# Further Maths Summer Task

You must complete **both** the Maths and Further Maths summer tasks.

Your solutions need to be laid out as detailed in the A Level Maths Summer task. The only difference is there are no answers provided for these tasks – bring your solutions and notes to your first Further Maths lesson in September.

## Part A - Skills Check

**1** Solve the following simultaneous equations:

(i) $2x + 5y = 11$, $2x - y = 5$

(ii) $x + 2y = 6$, $4x + 3y = 4$

(iii) $3a - 2b = 4$, $5a + 4b = 3$

(iv) $2p - 5q = 5$, $3p - 2q = -9$

**2** Solve the following simultaneous equations.

(i) $7x^2 + y^2 = 64$, $x + y = 4$

(ii) $3x^2 - 2y^2 = -5$, $y - x = 1$

(iii) $p^2 + pq = 2$, $q - p = 3$

(iv) $8a^2 - b^2 = 2$, $2a + b = 1$

**3** Simplify the following:

(i) $\dfrac{2^5 \times 4^{1/2}}{2}$

(ii) $(3^5)^{3/2} \times 9^{-7/4}$

(iii) $\sqrt{\dfrac{x^{4/3}}{x^{1/3} \times x^{8/3}}}$

**4** Simplify:

(i) $\dfrac{16x^{\frac{1}{2}}}{2^3 x^{-\frac{1}{2}}}$

(ii) $\dfrac{x^{\frac{5}{4}} x^{-1}}{\sqrt[4]{x^3}}$

**5** Simplify the following:

(i) $3^{5/2} - 3^{1/2}$

(ii) $2^{1/2} + 2^{3/2} + 2^{5/2}$

(iii) $y^{1/2} - y^{-1/2}$

**6** (a) For the points A(3, 1) and B(7, 4) calculate

(i) the gradient of AB

(ii) the gradient of a line perpendicular to AB

(iii) the midpoint of AB

(iv) the distance AB

(v) the coordinates of the point C which divides AB in the ratio 3:2.

(b) Repeat part (a) for the points A(-2, 9) and B(3, -1).

7 Given the points A(3, 1), B(6, $y$) and C(12, -2) find the value(s) of $y$ for which

(i) the line AB has gradient 2

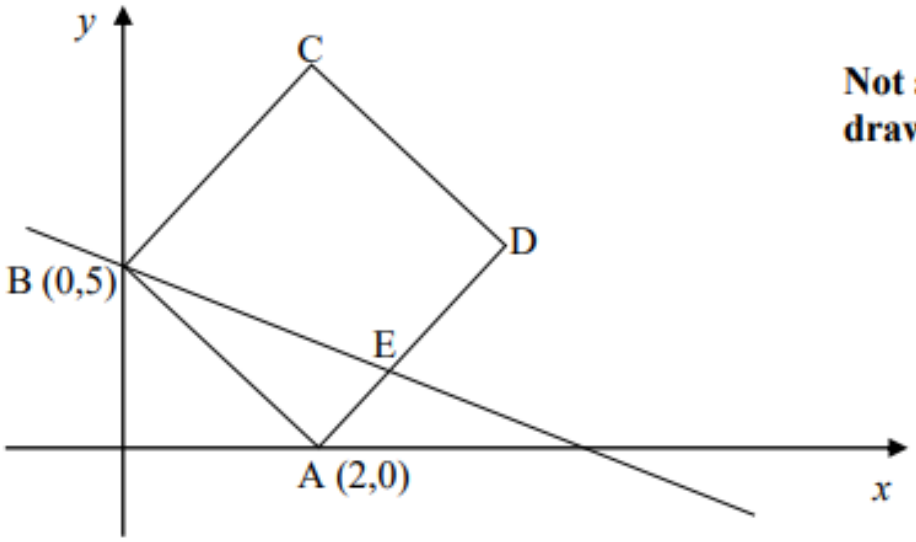
(ii) the distance AB is 5

(iii) A, B and C are collinear

(iv) AB is perpendicular to BC

(v) the lengths AB and BC are equal

8 ABCD is a square. Point E cuts AD in the ratio 1:2.

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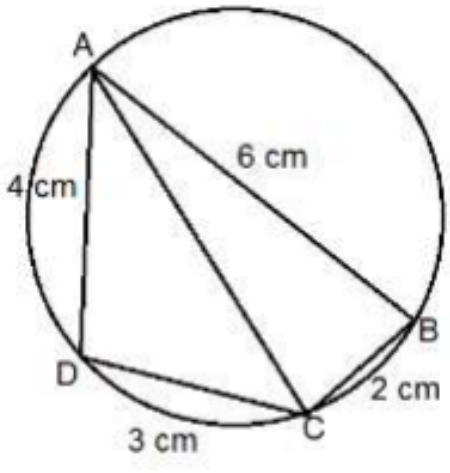
Find the coordinates of the point where line BE crosses the $x$-axis.

9 In the diagram below, ABCD is a cyclic quadrilateral.
AB = 6 cm, BC = 2 cm, CD = 3 cm, AD = 4 cm.

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Prove that triangles ABC and ADC have equal area.

## Part B – New Knowledge Exploration

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|---|---|
| 1 | Research "complex numbers"<br>How were they discovered? Why are they useful? You should read about what "$i$" represents, in the context of complex numbers. |
| 2 | Use what you have learned to simplify the following, using $i$<br>$\sqrt{-9}$ $\sqrt{-8}$ $\sqrt{-200}$ $i^2$ $i^3$ $i^4$ |
| 3 | How about…<br>$i^{11}$ ? $i^{106}$ ? |
| 4 | Use what you have learned to expand and simplify the following:<br>$(2+i)(7-8i)$ $(9i-5)(3+2i)$ $(17i-17)(3i-1)$ $(5i-1000)(5i+1000)$ |
| 5 | Research the "discriminant" test and what it is used for. It is related to the quadratic formula. |
| 6 | For the following equations,<br>i) Use the discriminant test to show that their solutions with be complex (not real)<br>ii) Solve using the quadratic formula, giving your answers as exact complex numbers<br>$7x^2-3x+11=0$ $\frac{x^2}{2}=5x-17$ $3x^2+10=4x$ $x+\frac{5}{x}=3$ |
| 7 | Show that $(x+7)(x^2+3x+8) \equiv x^3+10x^2+29x+56$<br>Hence, find the 3 solutions to the equation:<br>$x^3+10x^2+29x+56=0$ |