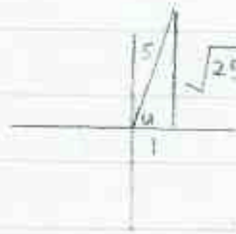
2. $\cos u = \frac{1}{5}$



$\sqrt{25-1} = \sqrt{24} = 2\sqrt{6}$

$u, v,$ 1^{st} quadrant

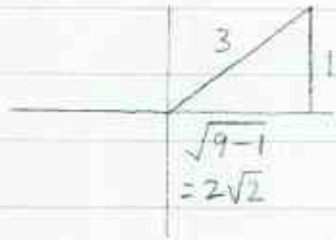
$\therefore \sin u = \frac{2\sqrt{6}}{5}$

$$\begin{aligned}\sin 2u &= 2 \sin u \cos u \\ &= 2\left(\frac{2\sqrt{6}}{5}\right)\left(\frac{1}{5}\right) \\ &= \frac{4\sqrt{6}}{25}\end{aligned}$$

$$\begin{aligned}\cos 2u &= 2\cos^2 u - 1 \\ &= 2\left(\frac{1}{5}\right)^2 - 1 \\ &= \frac{2}{25} - \frac{25}{25} \\ &= -\frac{23}{25}\end{aligned}$$

$$\begin{aligned}\tan 2u &= \sin 2u / \cos 2u \\ &= -4\sqrt{6} / 23\end{aligned}$$

2. $\sin v = \frac{1}{3}$



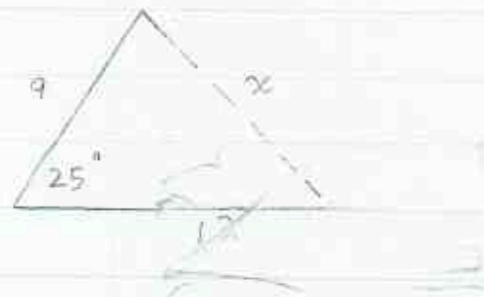
$\cos v = \frac{2\sqrt{2}}{3}$

$$\begin{aligned}
\sin 2v &= 2\sin v \cos v \\
&= 2\left(\frac{1}{3}\right)\left(\frac{2\sqrt{2}}{3}\right) \\
&= \frac{4\sqrt{2}}{9}
\end{aligned}$$

$$\begin{aligned}
\cos 2v &= 1 - 2\sin^2 v \\
&= 1 - 2\left(\frac{1}{3}\right)^2 \\
&= 1 - \frac{2}{9} \\
&= \frac{7}{9}
\end{aligned}$$

$$\tan 2v = \frac{\sin 2v}{\cos 2v} = \frac{4\sqrt{2}/9}{7/9} = \frac{4\sqrt{2}}{7}$$

3



Law cosines

$$x^2 = 9^2 + 12^2 - 2(9)(12)\cos 25°$$
$$x^2 = 29.2375$$
$$\underline{\underline{x = 5.407}}$$

4. $\vec{b} = |\vec{b}| \cos\theta\, \vec{i} + |\vec{b}| \sin\theta\, \vec{j}$

$= 25 \cos(193°)\vec{i} + 25 \sin(193°)\vec{j}$

$= -24.3\vec{i} + -5.62\vec{j}$

5. $\vec{c} = -8\vec{i} - 3\vec{j}$

$|\vec{c}| = \sqrt{(8)^2 + (3)^2}$

$|\vec{c}| = 854$

$\theta = \tan^{-1}\left(\frac{-3}{-8}\right)$

$\theta = 20.56°$

but $\vec{c}$ is in 3rd quadrant so direction of $\vec{c}$ is $180° + 20.56° = 200.56°$

mag. 8.54 direction of 200.56°

6. a) $\vec{d} + \vec{e} = (-6+2)\vec{i} + (10-4)\vec{j}$

$= -4\vec{i} + 6\vec{j}$

b) $\vec{d} - \vec{e} = (-6-2)\vec{i} + (10 - -4)\vec{j}$

$= -8\vec{i} + 14\vec{j}$

c) $\vec{d} \cdot \vec{e} = (-6)(2) + (10)(-4) = -12 + -40 = -52$

d) $\vec{d} \cdot \vec{e} = |\vec{d}||\vec{e}|\cos\theta$

$\cos\theta = \dfrac{\vec{d}\cdot\vec{e}}{|\vec{d}||\vec{e}|} = \dfrac{-52}{\sqrt{136}\sqrt{20}} =$

