Edexcel Maths FP1

Topic Questions from Papers

Complex Numbers

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1. $$f(x) = 2x^3 - 8x^2 + 7x - 3$$

Given that $x = 3$ is a solution of the equation $f(x) = 0$, solve $f(x) = 0$ completely.

(5)

Leave blank

9. Given that $z_1 = 3 + 2\text{i}$ and $z_2 = \dfrac{12 - 5\text{i}}{z_1}$,

(a) find z_2 in the form $a + \text{i}b$, where a and b are real.

(2)

(b) Show on an Argand diagram the point P representing z_1 and the point Q representing z_2.

(2)

(c) Given that O is the origin, show that $\angle POQ = \dfrac{\pi}{2}$.

(2)

The circle passing through the points O, P and Q has centre C. Find

(d) the complex number represented by C,

(2)

(e) the exact value of the radius of the circle.

(2)

Leave blank

1. The complex numbers z_1 and z_2 are given by

$$z_1 = 2 - \text{i} \quad \text{and} \quad z_2 = -8 + 9\text{i}$$

(a) Show z_1 and z_2 on a single Argand diagram.

(1)

Find, showing your working,

(b) the value of $|z_1|$,

(2)

(c) the value of arg z_1, giving your answer in radians to 2 decimal places,

(2)

(d) $\dfrac{z_2}{z_1}$ in the form $a + b\text{i}$, where a and b are real.

(3)

Leave blank

3. $$f(x) = (x^2 + 4)(x^2 + 8x + 25)$$

(a) Find the four roots of $f(x) = 0$.

(5)

(b) Find the sum of these four roots.

(2)

Leave blank

1. The complex numbers z_1 and z_2 are given by

$$z_1 = 2 + 8\mathrm{i} \quad \text{and} \quad z_2 = 1 - \mathrm{i}$$

Find, showing your working,

(a) $\frac{z_1}{z_2}$ in the form $a + b\mathrm{i}$, where a and b are real,

(3)

(b) the value of $\left|\frac{z_1}{z_2}\right|$,

(2)

(c) the value of $\arg \frac{z_1}{z_2}$, giving your answer in radians to 2 decimal places.

(2)

Leave blank

6. Given that 2 and 5 + 2i are roots of the equation

$$x^3 - 12x^2 + cx + d = 0, \qquad c, d \in \mathbb{R},$$

(a) write down the other complex root of the equation.

(1)

(b) Find the value of *c* and the value of *d*.

(5)

(c) Show the three roots of this equation on a single Argand diagram.

(2)

Leave blank

1. $z = 2 - 3\text{i}$

(a) Show that $z^2 = -5 - 12\text{i}$.

(2)

Find, showing your working,

(b) the value of $|z^2|$,

(2)

(c) the value of $\arg(z^2)$, giving your answer in radians to 2 decimal places.

(2)

(d) Show z and z^2 on a single Argand diagram.

(1)

Leave blank

4. $$f(x) = x^3 + x^2 + 44x + 150$$

Given that $f(x) = (x+3)(x^2 + ax + b)$, where a and b are real constants,

(a) find the value of a and the value of b.

(2)

(b) Find the three roots of $f(x) = 0$.

(4)

(c) Find the sum of the three roots of $f(x) = 0$.

(1)

Leave blank

1. $z = 5 - 3\text{i}, \quad w = 2 + 2\text{i}$

Express in the form $a + b\text{i}$, where a and b are real constants,

(a) z^2,

(2)

(b) $\dfrac{z}{w}$.

(3)

Q1

(Total 5 marks)

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Leave blank

4. Given that $2 - 4\mathrm{i}$ is a root of the equation

$$z^2 + pz + q = 0,$$

where p and q are real constants,

(a) write down the other root of the equation,

(1)

(b) find the value of p and the value of q.

(3)

N 3 5 4 0 6 A 0 8 3 2

Leave blank

7. $$z = -24 - 7\text{i}$$

(a) Show z on an Argand diagram.
(1)

(b) Calculate arg z, giving your answer in radians to 2 decimal places.
(2)

It is given that

$$w = a + b\text{i}, \quad a \in \mathbb{R},\ b \in \mathbb{R}$$

Given also that $|w| = 4$ and $\arg w = \dfrac{5\pi}{6}$,

(c) find the values of a and b,
(3)

(d) find the value of $|zw|$.
(3)

Leave blank

2. $$z_1 = -2 + \mathrm{i}$$

(a) Find the modulus of z_1.

