 pts 3. A hot-air balloon is 2400 ft directly above Interstate 80 in Nebraska which extends for miles in a straight line. The angle of depression to a truck on Interstate 80 is 16° 42'. Directly ahead of the truck at an angle of depression of 7° 24' is a tall statue on the side of the road of I 80. To the nearest 10 ft., how far from the statue is the truck?

Ans. _____

Trigonometric Mechanics

1. $\sin \angle C = 59/74$. $C = 52.9^\circ$.

Ans. 52.9°

2. $\sin 37^\circ 15' = \frac{BC}{8.62}$, so $BC = 8.62 \sin 37^\circ 15'$. $\tan 41^\circ 45' = \frac{BC}{CD}$.

$CD = \frac{8.62 \sin 37^\circ 15'}{\tan 41^\circ 45'} = 5.8458$.

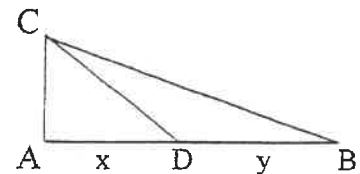
Ans. 5.85

3. In the figure, $x + y$ is the distance from a point A directly below the balloon on I 80 to the statue at B. y is the distance from the truck D to the statue and x is the distance from A to D.

$m\angle B = 7^\circ 24'$, so $\tan 7^\circ 24' = \frac{2400}{x+y} \Rightarrow x+y = \frac{2400}{\tan 7^\circ 24'}$.

$m\angle B = 16^\circ 42'$, so $\tan \angle B = 16^\circ 42' = \frac{2400}{x} \Rightarrow x = \frac{2400}{\tan 16^\circ 42'}$.

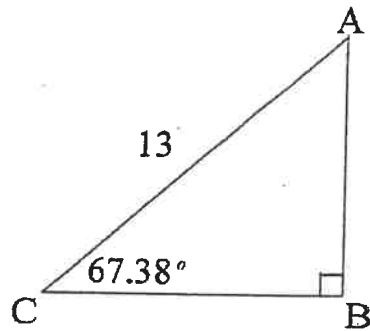
$x + y - x = \frac{2400}{\tan 7^\circ 24'} - \frac{2400}{\tan 16^\circ 42'} = 10,479 = \text{Rounded: } 10,480 \text{ ft.}$



Ans. 10,480 ft

5 Trigonometric Mechanics Feb 2013 (You may use calculators)

3 pts 1. Find the perimeter of triangle ABC. Round to the nearest unit.



Ans. _____

4 pts 2. At time $t = 0$, ship A is 40 nm west of ship B and is traveling due east at 10 knots. Ship B is heading due north at 8 knots. Find the value of t in hours when ship B will be 50 degrees north of east as measured from ship A. Round answer to nearest 100th of an hour.

Ans. _____

5 pts 3. The ground in a field slopes upward 3° over the horizontal in the direction from a kite string holder to her kite. The kite is flying on 400 feet of straight string and its shadow is 327 ft from the holder (measured along the ground) when the sun is directly vertical. Because the wind is so strong, she is standing on the spool of string so the kite won't blow away. Measured perpendicular to the ground, how high is the kite in feet? Round answer to nearest tenth of a foot.

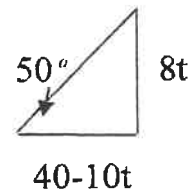
Ans. _____

Trigonometric Mechanics

1. $AB = \sin 67.38^\circ$. $BC = \cos 67.38^\circ$. Perimeter = 30.0000165.

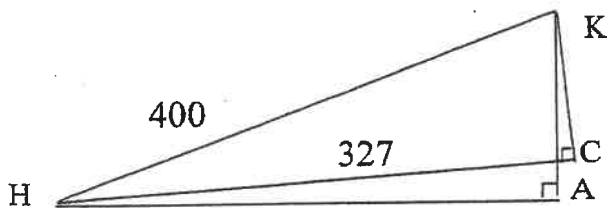
Ans. 30

2. $\tan 50^\circ = \frac{8t}{40-10t} \rightarrow t = \frac{40 \tan 50^\circ}{8+10 \tan 50^\circ} = 2.39337$



Ans. 2.39

3.



