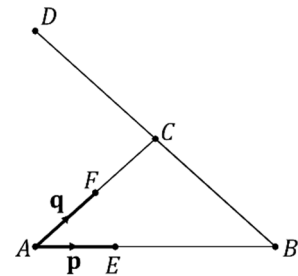


Pure 12 – Vectors 2

Please **complete** this homework by _____. Start it early. If you can't do a question you will then have time to ask your teacher for help or go to a drop in session.

Section 1 – Review of previous topics. Please complete all questions.

- In the diagram C is the midpoint of BD , F is the midpoint of AC and $EB = 2AE$. The vectors \overrightarrow{AE} and \overrightarrow{EF} are \mathbf{p} and \mathbf{q} respectively.
 - Express these vectors in terms of \mathbf{p} and \mathbf{q}
 - \overrightarrow{AB}
 - \overrightarrow{BC}
 - \overrightarrow{DF}
 - Show that E, F and D are collinear.



- Expand $(1 - 2x)^9$ in ascending powers of x up to and including the term in x^3 .
 - Use the expression to find an approximation to $(0.98)^9$, correct to 4 decimal places.
- The line l has equation $4y + 3x = 12$.
 - Find the coordinates of the intercepts of l on the axes
 - Hence or otherwise find the equation of the reflection of l in the x -axis, the y -axis and the line $y = x$.
 - Find the area of the triangle enclosed by the line l and the axes.

Section 2 – Consolidation of this week's topic. Please complete all questions.

- A canoeist takes part in a race across a lake. They must pass through checkpoints, whose positions on a grid map are given by the x and y -coordinates $(1, 11)$, $(7, 6)$ and $(13, 1)$ respectively. Show that the canoeist will pass through all three checkpoints if they paddle in a straight line.

(4 marks)

- Particles A and B have position vectors $\mathbf{a} = (2\mathbf{i} + 5\mathbf{j})$ m and $\mathbf{b} = (6\mathbf{i} + 3\mathbf{j})$ m respectively. Particle A undergoes a displacement of $(2\mathbf{i} - 3\mathbf{j})$ m and particle B moves in the opposite direction to particle A and three times as far. Calculate the distance between the particles after these displacements.

(6 marks)

- Points A and B have position vectors $\mathbf{a} = 3\mathbf{i} + \mathbf{j}$ and $\mathbf{b} = 11\mathbf{i} + 6\mathbf{j}$ respectively. Point C lies on the same straight line as A and B . The lengths AC and BC are in the ratio 3:2. Show that there are two possible positions for point C , and find the position vector of each.

(5 marks)

4. A town contains four shops A, B, C and D . Shop B is 200 m west of A . Shop C is 100m north of A . Shop D is 283 m north-east of A . Show that the positions of shops B, C and D are collinear, given that the distances are rounded.

(6 marks)

5. Particle A starts at the point $(3\mathbf{i} + \mathbf{j})$ m and travels along a track, finishing at the point $(7\mathbf{i} + 4\mathbf{j})$ m. A second particle, B , starts at the same time from the point $2\mathbf{i}$ m. It travels along a track parallel to that for A for a distance of d m.
- Work out the final position vector of B in component form, in terms of d .
 - If $d = 15$, evaluate the final distance from A to B .

(8 marks)

6. The road from P to Q makes a detour round a mountain. It first goes 6 km from P on a bearing of 080° , then 7 km on a bearing of 020° and finally 5 km on a bearing of 295° to reach Q . There is a plan to bore a tunnel through the mountain from P to Q . It will be considered cost-effective if it reduces the journey by more than 10 km. Determine whether the tunnel should be built based on this information.

(7 marks)

7. A particle has position vector $4\mathbf{j}$ m. It moves with constant velocity $(2\mathbf{i} - \mathbf{j}) \text{ ms}^{-1}$. A second particle has position vector $(6\mathbf{i} + 8\mathbf{j})$ m. It moves with constant velocity $(-\mathbf{i} - 3\mathbf{j}) \text{ ms}^{-1}$.
- Find the position vectors of the two particles after time t (Hint: If a particle moves with constant velocity \mathbf{v} , its displacement after time t is $\mathbf{v}t$. Your answers will be in terms of t).
 - Show that the particles collide, and find the time at which they do so.

(3 marks)

TOTAL: 39 Marks