(1)

(b) Find, in radians, the argument of z_1, giving your answer to 2 decimal places.

(2)

The solutions to the quadratic equation

$$z^2 - 10z + 28 = 0$$

are z_2 and z_3.

(c) Find z_2 and z_3, giving your answers in the form $p \pm \mathrm{i}\sqrt{q}$, where p and q are integers.

(3)

(d) Show, on an Argand diagram, the points representing your complex numbers z_1, z_2 and z_3.

(2)

Leave blank

6. Given that $z = x + \mathrm{i}y$, find the value of x and the value of y such that

$$z + 3\mathrm{i}z^{*} = -1 + 13\mathrm{i}$$

where z^{*} is the complex conjugate of z.

(7)

Leave blank

1. Given that $z_1 = 1 - \mathrm{i}$,

(a) find $\arg(z_1)$.
(2)

Given also that $z_2 = 3 + 4\mathrm{i}$, find, in the form $a + \mathrm{i}b$, $a, b \in \mathbb{R}$,

(b) $z_1 z_2$,
(2)

(c) $\dfrac{z_2}{z_1}$.
(3)

In part (b) and part (c) you must show all your working clearly.

Leave blank

5. The roots of the equation

$$z^3 - 8z^2 + 22z - 20 = 0$$

are z_1, z_2 and z_3.

(a) Given that $z_1 = 3 + \text{i}$, find z_2 and z_3.

(4)

(b) Show, on a single Argand diagram, the points representing z_1, z_2 and z_3.

(2)

Leave blank

1. $$f(x) = 2x^3 - 6x^2 - 7x - 4$$

(a) Show that $f(4) = 0$

(1)

(b) Use algebra to solve $f(x) = 0$ completely.

(4)

Leave blank

7. $$z = 2 - \mathrm{i}\sqrt{3}$$

(a) Calculate arg z , giving your answer in radians to 2 decimal places. **(2)**

Use algebra to express

(b) $z + z^2$ in the form $a + b\mathrm{i}\sqrt{3}$, where a and b are integers, **(3)**

(c) $\dfrac{z+7}{z-1}$ in the form $c + d\mathrm{i}\sqrt{3}$, where c and d are integers. **(4)**

Given that

$$w = \lambda - 3\mathrm{i}$$

where λ is a real constant, and $\arg(4 - 5\mathrm{i} + 3w) = -\dfrac{\pi}{2}$,

(d) find the value of λ. **(2)**

Leave blank

2.

$$z = \frac{50}{3+4\text{i}}$$

Find, in the form $a + \text{i}\,b$ where $a, b \in \mathbb{R}$,

(a) z,

(2)

(b) z^2.

(2)

Find

(c) $|z|$,

(2)

(d) $\arg z^2$, giving your answer in degrees to 1 decimal place.

(2)

Leave blank

5.

$$f(x) = (4x^2 + 9)(x^2 - 6x + 34)$$

(a) Find the four roots of $f(x) = 0$

Give your answers in the form $x = p + iq$, where p and q are real.

(5)

(b) Show these four roots on a single Argand diagram.

(2)

Leave blank

3. Given that $x = \frac{1}{2}$ is a root of the equation

$$2x^3 - 9x^2 + kx - 13 = 0, \qquad k \in \mathbb{R}$$

find

(a) the value of k,

(3)

(b) the other 2 roots of the equation.

(4)

Leave blank

7. $z_1 = 2 + 3\text{i}, \quad z_2 = 3 + 2\text{i}, \quad z_3 = a + b\text{i}, \quad a, b \in \mathbb{R}$

(a) Find the exact value of $|z_1 + z_2|$.

(2)

Given that $w = \dfrac{z_1 z_3}{z_2}$,

(b) find w in terms of a and b, giving your answer in the form $x + \text{i}y, \quad x, y \in \mathbb{R}$

(4)

Given also that $w = \dfrac{17}{13} - \dfrac{7}{13}\text{i}$,

(c) find the value of a and the value of b,

(3)

(d) find arg w, giving your answer in radians to 3 decimal places.

