In each diagram AOB is a triangle. APN and OPQ are straight lines. $\overrightarrow{OA} = \boldsymbol{a}$ and $\overrightarrow{OB} = \boldsymbol{b}$.

Work out the ratio $ON:NB$.

1
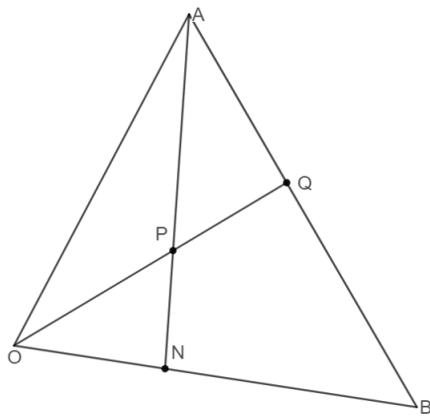

OP:PQ = 7:5

AQ:QB=3:4

2
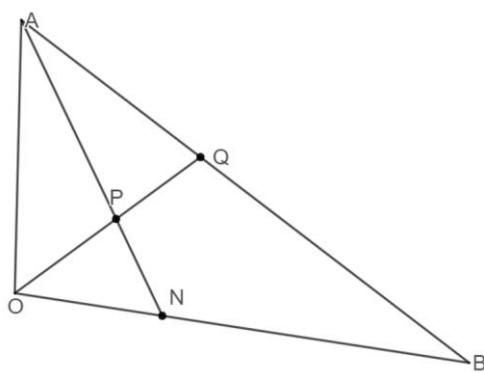
OP:PQ = 6:5

AQ:QB=2:3

3
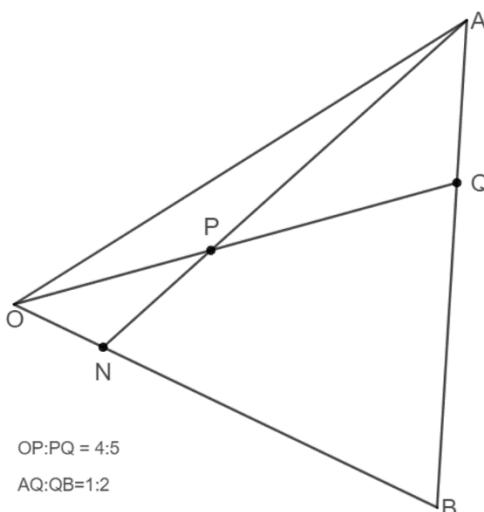
OP:PQ = 4:5

AQ:QB=1:2

Answers

1)

$$\overrightarrow{OP} = \tfrac{7}{12}\left(\overrightarrow{OA} + \overrightarrow{AQ}\right) = \tfrac{7}{12}\left(\boldsymbol{a} + \tfrac{3}{7}(-\boldsymbol{a} + \boldsymbol{b})\right) = \tfrac{1}{3}\boldsymbol{a} + \tfrac{1}{4}\boldsymbol{b}$$

$$\overrightarrow{ON} = \overrightarrow{OA} + \overrightarrow{AN} = \boldsymbol{a} + m\overrightarrow{AP} = \boldsymbol{a} + m\left(\overrightarrow{AO} + \overrightarrow{OP}\right) = \boldsymbol{a} - m\boldsymbol{a} + \tfrac{1}{3}m\boldsymbol{a} + \tfrac{1}{4}m\boldsymbol{b}$$

$$1 - m + \tfrac{1}{3}m = 0 \Rightarrow m = \tfrac{3}{2} \Rightarrow \overrightarrow{ON} = \tfrac{3}{8}\boldsymbol{b} \Rightarrow ON{:}NB = 3{:}5$$

2) 12:25

3) 4:15