$AH = 327 \cos 3^\circ$. $m \angle KHA = \cos^{-1} \left(\frac{327 \cos 3^\circ}{400} \right)$. $m \angle KHC = m \angle KHA - 3^\circ$.

$KC = 400 \sin \left[\cos^{-1} \left(\frac{327 \cos 3^\circ}{400} \right) - 3^\circ \right] = 213.59925$.

Ans. 213.6

Team

1. $4 = 3x - 2$, thus $x = 2$. $1 - x = 1 - (2) = -1$.

Ans. -1

5 Trigonometric Mechanics Jan 2011 (You may use Calculators)

3 pts 1. In right triangle ABC, $\sin A = \frac{7}{20}$. Find the cosine of angle A in simplest radical form.

Ans. _____

4 pts 2. The sides of a triangle are 9, 13, and 19. What is the sum of the two smallest angles? Give answer to nearest minute.

Ans. _____

5 pts 3. In triangle ABC, $AC = 20$, $AB = 17$ and $m\angle C = 30^\circ$. There are two possible triangles which exist under these conditions. Find the difference between the area of the larger triangle and the area of the smaller triangle. Round answer to nearest 100th.

Ans. _____

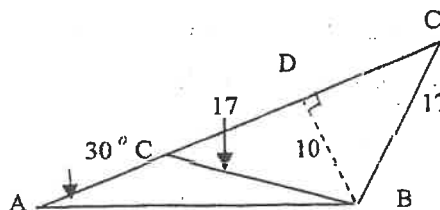
Trigonometric Mechanics

1. Since $\sin A = 7/20$, the other leg is $\sqrt{20^2 - 7^2} = \sqrt{351}$. Thus $\cos A = \frac{\sqrt{351}}{20} = \text{Ans. } \frac{3\sqrt{39}}{20}$

2. The sum of the two smaller angles is 180° - the largest angle. Let $a = 9$, $b = 13$ and $c = 19$. By the cosine law: $19^2 = 9^2 + 13^2 - 2(9)(13) \cos C$. $C = 118^\circ 19'$. **Ans: $61^\circ 41'$**

3. The figure at right shows the two possibilities for the two triangles. The difference between the areas of the two triangles $\triangle ABC'$ and $\triangle ABC$ would be the area of $\triangle BCC'$. Since $m\angle A = 30^\circ$, then the perpendicular drawn from B to meet $\overline{CC'}$ at D is 10.

Therefore $DC' = \sqrt{17^2 - 10^2} = \sqrt{189}$ and the area of the triangle is $10\sqrt{189} = 137.4772$. **Ans. 137.48**

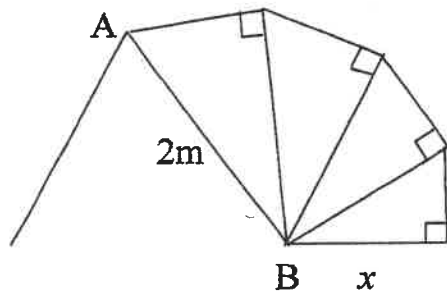


5 Trigonometric Mechanics Feb 2011 (You may use Calculators)

3 pts 1. A rhombus has sides 25 units long and its height is 24 units. Find the measure of its obtuse angle to the nearest hundredth of a degree.

Ans. _____

4 pts 2. The side of the beach shelter shown below is made up of four $30^\circ - 60^\circ - 90^\circ$ triangles. Find the dimension marked x . Give exact answer or give answer rounded to the nearest thousandth. The side AB is 2 meters long.