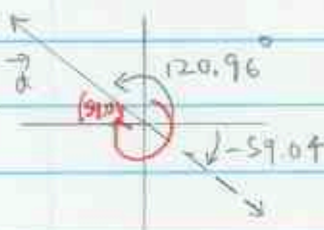
$\cos\theta = -0.997054$

$\theta = \cos^{-1}(-0.997054)$

$\theta = 175.6^\circ$

e) $|\vec{d}| = \sqrt{(-6)^2 + (10)^2} = \sqrt{136} \approx 11.7$

$\theta = \tan^{-1}\left(\frac{10}{-6}\right) = -59.04^\circ$, but $\vec{d}$ in 2^{nd} quadrant



bearing $= 270^\circ + 59.04^\circ$

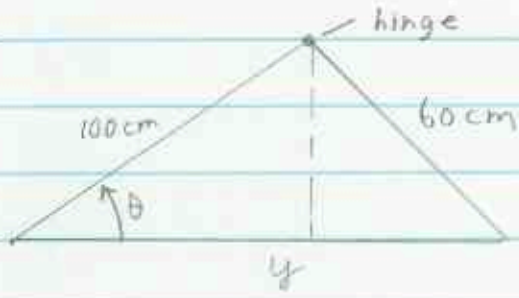
$= 329.04^\circ$

$|\vec{e}| = \sqrt{2^2 + 4^2} = \sqrt{20} = 2\sqrt{5} \approx 4.47$

$\theta = \tan^{-1}\left(-4/2\right) = -63.43$ $\vec{e}$ in 4^{th} quadrant

bearing $= 90 + 63.43 = 153.43^\circ$

7. p 279 #16



a) Law Cosines :

$c^2 = b^2 + a^2 - 2ab\cos C$

$(60)^2 = y^2 + 100^2 - 2(y)(100)\cos 20^\circ$

$y^2 - (200\cos 20^\circ)\,y + 6400 = 0$

$\underline{y = 143.3\text{ cm}}$ or $\underline{y = 44.7\text{ cm}}$

(use quadratic eq. to solve)

b) If $\theta = 50^\circ$, $b^2 - 4ac < 0$

$[-200\cos(50^\circ)]^2 - 4(1)(6400) < 0$

$-29873.0 < 0$

Therefore, no triangles can have this combination of sides and included angle.

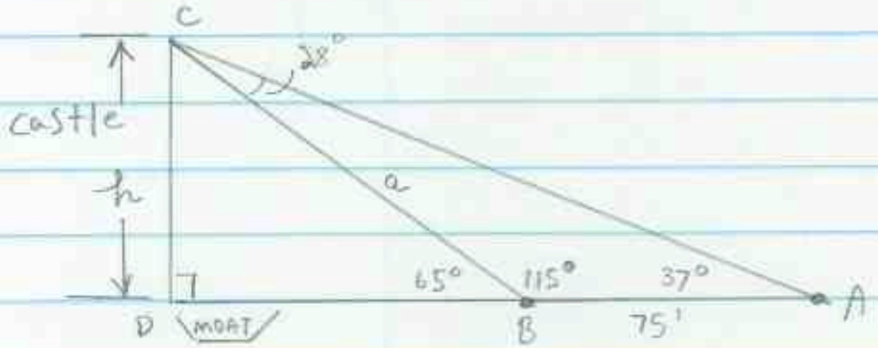
c) Just one possible triangle occurs when the angle between side opposite θ and base is 90°. Thus, use right △ properties:

$\sin\theta = \frac{60}{100}$

$\theta = \sin^{-1}\left(\frac{60}{100}\right)$

$\underline{\theta = 36.87^\circ}$

8. Castle Height Problem



Plan: 1) find a using $\triangle ABC$

2) use a and $90°$ $\angle D$ to find h

1) LAW OF SINES: $\dfrac{a}{\sin 37°} = \dfrac{75'}{\sin 28°} \Rightarrow a = 75' \dfrac{\sin 37°}{\sin 28°}$

