

**FP1 mock paper spring 2017. This is the "Specimen Paper" issued by Edexcel in 2007.**

1.  $f(x) = x^3 - 3x^2 + 5x - 4$
- (a) Use differentiation to find  $f'(x)$ . (2)

The equation  $f(x) = 0$  has a root  $\alpha$  in the interval  $1.4 < x < 1.5$

- (b) Taking 1.4 as a first approximation to  $\alpha$ , use the Newton-Raphson procedure once to obtain a second approximation to  $\alpha$ . Give your answer to 3 decimal places. (4)

**(Total 6 marks)**

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2. The rectangle  $R$  has vertices at the points  $(0, 0)$ ,  $(1, 0)$ ,  $(1, 2)$  and  $(0, 2)$ .
- (a) Find the coordinates of the vertices of the image of  $R$  under the transformation given by the matrix  $\mathbf{A} = \begin{pmatrix} a & 4 \\ -1 & 1 \end{pmatrix}$ , where  $a$  is a constant. (3)
- (b) Find  $\det \mathbf{A}$ , giving your answer in terms of  $a$ . (1)

Given that the area of the image of  $R$  is 18,

- (c) find the value of  $a$ . (3)

**(Total 7 marks)**

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3. The matrix  $\mathbf{R}$  is given by  $\mathbf{R} = \begin{pmatrix} \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \\ -\frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \end{pmatrix}$
- (a) Find  $\mathbf{R}^2$ . (2)
- (b) Describe the geometrical transformation represented by  $\mathbf{R}^2$ . (2)
- (c) Describe the geometrical transformation represented by  $\mathbf{R}$ . (1)

**(Total 5 marks)**

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4.  $f(x) = 2^x - 6x$

The equation  $f(x) = 0$  has a root  $\alpha$  in the interval  $[4, 5]$ .

Using the end points of this interval find, by linear interpolation, an approximation to  $\alpha$ .

**(Total 3 marks)**

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5. (a) Show that  $\sum_{r=1}^n (r^2 - r - 1) = \frac{1}{3}(n-2)n(n+2)$ . (6)

(b) Hence calculate the value of  $\sum_{r=10}^{40} (r^2 - r - 1)$ . (3)

**(Total 9 marks)**

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6. Given that  $z = -3 + 4i$ ,

(a) find the modulus of  $z$ , (2)

(b) the argument of  $z$  in radians to 2 decimal places. (2)

Given also that  $w = \frac{-14 + 2i}{z}$ ,

(c) use algebra to find  $w$ , giving your answers in the form  $a + ib$ , where  $a$  and  $b$  are real. (4)

The complex numbers  $z$  and  $w$  are represented by points  $A$  and  $B$  on an Argand diagram.

(d) Show the points  $A$  and  $B$  on an Argand diagram. (2)

**(Total 10 marks)**

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7. The parabola  $C$  has equation  $y^2 = 4ax$ , where  $a$  is a constant.

The point  $(4t^2, 8t)$  is a general point on  $C$ .

(a) Find the value of  $a$ .

(1)

(b) Show that the equation for the tangent to  $C$  at the point  $(4t^2, 8t)$  is

$$yt = x + 4t^2.$$

(4)

The tangent to  $C$  at the point  $A$  meets the tangent to  $C$  at the point  $B$  on the directrix of  $C$  when  $y = 15$ .

(c) Find the coordinates of  $A$  and the coordinates of  $B$ .

(7)

**(Total 12 marks)**

8.  $f(x) \equiv 2x^3 - 5x^2 + px - 5, p \in \mathbb{R}$

Given that  $1 - 2i$  is a complex solution of  $f(x) = 0$ ,

(a) write down the other complex solution of  $f(x) = 0$ ,

(1)

(b) solve the equation  $f(x) = 0$ ,

(6)

(c) find the value of  $p$ .

(2)

**(Total 9 marks)**

9. Use the method of mathematical induction to prove that, for  $n \in \mathbb{Z}^+$ ,

(a) 
$$\begin{pmatrix} 2 & 1 \\ -1 & 0 \end{pmatrix}^n = \begin{pmatrix} n+1 & n \\ -n & 1-n \end{pmatrix}$$

(7)

(b)  $f(n) = 4^n + 6n - 1$  is divisible by 3.

(7)

**(Total 14 marks)**

**TOTAL FOR PAPER: 75 MARKS**

**END**