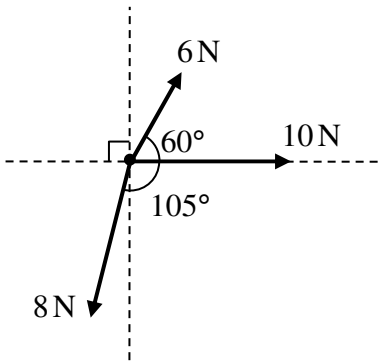
RESULTANT FORCES

Question 1 (**)



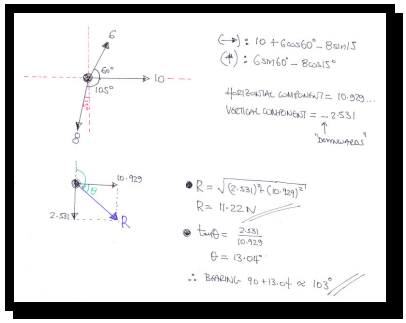
The figure above shows three forces which lie on the same plane, acting on a particle.

The magnitudes of these forces and their relative directions are shown in the figure.

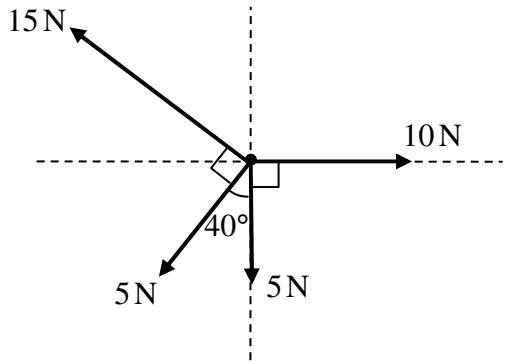
a) Find the magnitude of the resultant of the above three forces.

b) Give the direction of the resultant as a bearing.

$\boxed{R \approx 11.22 \text{ N}}$, $\boxed{\approx 103°}$



Question 2 (**)



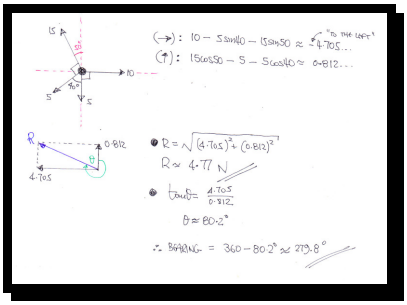
The figure above shows four forces which lie on the same plane, acting on a particle.

The magnitudes of these forces and their relative directions are shown in the figure.

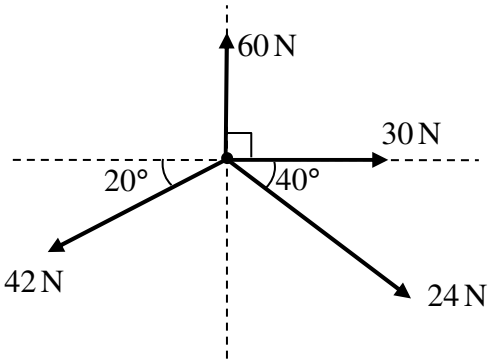
a) Find the magnitude of the resultant of the above four forces.

b) Give the direction of the resultant as a bearing.

$\boxed{R \approx 4.77 \text{ N}}$, $\boxed{\approx 280°}$



Question 3 (**)



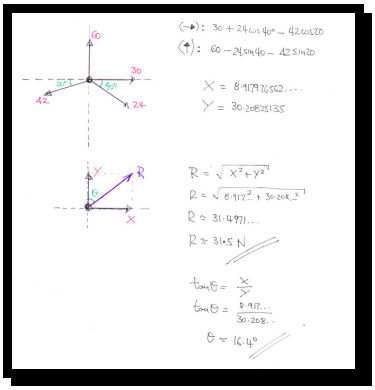
The figure above shows four forces which lie on the same plane, acting on a particle.

The magnitudes of these forces and their relative directions are shown in the figure.

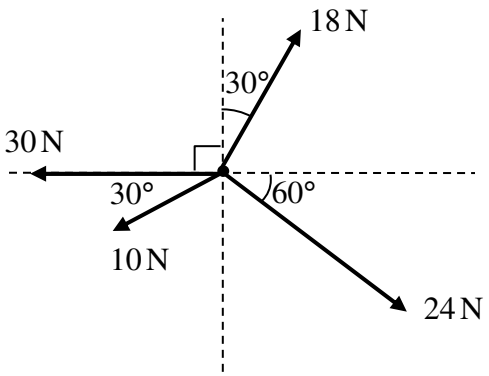
a) Find the magnitude of the resultant of the above four forces.

b) Give the direction of the resultant as a bearing.