Ans. _____

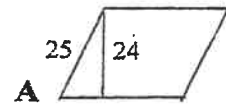
5 pts 3. A vertical pole 30 meters tall standing on a 10° slope is braced by two cables extending from the top of the pole to two points on the ground, one point 25 meters directly up the slope and the other point 25 meters directly down the slope. To the nearest hundredth find the sum of the lengths of the two cables.

Ans. _____

Trigonometric Mechanics

1. $\sin A = 24/25$, $A = 73.7398$. $180 - 73.7398 = 106.26^\circ$.

Ans. 106.26°



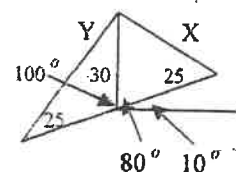
2. Each of the long legs is $\frac{\sqrt{3}}{2}$ times the hypotenuse or $2 \left(\frac{\sqrt{3}}{2} \right)^4 = 2 \cdot \frac{9}{16}$. Ans. $\frac{9}{8}$ or 1.125

3. $x^2 = 25^2 + 30^2 - 2 \cdot 25 \cdot 30 \cos 80^\circ = 1264.528 \rightarrow x = 35.5602$

$y^2 = 25^2 + 30^2 - 2 \cdot 25 \cdot 30 \cos 100^\circ = 1785.472 \rightarrow y = 42.2548$

$x + y = 77.815 = 77.82$ to nearest hundredth.

Ans. 77.82



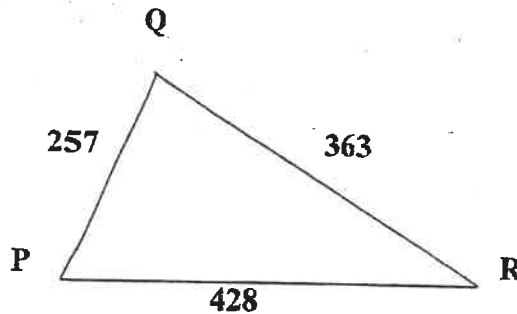
5 Trigonometric Mechanics Feb 2010 (You may use Calculators)

3 pts 1. The lengths of the sides of an isosceles triangle are 23, 23, and 36. To the nearest degree, find the measure of a base angle.

Ans. _____

4 pts 2.

Find the measure of angle P. Express answer to the nearest minute.



Ans. _____

5 pts 3. From a lighthouse on a small island in the ocean, an observer sighted a buoy at an angle of depression of $11^{\circ}38'$, due north. He then turned due east and sighted a second buoy at an angle of depression of $7^{\circ}24'$. If the sighting takes place 204 feet above sea level, how far apart are the two buoys? Give answer to nearest foot.

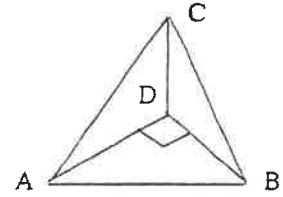
Ans. _____

Trigonometric Mechanics

1. Dropping the altitude from B to \overline{AC} to meet at T forms a right triangle, with $AT = 18$.
 $\cos A = 18/23$. $A = 38.49\dots$ **Ans. 38°**

2. Using cosine law: $363^2 = 257^2 + 428^2 - 2(257)(428) \cos P$.
 $\cos P = \frac{363^2 - 257^2 - 428^2}{-2(257)(428)} = .533947$. $m\angle P = 57^\circ 44'$ **Ans. $57^\circ 44'$**

3. In the 3-dimensional figure at right. C is where the observer is above sea level D. First buoy is at B and second at A. $\triangle ADB$ is a right triangle. $CD = 204$ and we are looking for AB.
 $\tan 7^\circ 24' = 204/AD$ and $\tan 11^\circ 38' = 204/BD$.



$$AB = \sqrt{\left(\frac{204}{\tan 7^\circ 24'}\right)^2 + \left(\frac{204}{\tan 11^\circ 38'}\right)^2} = \sqrt{(1570.7)^2 + (990.88)^2} = 1857$$

Ans. 1857