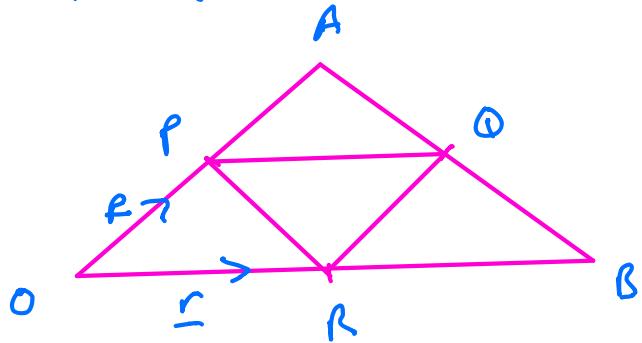


Exercise 1(E)

2)



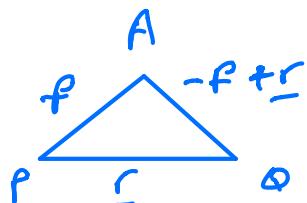
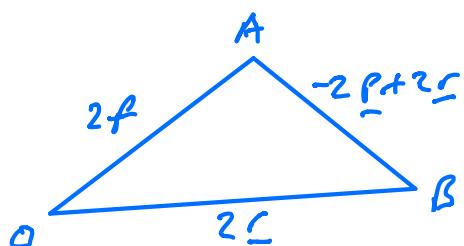
$$\overrightarrow{OB} = 2\bar{r}$$

$$\overrightarrow{OA} = 2\bar{f}$$

$$\begin{aligned}\overrightarrow{AB} &= \overrightarrow{AO} + \overrightarrow{OB} \\ &= -2\bar{f} + 2\bar{r}\end{aligned}$$

$$\overrightarrow{AQ} = \frac{1}{2}\overrightarrow{AB} = -\bar{f} + \bar{s}$$

$$\begin{aligned}\overrightarrow{PQ} &= \overrightarrow{PA} + \overrightarrow{AQ} \\ &= \bar{f} + -\bar{f} + \bar{s} \\ \overrightarrow{PQ} &= \bar{s}\end{aligned}$$

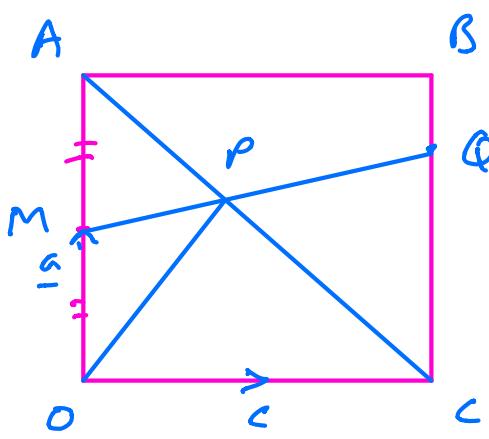


All corresponding sides parallel

$\triangle OAB$ is an enlargement of $\triangle PAQ$ scale factor 2

$\therefore \triangle$ s are similar

4)



\therefore

$$\overrightarrow{AC} = \overrightarrow{AO} + \overrightarrow{OC}$$

$$\overrightarrow{AC} = -\bar{g} + \bar{s}$$

$$\overrightarrow{OP} = \overrightarrow{OA} + \lambda \overrightarrow{AC}$$

$$\overrightarrow{OP} = \bar{g} + \lambda(-\bar{g} + \bar{s})$$

$$\begin{aligned}
 &= \frac{(1-\lambda)\underline{a} + \lambda\underline{c}}{\overrightarrow{MQ}} \\
 \overrightarrow{MQ} &= \overrightarrow{MA} + \overrightarrow{AB} + \overrightarrow{BQ} \\
 &= \frac{1}{2}\underline{a} + \underline{c} - \frac{1}{4}\underline{a} \\
 \overrightarrow{MQ} &= \frac{1}{4}\underline{a} + \underline{c} \\
 \overrightarrow{OP} &= \overrightarrow{OM} + \overrightarrow{MP} = \overrightarrow{OM} + \mu \overrightarrow{MQ} \\
 &= \frac{1}{2}\underline{a} + \mu \left(\frac{1}{4}\underline{a} + \underline{c} \right) \\
 \overrightarrow{OP} &= \left(\frac{1}{2} + \frac{1}{4}\mu \right) \underline{a} + \mu \underline{c}
 \end{aligned}$$

$$\Rightarrow \lambda = \mu$$

$$\text{and } 1 - \lambda = \frac{1}{2} + \frac{1}{4}\mu$$

$$\text{Sub for } \mu \quad 1 - \lambda = \frac{1}{2} + \frac{1}{4}\lambda$$

$$1 - \frac{1}{2} = \frac{1}{4}\lambda + \lambda$$

$$\frac{1}{2} = \frac{5}{4}\lambda$$

$$\frac{1}{2} \div \frac{5}{4} = \lambda$$

$$\frac{1}{2} \times \frac{4}{5} = \lambda$$

$$\frac{2}{5} = \lambda$$

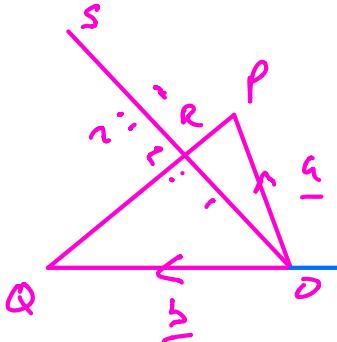
$$\frac{2}{5} = \lambda$$

$$\overrightarrow{AP} = \lambda \overrightarrow{AC} = \frac{2}{5} \overrightarrow{AC}$$

$\therefore P$ divides \overrightarrow{AC} in ratio $2:3$

$$\begin{aligned}\overrightarrow{OP} &= \left(1 - \frac{2}{3}\right)\underline{a} + \frac{2}{3}\underline{c} \\ &= \frac{1}{3}\underline{a} + \frac{2}{3}\underline{c}\end{aligned}$$

6)



$$\begin{aligned}\overrightarrow{QP} &= -\underline{b} + \underline{a} \\ \overrightarrow{QR} &= \overrightarrow{OQ} + \frac{2}{3}\overrightarrow{QP} \\ &= \underline{b} + \frac{2}{3}(-\underline{b} + \underline{a}) \\ &= \frac{1}{3}\underline{b} + \frac{2}{3}\underline{a} \\ \overrightarrow{QS} &= 3\overrightarrow{QR} = 3\left(\frac{1}{3}\underline{b} + \frac{2}{3}\underline{a}\right) \\ &= \underline{b} + 2\underline{a}\end{aligned}$$

$$\begin{aligned}\overrightarrow{TP} &= \overrightarrow{TO} + \overrightarrow{OP} \\ &= +\underline{b} + \underline{a}\end{aligned}$$

$$\begin{aligned}\overrightarrow{TS} &= \overrightarrow{TO} + \overrightarrow{OS} = \underline{b} + \underline{b} + 2\underline{a} = 2\underline{b} + 2\underline{a} \\ &= 2(\underline{b} + \underline{a}) \\ &= 2\overrightarrow{TP}\end{aligned}$$

$\therefore T, S, P$ in straight line