$\boxed{R \approx 31.5 \text{ N}}$, $\boxed{\approx 016.4°}$



Question 4 (**)



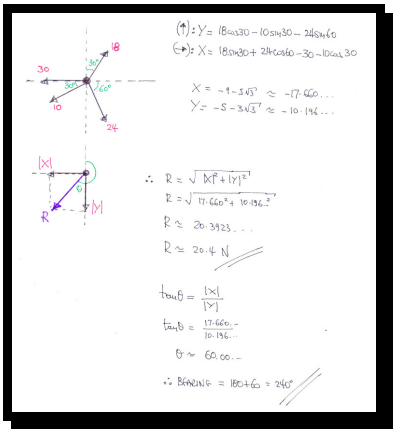
The figure above shows four forces which lie on the same plane, acting on a particle.

The magnitudes of these forces and their relative directions are shown in the figure.

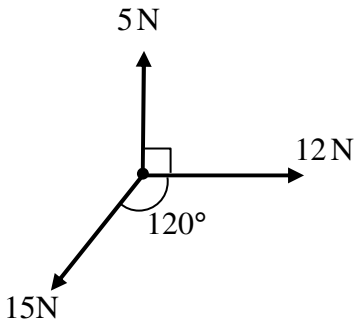
a) Find the magnitude of the resultant of the above four forces.

b) Give the direction of the resultant as a bearing.

$\boxed{R \approx 20.4 \text{ N}}$, $\boxed{= 240°}$



Question 5 (**)



The figure above shows three forces which lie on the same plane, acting on a particle.

The magnitudes of these forces and their relative directions are shown in the figure.

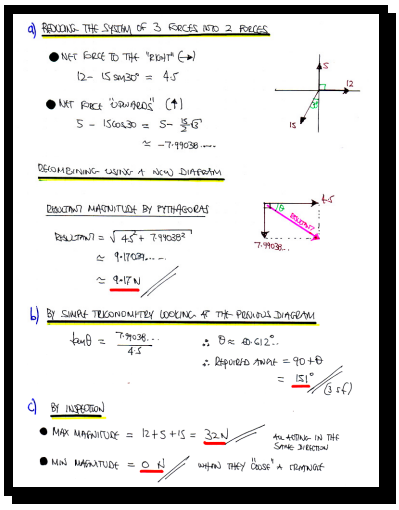
a) Find the magnitude of the resultant of the above three forces.

b) Find the angle the resultant makes with the 5 N force.

The direction in which these three forces act can be changed.

c) State, with full justification, the least and the greatest magnitudes of the resultant force.

$\boxed{}$, $\boxed{R \approx 9.17 \text{ N}}$, $\boxed{\approx 150.6^\circ}$, $\boxed{R_{\max} = 32 \text{ N}}$, $\boxed{R_{\min} = 0 \text{ N}}$



Question 6 (***)



Two forces, F_1 N and F_2 N, are acting on a particle at right angles to each other, as shown in the figure above. The resultant of the two forces has magnitude 41 N.

a) Given that the magnitude of F_1 is 9 N, find the magnitude of F_2.

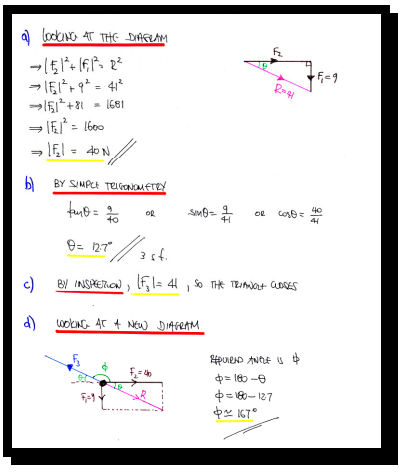
b) Determine the angle the resultant makes with F_2.

A third force F_3 is added on the particle so that all three forces are in equilibrium.

c) State the magnitude of F_3.

d) Calculate the angle F_3 makes with F_2.

$\boxed{}$, $\boxed{|F_1| = 40}$, $\boxed{\approx 12.68^\circ}$, $\boxed{|F_3| = 41}$, $\boxed{\approx 167.32^\circ}$



Question 7 (*+)**

Three coplanar forces $\mathbf{F}_1$, $\mathbf{F}_2$ and $\mathbf{F}_3$ act on a particle.

$\mathbf{F}_1$ has magnitude 25 N, acting in a bearing of $270°$.

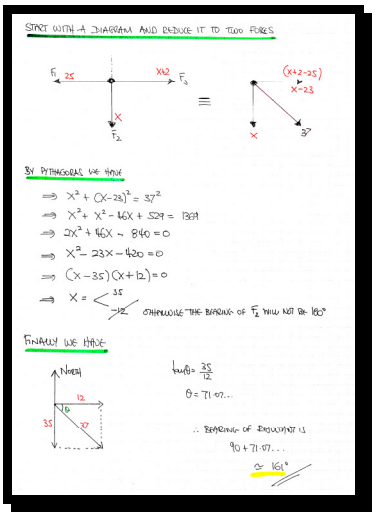
$\mathbf{F}_2$ has magnitude X N, acting in a bearing of $180°$.

