

NAME:

SECTION:

Instructor:

TO RECEIVE CREDIT FOR AN ANSWER,
YOU MUST SHOW WORK JUSTIFYING THAT ANSWER.

I		(25)
II		(30)
III		(25)
IV		(25)
V		(15)
Total:		120

I. (NO CALCULATOR, and do not forget to provide full justification)
(25 points)

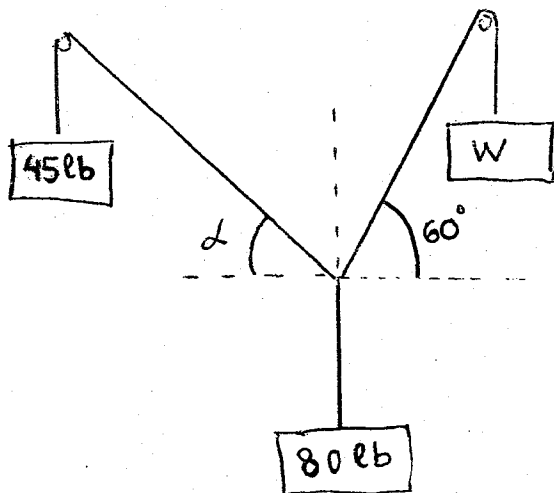
Find an angle α such that:

$$\cos^2 \alpha = 1 - \sin^2 10^\circ \text{ and } 90^\circ < \alpha < 180^\circ .$$

II.

(30 points)

Find the weight W and the angle α in order that the figure shows an equilibrium.

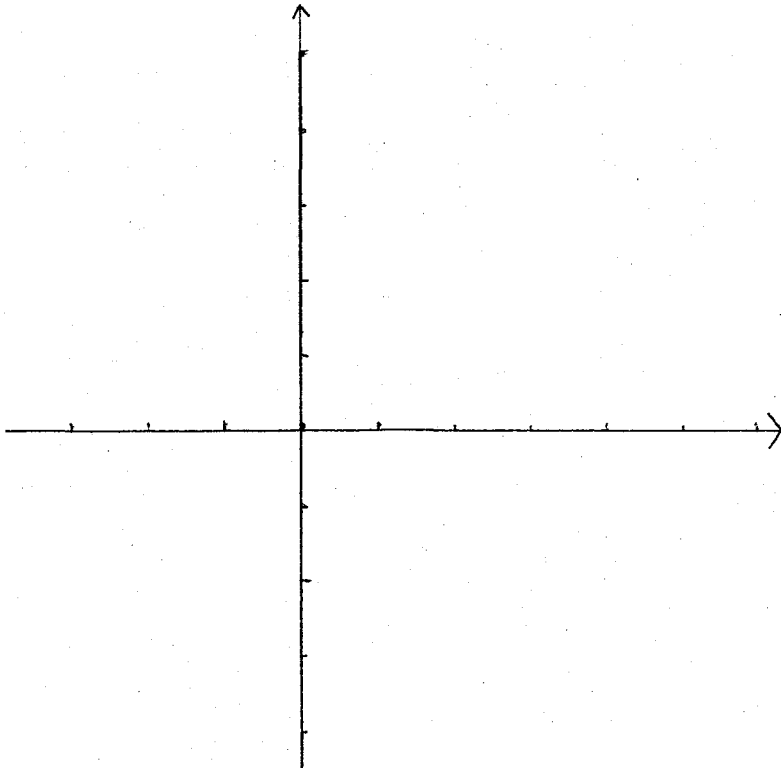


III. NO CALCULATOR.

(25 points)

Let $\vec{U} = \langle -1, 3 \rangle$ and $\vec{V} = \langle 5, 2 \rangle$. On the figure, show the vectors \vec{U} , \vec{V} , $\vec{U} + \vec{V}$, and $\vec{V} - \vec{U}$. Evaluate the lengths, $|\vec{U}|$ and $|\vec{V}|$ of the vectors \vec{U} and \vec{V} , and evaluate the dot product $\vec{U} \cdot \vec{V}$.

Give the EXACT value of the cosine of the angle α between the vectors \vec{U} and \vec{V} (geometric angle in the range from 0° to 180° , with no orientation taken into account). Without calculator can you say whether this is an acute or an obtuse angle?



IV.

(25 points)

Let z and z' be the complex numbers $z = -1 + 3i$ and $z' = 5 + 2i$. Evaluate $z + z'$, zz' and $\frac{z}{z'}$ in Cartesian form (i.e. $a + bi$). If $\frac{z}{z'} = r(\cos \theta + i \sin \theta)$ is the writing of $\frac{z}{z'}$ in polar (i.e. trigonometric) form, with $r > 0$ and $-\pi < \theta \leq \pi$, give the EXACT values for r , $\cos \theta$ and $\sin \theta$. No Calculator, you are not asked the exact value of θ . On the figure of Problem III, show the angle θ with its orientation. Using your calculator, give an approximate value of θ (in radians).

----- ANSWERS -----

$$z + z' =$$

$$zz' =$$

$$\frac{z}{z'} =$$

$$r =$$

$$, \cos \theta =$$

$$, \sin \theta =$$

$$\theta \simeq$$

radians.

V. Prove that the following figure is not possible:

(15 points)