(2)

Leave blank

1. The complex numbers z and w are given by

$$z = 8 + 3\text{i}, \quad w = -2\text{i}$$

Express in the form $a + b\text{i}$, where a and b are real constants,

(a) $z - w$,

(1)

(b) zw.

(2)

Leave blank

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

(a) Find the four roots of $f(x) = 0$

(4)

(b) Show the four roots of $f(x) = 0$ on a single Argand diagram.

(2)

Leave blank

9. The complex number w is given by

$$w = 10 - 5\mathrm{i}$$

(a) Find $|w|$.

(1)

(b) Find arg w, giving your answer in radians to 2 decimal places.

(2)

The complex numbers z and w satisfy the equation

$$(2 + \mathrm{i})(z + 3\mathrm{i}) = w$$

(c) Use algebra to find z, giving your answer in the form $a + b\mathrm{i}$, where a and b are real numbers.

(4)

Given that

$$\arg(\lambda + 9\mathrm{i} + w) = \frac{\pi}{4}$$

where λ is a real constant,

(d) find the value of λ.

(2)

Further Pure Mathematics FP1

Candidates sitting FP1 may also require those formulae listed under Core Mathematics C1 and C2.

Summations

$$\sum_{r=1}^{n} r^2 = \tfrac{1}{6}n(n+1)(2n+1)$$

$$\sum_{r=1}^{n} r^3 = \tfrac{1}{4}n^2(n+1)^2$$

Numerical solution of equations

The Newton-Raphson iteration for solving $\mathrm{f}(x) = 0$: $x_{n+1} = x_n - \dfrac{\mathrm{f}(x_n)}{\mathrm{f}'(x_n)}$

Conics

	Parabola	**Rectangular Hyperbola**
Standard Form	$y^2 = 4ax$	$xy = c^2$
Parametric Form	$(at^2, 2at)$	$\left(ct, \dfrac{c}{t}\right)$
Foci	$(a, 0)$	Not required
Directrices	$x = -a$	Not required

Matrix transformations

Anticlockwise rotation through θ about O: $\begin{pmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{pmatrix}$

Reflection in the line $y = (\tan\theta)x$: $\begin{pmatrix} \cos 2\theta & \sin 2\theta \\ \sin 2\theta & -\cos 2\theta \end{pmatrix}$

In FP1, θ will be a multiple of 45°.

Core Mathematics C1

Mensuration

Surface area of sphere = $4\pi r^2$

Area of curved surface of cone = $\pi r \times$ slant height

Arithmetic series

$u_n = a + (n - 1)d$

$S_n = \frac{1}{2}n(a + l) = \frac{1}{2}n[2a + (n - 1)d]$

Core Mathematics C2

Candidates sitting C2 may also require those formulae listed under Core Mathematics C1.

Cosine rule

$$a^2 = b^2 + c^2 - 2bc \cos A$$

Binomial series

$$(a+b)^n = a^n + \binom{n}{1} a^{n-1} b + \binom{n}{2} a^{n-2} b^2 + \ldots + \binom{n}{r} a^{n-r} b^r + \ldots + b^n \qquad (n \in \mathbb{N})$$

where $\binom{n}{r} = {}^n\mathrm{C}_r = \dfrac{n!}{r!(n-r)!}$

$$(1+x)^n = 1 + nx + \frac{n(n-1)}{1 \times 2} x^2 + \ldots + \frac{n(n-1)\ldots(n-r+1)}{1 \times 2 \times \ldots \times r} x^r + \ldots \qquad (|x| < 1, n \in \mathbb{R})$$

Logarithms and exponentials

$$\log_a x = \frac{\log_b x}{\log_b a}$$

Geometric series

$$u_n = ar^{n-1}$$

$$S_n = \frac{a(1-r^n)}{1-r}$$

$$S_\infty = \frac{a}{1-r} \text{ for } |r| < 1$$

Numerical integration

The trapezium rule: $\int_a^b y \, \mathrm{d}x \approx \frac{1}{2} h\{(y_0 + y_n) + 2(y_1 + y_2 + \ldots + y_{n-1})\}$, where $h = \dfrac{b-a}{n}$