$\mathbf{F}_3$ has magnitude $(X+2)$ N, acting in a bearing of $90°$.

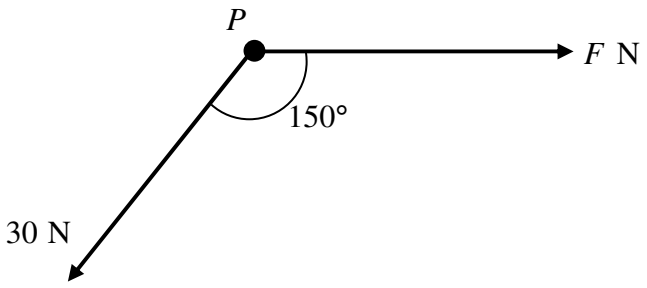
The resultant of these three forces has magnitude 37 N.

Determine, as a bearing, the angle at which the resultant of these three forces is acting.

$\boxed{}$, $\boxed{\theta \approx 161°}$



Question 8 (****)



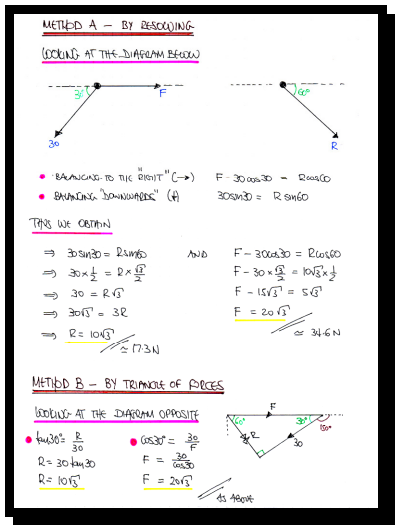
Two forces, act on a particle P so that the angle between the two forces is $150°$.

The magnitude of one of these forces is 30 N and the magnitude of the other force is F N, as shown in the figure above.

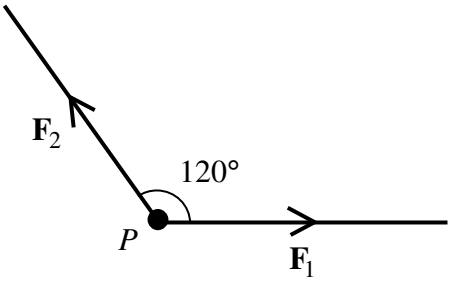
The resultant of these two forces has magnitude R N, and acts at $60°$ to the force with magnitude F N.

Calculate in any order the value of R and the value of F.

$\boxed{}$, $\boxed{R=10\sqrt{3}\approx 17.3\text{ N}}$, $\boxed{R=20\sqrt{3}\approx 34.6\text{ N}}$



Question 9 **(****)**



The figure above shows two forces $\mathbf{F}_1$ and $\mathbf{F}_2$, of magnitude 24 N and x N respectively, acting on a particle P.

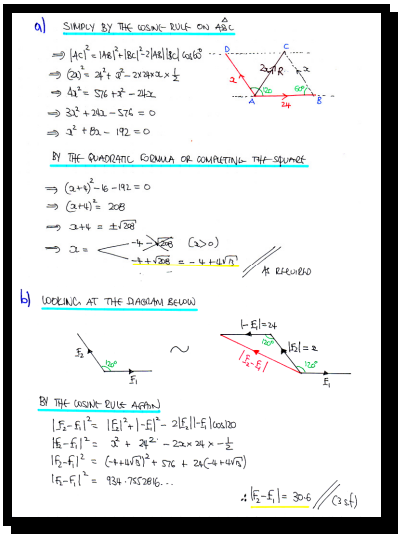
The angle between the lines of action of $\mathbf{F}_1$ and $\mathbf{F}_2$ is $120°$.

The resultant of $\mathbf{F}_1$ and $\mathbf{F}_2$ is the force $\mathbf{R}$, whose magnitude is $2x$ N.

a) Show clearly that $x=-4+4\sqrt{13}$.

b) Calculate the value of $|\mathbf{F}_2-\mathbf{F}_1|$, correct to three significant figures.

$\boxed{}$, $\boxed{|\mathbf{F}_2-\mathbf{F}_1|\approx 30.6 \text{ N}}$



Question 10 (**+)**

Two forces, F_1 N and F_2 N, are acting on a particle so that the resultant of the two forces has magnitude 120 N and acts on a bearing of $120°$.

It is further given that the F_1 acts due North and has magnitude 80 N.

Calculate in any order …

a) … the magnitude of F_2

b) … the direction in which F_2 acts, giving the answer as a bearing.

$\boxed{}$, $\boxed{|F_2| = 40\sqrt{19} \approx 174 \text{ N}}$, $\boxed{\approx 143.4°}$

