MULTIPLE CHOICE: **Circle the letter corresponding to the correct answer.** SCORE: _____ / 5 PTS

If $e = 5.3$ and $n = 2.9$, there is a possible triangle ΔLEN if $l =$

$2.4 + 2.9 \ngtr 5.3$ $\quad$ $2.5 + 2.9 > 5.3$ $\quad$ $5.3 + 2.9 \ngtr 8.2$ $\quad$ $5.3 + 2.9 \ngtr 8.3$

[A] 2.4 [B] 2.5 [C] 8.2 [D] 8.3 [E] none of the above

Suppose that $B = 41^\circ$ and $h = 7.2$. Find all values of b so that there is exactly one possible triangle ΔBHO. SCORE: _____ / 5 PTS

$b = h \sin B$ or $b \geq h$

$b = 7.2 \sin 41^\circ$ or $b \geq 7.2$

$b = 4.72$ or $b \geq 7.2$

Solve triangle ΔCPR if $P = 64^\circ$, $r = 7.9$ and $p = 7.3$. **Sketch and label triangles with your final answers.** SCORE: _____ / 15 PTS
If no such triangle exists, write "DNE". If more than one triangle is possible, solve for all possible triangles.

$r \sin P = 7.9 \sin 64^\circ = 7.1$

$7.1 < 7.3 < 7.9 \longrightarrow 2\ \Delta$'s

$\frac{\sin R}{7.9} = \frac{\sin 64^\circ}{7.3}$

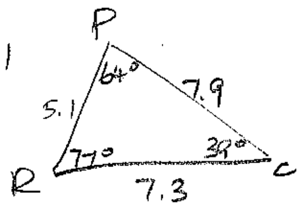
$R = \sin^{-1} \frac{7.9 \sin 64^\circ}{7.3} \approx 77^\circ$

or $R = 180^\circ - 77^\circ = 103^\circ$

$C = 180^\circ - (64^\circ + 77^\circ) = 39^\circ$

$\frac{c}{\sin 39^\circ} = \frac{7.3}{\sin 64^\circ}$

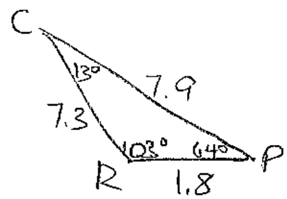
$c = \frac{7.3 \sin 39^\circ}{\sin 64^\circ} = 5.1$



$C = 180^\circ - (64^\circ + 103^\circ) = 13^\circ$

$\frac{c}{\sin 13^\circ} = \frac{7.3}{\sin 64^\circ}$

$c = \frac{7.3 \sin 13^\circ}{\sin 64^\circ} = 1.8$

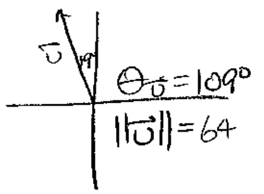


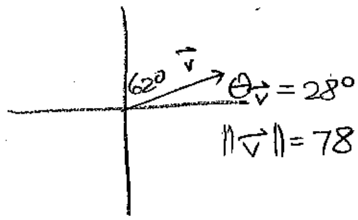
Find the area of triangle ΔMAX if $a = 11.4$, $m = 9.3$, $M = 32^\circ$, $A = 41^\circ$ and $X = 107^\circ$. SCORE: _____ / 5 PTS

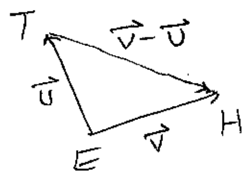
$\frac{1}{2} am \sin X = \frac{1}{2}(11.4)(9.3) \sin 107^\circ = 50.69$

The tourist information center is located 64 meters from the entrance of the parking lot on a bearing of N 19° W. **SCORE: _____ / 20 PTS**
The trailhead is located 78 meters from the entrance of the parking lot on a bearing of N 62° E.

[a] Find the vector which represents the position of the trailhead from the tourist information center.
Write your answer as a linear combination of $\vec{i}$ and $\vec{j}$.
You must use vector methods throughout your solution. Do NOT use the law of sines/cosines.



