| | | |
|---|---|---|
| 3 | $Q = \frac{1}{2}Y = (-14, 2, -6)$ | M1 |
| | $R = \frac{1}{4}X = (-6, 18, 6)$ | M1 |
| | $\overrightarrow{RP} = k\overrightarrow{RY} = k(\boldsymbol{y} - \boldsymbol{r})$ | M1 |
| | $\overrightarrow{RP} = k\big((-28, 4, -12) - (-6, 18, 6)\big) = (-22k, -14k, -18k)$ | M1 |
| | $\overrightarrow{QP} = \overrightarrow{QO} + \overrightarrow{OR} + \overrightarrow{RP}$<br>$= -(-14, 2, -6) + (-6, 18, 6) + (-22k, -14k, -18k)$<br>$= (-22k + 8, -14k + 16, -18k + 12)$ | M1 |
| | $\overrightarrow{PX} = \overrightarrow{PR} + \overrightarrow{RX}$<br>$= -(-22k, -14k, -18k) + 3(-6, 18, 6)$<br>$= (22k - 18, 14k + 54, 18k + 18)$ | M1 |
| | $P$, $Q$ and $X$ are colinear, so $\overrightarrow{QP} = \lambda\overrightarrow{PX}$<br>$(-22k + 8, -14k + 16, -8k + 12) = \lambda(22k - 18, 14k + 54, 18k + 18)$ | M1 |
| | Equate any two components,<br>e.g. $-22k + 8 = 22\lambda k - 18\lambda$<br>**and** $-14k + 16 = 14\lambda k + 54\lambda$ | M1 |
| | Multiply the second equation by $\frac{11}{7}$, and then equate<br>$-18\lambda - 8 = \frac{594}{7}\lambda - \frac{176}{7}$<br>$\lambda = \frac{1}{6}$ | M1 |

| | | |
|---|---|---|
| **3 cont.** | Substitute to find $k$,<br>e.g. $-22k - 22\left(\frac{1}{6}\right)k = -18\left(\frac{1}{6}\right) - 8$<br>$k = \frac{3}{7}$ | M1 |
| | $\overrightarrow{OP} = \overrightarrow{OR} + \overrightarrow{RP}$<br>$= (-6, 18, 6) + \left(-22\left(\frac{3}{7}\right), -14\left(\frac{3}{7}\right), -18\left(\frac{3}{7}\right)\right)$<br>$= \left(-\frac{108}{7}, 12, -\frac{12}{7}\right) = P$ | M1 |
| | | **[11]** |
| | | **[11 marks]** |