

1 Vectors from diagrams

Q1 (a) $-\frac{3}{7}m$ (b) $\frac{6}{7}m$ (c) $-\frac{9}{7}m$

Q2 (a) $-\frac{1}{2}n$ (b) $-\frac{2}{3}n$ (c) $\frac{1}{6}n$

Q3 (a) $4m$ (b) $-4m$ (c) $2m$

Q4 (a) $12m$ (b) $-12m$ (c) $8m$

Q5 (a) $\frac{3}{4}m + \frac{1}{4}n$
(b) $-\frac{3}{4}m + \frac{3}{4}n$

Q6 (a) $-\frac{3}{5}m + \frac{2}{3}n$
(b) $\frac{3}{5}m - \frac{2}{3}n$

Q7 $-\frac{1}{2}m + \frac{9}{4}n$

Q8 (a) $-\frac{1}{3}m - \frac{5}{12}n$
(b) E.g. $\overrightarrow{DC} + \overrightarrow{CE} = \frac{1}{3}(-m + n) - \frac{3}{4}n$, giving (a).

Q9 $\frac{4}{3}m - \frac{1}{3}n$

Q10 (a) $\frac{7}{6}m - \frac{1}{6}n$
(b) $\frac{1}{3}m + \frac{2}{3}n$

Q11 (a) $-\frac{4}{5}m + \frac{5}{8}n$
(b) $\frac{1}{5}m - \frac{3}{8}n$

Q12 (a) $\frac{1}{2}m + \frac{1}{2}n$
(b) Yes: $\overrightarrow{OT} = \frac{1}{2}\overrightarrow{OB}$.

2 Equating coefficients

Q13 $x = 6, y = -5$

Q14 $p = 3, q = 3$

Q15 $x = 4$

Q16 (a) $x = 4$ (b) $x = 2$

Q17 $x = 3, y = 2$

Q18 $x = 3, y = 4$

Q19 $x = 6, y = 2$

Q20 $x = 3, y = -2$

Q21 (a) $p = 13$
(b) Four times as long; same directions.

Q22 (a) $q = -7$
(b) Twice as long; opposite directions.

Q23 (a) $k = -12$
(b) Five times as long; opposite directions.

Q24 (a) $t = -1$
(b) Same length; opposite directions.
(c) $\lambda = -1$.

3 Harder vector problems

Q25 $AP : PB = 2 : 3$

Q26 $s = \frac{1}{7}, t = \frac{3}{7}$

Q27 $AX : XC = 3 : 1$

Q28 (a) $k = -\frac{3}{10}$ (b) $AE : EC = 7 : 3$

Q29 (a) $AR : RQ = 6 : 1$ (b) $BR : RP = 3 : 4$

Q30 (a) $AP : PF = 3 : 7$ (b) $BP : PE = 3 : 2$

Q31 (a) $\frac{4}{9}m + \frac{2}{9}n$
(b) $BP : PE = 5 : 4$

Q32 (a) $2m - 2n$
(b) $BP : PE = 1 : 2$
(c) Beyond B: $\overrightarrow{BP} = -\overrightarrow{BE}$.

Q33 $AQ : QD = 8 : 9$

Q34 $AQ : QB = 1 : 4$

Q35 (a) $OQ : QB = 2 : 1$
(b) $OR : RA = 1 : 1$
(c) No: $\overrightarrow{QR} = \frac{1}{2}m - \frac{2}{3}n$ is not a multiple of $\overrightarrow{AB} = -m + n$.

Q36 (a) $r = \frac{3}{2}$
(b) $\frac{AQ}{AD} = \frac{r+1}{3r+1}$ and $\frac{QD}{AD} = \frac{2r}{3r+1}$, hence $AQ : QD = (r+1) : 2r$.