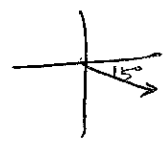




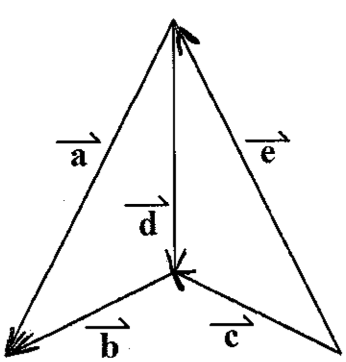
$$\vec{v}-\vec{u} = \langle 78\cos 28°, 78\sin 28°\rangle - \langle 64\cos 109°, 64\sin 109°\rangle$$
$$= \langle 90, -24\rangle = 90\vec{i} - 24\vec{j}$$

[b] Find the bearing of the trailhead from the tourist information center. Write your answer in the same format used in the question.

$$\theta_{\vec{v}-\vec{u}} = \tan^{-1}\frac{-24}{90} = -15°$$
S 75° E



Write vectors $\vec{d}$ and $\vec{e}$ in terms of vectors $\vec{a}$, $\vec{b}$ and $\vec{c}$ in the diagram below. **SCORE: _____ / 5 PTS**



$\vec{d} + \vec{b} = \vec{a}$
$\vec{d} = \vec{a} - \vec{b}$
$\vec{e} + \vec{d} = \vec{c}$
$\vec{e} = \vec{c} - \vec{d}$
$= \vec{c} - (\vec{a} - \vec{b})$
$= \vec{c} - \vec{a} + \vec{b}$

Let $\vec{m}$ be the vector $< -6, 4 >$. **SCORE: _____ / 45 PTS**

Let $\vec{y}$ be the vector $\vec{i} - 2\vec{j}$.

[a] If a force represented by vector $\vec{m}$ (in Newtons) is applied to an object as it moves from $(-4, -7)$ to $(-6, 1)$ (in meters), find the work done. State the units of your answer.

$$\vec{d} = \langle -6 - -4, 1 - -7 \rangle = \langle -2, 8 \rangle$$
$$\vec{m} \cdot \vec{d} = \langle -6, 4 \rangle \langle -2, 8 \rangle = 44\,J$$

[b] Find $2\vec{y} - 3\vec{m}$. Write your final answer in component form.

$$2\langle 1, -2 \rangle - 3\langle -6, 4 \rangle = \langle 2, -4 \rangle - \langle -18, 12 \rangle = \langle 20, -16 \rangle$$

[c] Find the angle (rounded to the nearest integer degrees) between $\vec{m}$ and $-3\vec{j}$.

$$\cos^{-1} \frac{\langle -6, 4 \rangle \cdot \langle 0, -3 \rangle}{(2\sqrt{13})(3)} = \cos^{-1}\left(-\frac{2}{\sqrt{13}}\right) = 124°$$

[d] Find the projection of $\vec{i} + 28\vec{j}$ onto $\vec{y}$.

$$\text{PROJ}_{\langle 1, -2 \rangle} \langle 1, 28 \rangle = \frac{\langle 1, 28 \rangle \cdot \langle 1, -2 \rangle}{\langle 1, -2 \rangle \cdot \langle 1, -2 \rangle} \langle 1, -2 \rangle = \frac{\cancel{-55}^{-11}}{\cancel{5}} \langle 1, -2 \rangle = \langle -11, 22 \rangle$$

[e] Find a vector of magnitude 4 in the opposite direction as $\vec{y}$. Write your final answer as a linear combination of $\vec{i}$ and $\vec{j}$.

$$-4\left(\frac{1}{\|\vec{y}\|}\right)\vec{y} = -4\left(\frac{1}{\sqrt{5}}\right)\langle 1, -2 \rangle$$
$$= \frac{-4\sqrt{5}}{5} \langle 1, -2 \rangle$$
$$= \frac{-4\sqrt{5}}{5}\vec{i} + \frac{8\sqrt{5}}{5}\vec{j}$$