$a = 96.142$ ft

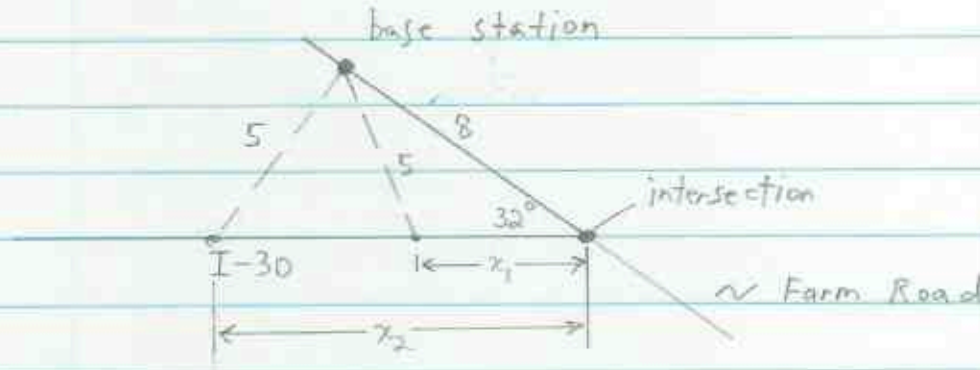
2) Def. of sine: $\sin \angle B = \dfrac{h}{a}$

$h = a \sin \angle B$

$= (96.142) \sin 65°$

$h = 87.1$ ft

9. CB Radio.



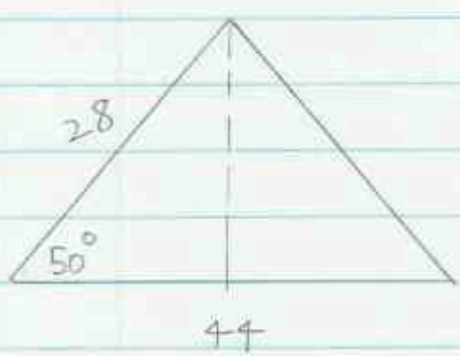
LAW OF COSINES

$$(5)^2 = (8)^2 + x^2 - 2(8)(x)\cos 32^\circ$$
$$25 = 64 + x^2 - (16\cos 32^\circ)x$$
$$0 = x^2 - (16\cos 32^\circ)x + 39$$

USE QUADRATIC FORMULA

$$\Rightarrow x_2 = 9.44 \text{ mi}$$
$$x_1 = 4.13 \text{ mi}$$

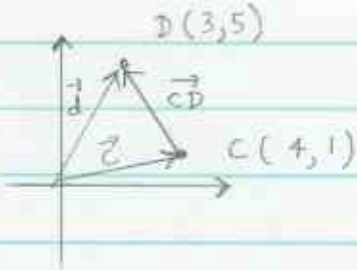
10.



$$\text{Area} = \frac{1}{2} ab\sin C$$
$$= \frac{1}{2}(28)(44)\sin 50^\circ$$

$$\text{Area} = 471.9 \text{ ft}^2$$

11.



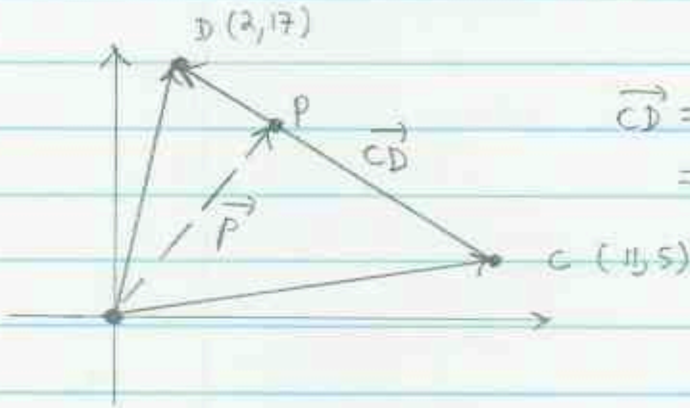
$$\vec{c} = 4\vec{i} + 1\vec{j}$$

$$\vec{d} = 3\vec{i} + 5\vec{j}$$

$$\vec{CD} = \vec{d} - \vec{c} = (3-4)\vec{i} + (5-1)\vec{j}$$

$$\underline{\underline{\vec{CD} = -1\vec{i} + 4\vec{j}}}$$

12.



