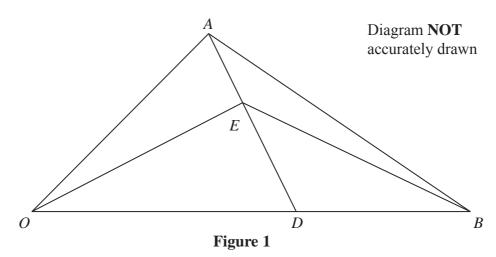**8**

Figure 1

In Figure 1, $\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$ and $\overrightarrow{OD} = \dfrac{2}{3}\mathbf{b}$

The point E divides AD in the ratio $2:3$

(a) Find as simplified expressions in terms of $\mathbf{a}$ and $\mathbf{b}$

        (i) $\overrightarrow{AD}$ (ii) $\overrightarrow{OE}$ (iii) $\overrightarrow{BE}$

(5)

The point F lies on OA such that $\overrightarrow{OF} = \lambda\overrightarrow{OA}$ and F, E and B are collinear.

(b) Find the value of λ.

(5)

The area of triangle OFB is 5 square units.

(c) Find the area of triangle OAD.

    Give your answer in the form $\dfrac{p}{q}$, where p and q are integers.

(3)

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Question 8 continued

Question 8 continued

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Question 8 continued

(Total for Question 8 is 13 marks)

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9
$$f(x) = 3x^2 - 5x - 4$$

The roots of the equation $f(x) = 0$ are α and β

(a) Without solving the equation $f(x) = 0$, form an equation, with integer coefficients, which has

   (i) roots $\dfrac{\alpha}{\beta}$ and $\dfrac{\beta}{\alpha}$

(6)

   (ii) roots $2\alpha + \beta$ and $\alpha + 2\beta$

(5)

(b) Express $f(x)$ in the form $A(x + B)^2 + C$, stating the values of the constants A, B and C.

(3)

(c) Hence, or otherwise, show that the equation $f(x) = -8$ has no real roots.

(2)

Question 9 continued

P 4 6 9 0 1 A 0 2 7 3 2

Question 9 continued

Question 9 continued

(Total for Question 9 is 16 marks)

10 The points *A* and *B* have coordinates (2, 4) and (5, –2) respectively.
The point *C* divides *AB* in the ratio 1:2

   (a) Find the coordinates of *C*.

(2)

The point *D* has coordinates (1, 1)

   (b) Show that *DC* is perpendicular to *AB*.

(3)

   (c) Find the equation of *DC* in the form $py = x + q$

(2)

The point *E* is such that *DCE* is a straight line and *DC* = *CE*.

   (d) Find the coordinates of *E*.

(2)

   (e) Calculate the area of quadrilateral *ADBE*.

(4)

Question 10 continued

Question 10 continued

(Total for Question 10 is 13 marks)

TOTAL FOR PAPER IS 100 MARKS

P 4 6 9 0 1 A 0 3 2 3 2