AQA A-Level Further Mathematics Warmup - Paper 2 2024

Let $z = 3 + 2\text{i}$ and $w = 1 - 3\text{i}$. Find zw^*	Sketch the locus of points in the Argand diagram that satisfy $\lvert z - 3 + 2i \rvert = 3$	Sketch $y = \dfrac{x-2}{x+3}$	Find $\displaystyle\int \frac{3x^2 + 2x + 14}{(x+1)(x^2+4)}\,\mathrm{d}x$	For $I_n = \displaystyle\int x^n \mathrm{e}^{-x}\,\mathrm{d}x$ the reduction formula $I_n = nI_{n-1} - x^n\mathrm{e}^{-x}$. Use this to find $I_3 = \displaystyle\int x^3\mathrm{e}^{-x}\mathrm{d}x$
Find the Maclaurin series expansion of $2\mathrm{e}^x + \mathrm{e}^{-x}$ up to the term involving x^3	Find the eigenvalues and eigenvectors of the matrix $\begin{pmatrix} 2 & 0 \\ 1 & 1 \end{pmatrix}$	Sketch $\dfrac{x^2}{16} - \dfrac{(y-1)^2}{9} = 1$	The polynomial $x^3 - 7x + 6$ has roots α, β, γ. Find a polynomial with roots $\alpha + 2, \beta + 2$ and $\gamma + 2$.	Sketch the locus of points in the Argand diagram that satisfy $\lvert z - 6 \rvert = \lvert z - 4\text{i} \rvert$
Points A and B on an Argand diagram represent $z_1 = \dfrac{3\sqrt{3}}{2} + \dfrac{3}{2}\text{i}$ and $z_2 = 9$ respectively. Describe a combination of two transformations that maps A to B.	Find using the method of differences $\displaystyle\sum_{r=1}^{n} \frac{1}{r(r+2)}$	Setup a matrix method to solve the simultaneous equations $3x + y + z = 11$, $2x + y + 3z = 17$, $x + y + z = 7$	What are the equations of the invariant lines for the matrix $\mathbf{A} = \begin{pmatrix} -\frac{3}{5} & \frac{4}{5} \\ \frac{4}{5} & \frac{3}{5} \end{pmatrix}$	Sketch $y = \lvert (x-3)(x+4) \rvert$
Show that $(b - a)$ is a factor of $\begin{vmatrix} bc & 1 & a \\ 1 & a & b \\ ac & 1 & b \end{vmatrix}$	What is $\displaystyle\sum_{r=1}^{n} r$?	How do you find the volume generated when the function $f(x)$, between $x = a$ and $x = b$ is rotated 2π radians around the $x-$ axis?	Write down the equations of the asymptotes of the curve $y = \dfrac{ax^2 + bx + c}{x^2 - d}$ where a, b, c and d are positive constants.	Use Simpson's rule to approximate $\displaystyle\int_2^4 \ln(x)\,\mathrm{d}x$ with 4 strips.

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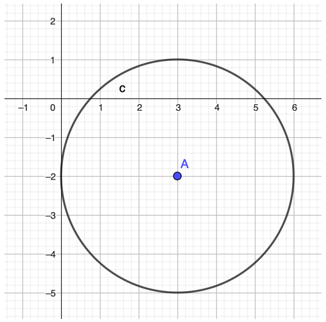
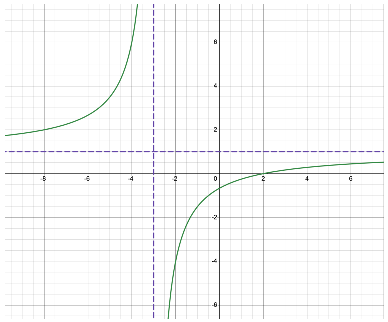
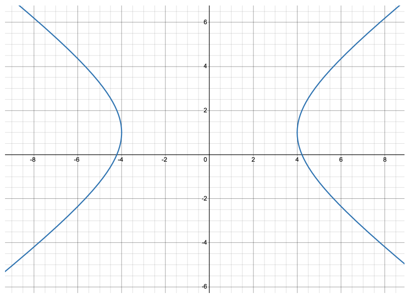
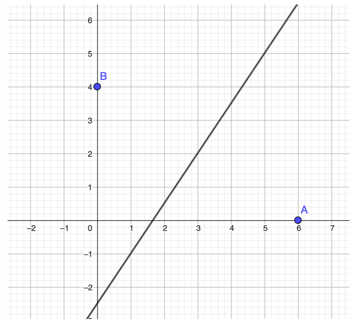
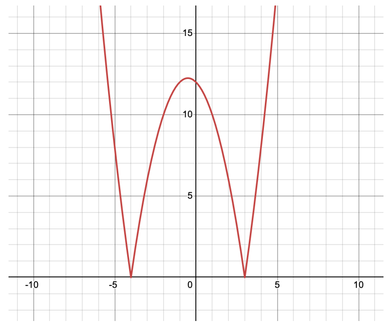
$-3+11\mathrm{i}$			$\dfrac{3x^2+2x+14}{(x+1)(x^2+4)} = \dfrac{3}{x+1} + \dfrac{2}{x^2+4}$ so, $\displaystyle\int \frac{3x^2+2x+14}{(x+1)(x^2+4)}\,\mathrm{d}x = 3\ln(x+1) + \arctan\left(\frac{x}{2}\right)$	$-e^{-x}(x^3+3x^2+6x+6)+C$
$3+x+\dfrac{3x^2}{2}+\dfrac{x^3}{6}$	$\lambda_1 = 2,\ \mathbf{v}_1 = \begin{pmatrix}1\\1\end{pmatrix}$ $\lambda_2 = 1,\ \mathbf{v}_2 = \begin{pmatrix}0\\1\end{pmatrix}$		$x^3-6x^2+5x+12$	
$\lvert z_1\rvert = 3,\ \arg(z_1) = \dfrac{\pi}{6}$ $\lvert z_2\rvert = 9,\ \arg(z_1) = \dfrac{\pi}{2}$ So an enlargement scale factor 3 followed by a rotation through $\dfrac{\pi}{3}$ about the origin.	$\dfrac{1}{r(r+2)} = \dfrac{1}{2r} - \dfrac{1}{2(r+2)}$ then using the method of differences $\displaystyle\sum_{r=1}^{n} \frac{1}{r(r+2)} = \frac{3}{4} - \frac{2n+3}{2(n+1)(n+2)}$	$\begin{pmatrix}3&1&1\\2&1&3\\1&1&1\end{pmatrix}\begin{pmatrix}x\\y\\z\end{pmatrix} = \begin{pmatrix}11\\17\\7\end{pmatrix}$ $x=2,\ y=1$ and $z=4$	$y=2x$ and $y=-\dfrac{1}{2}x+c$	
$\begin{vmatrix}bc&1&a\\1&a&b\\ac&1&b\end{vmatrix} = \begin{vmatrix}c(b-a)&0&a-b\\1&a&b\\ac&1&b\end{vmatrix}$ $=(b-a)\begin{vmatrix}c&0&-1\\1&a&b\\ac&1&b\end{vmatrix}$	$\displaystyle\sum_{r=1}^{n} r = \frac{1}{2}n(n+1)$	$V = \pi\displaystyle\int_a^b y^2\ \mathrm{d}x$	$y=a$ and $x=d$ and $x=-d$	2.158813487