$$\vec{CD} = (2-11)\vec{i} + (17-5)\vec{j}$$

$$= -9\vec{i} + 12\vec{j}$$

$$\vec{p} = \vec{C} + \frac{2}{3}(\vec{CD})$$

$$= 11\vec{i} + 5\vec{j} + \frac{2}{3}(-9\vec{i} + 12\vec{j})$$

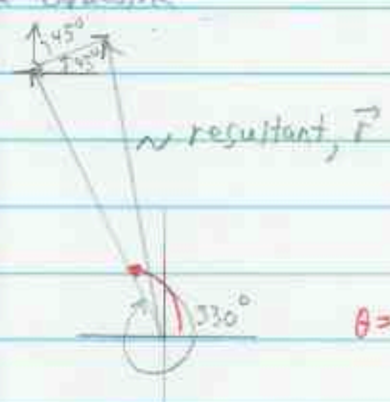
$$= 11\vec{i} + 5\vec{j} + -6\vec{i} + 8\vec{j}$$

$\vec{p} = 5\vec{i} + 13\vec{j}$ (position vector, so

So point P located at (5, 13)

13. Although you solve this graphically, I think using components is much more straightforward.

exaggerated drawing



$\theta = 90^\circ + 30^\circ = 120^\circ$ plane direction

Plane; $\vec{p} = 500\cos(120^\circ)\vec{i} + 500\sin(120^\circ)\vec{j}$

$\vec{p} = -250\vec{i} + 433\vec{j}$

wind; $\vec{w} = 70\cos(45)\vec{i} + 70\sin(45^\circ)\vec{j}$

$\vec{w} = 49.5\vec{i} + 49.5\vec{j}$

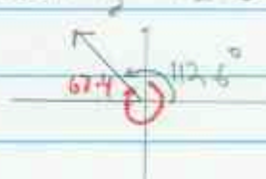
$\vec{r} = \vec{p} + \vec{w} = -200.5\vec{i} + 482\vec{j}$

$|\vec{r}| = \sqrt{(-200.5)^2 + (482)^2} = 522.04$ mph note 2nd Quad.

$\theta = \tan^{-1}\left(\frac{482}{-200.5}\right) = -67.41$. direction is $-67.41 + 180$

$\underline{112.6^\circ}$

Note as a bearing 112.6° is 337.4°



Bearing $= 270^\circ + 67.4 = 337.4^\circ$.

$-3.14, 6.28$

14. $\cos x(\cos x + 1) = 0 \qquad [-\pi, 2\pi]$

$\cos x = 0 \qquad$ or $\qquad \cos x + 1 = 0$

$x = \arccos(0) \qquad\qquad x = \arccos(-1)$

$x = \pm\cos^{-1}(0) + 2\pi n \qquad$ or $\qquad x = \pm\cos^{-1}(-1) + 2\pi n$

n	$+\cos^{-1}(0)$	$-\cos^{-1}(0)$
0	$1.57\ (\frac{\pi}{2})$	$-1.57\ (-\frac{\pi}{2})$
1	7.854	$4.71\ (+\frac{3\pi}{2})$

n	$+\cos^{-1}(-1)$	$-\cos^{-1}(-1)$
-1	$-3.142 (-\pi)$	-9.425
0	$3.142\ (\pi)$	$-\pi$
1	3π	π

Note there are duplicate answers:
should be able to do this problem w/out calculator.

$[-\pi, 2\pi] \qquad x = -\pi, -\frac{\pi}{2}, \frac{\pi}{2}, \pi, \frac{3\pi}{2}, \pi$

15. $3\sec x + 4 = 10 \qquad [-\pi, 2\pi]$

$3\sec x = 6$

$\sec x = 2$

$\cos x = \frac{1}{2}$

$x = \arccos(\frac{1}{2}) = \pm\cos^{-1}(\frac{1}{2}) + 2\pi n$

n	$+\cos^{-1}(0.5) + 2\pi n$	$-\cos^{-1}(0.5) + 2\pi n$
0	1.047 ✓	-1.047 ✓
1	7.330	5.236 ✓

$x = -1.047, 1.047, 5.236$