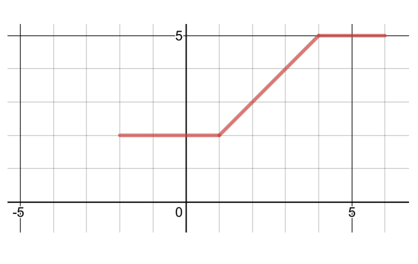
AQA Level 2 Further Mathematics Warmup - Paper 1 2019

Differentiate $y = x(x + 1)(x - 3)$	Write the matrix representing a rotation through $270°$, anticlockwise, about the origin.	State the factor theorem.	Find the second derivative of $y = 3x^4 + 2x^2 - 10x^2 - 7x + 5$	Write down the 5 term of the sequence defined by $u_n = \frac{3n + 2}{2n}$. What is the limiting value of u_n as $n \to \infty$?
Find the centre and radius of the circle $x^2 - 4x + y^2 + 6y + 4 = 0$		Find the solutions of $3\sin^2(x) + \cos^2(x) + 3\sin(x) - 3 = 0$ in the range $0° \le x \le 360°$	Simplify $\frac{4a^2b^2}{3c} \times \frac{9c^2}{2a^2}$	Sketch, showing any intersections the curve $y = 3x^2 + 9x - 3$
A bird flies in a straight line at an angle of elevation $13°$ from the ground to a branch on a tree. Given that the branch is at a height of 15m how far away is the tree.	The graph above shows a piece wise function $g(x)$. Define $g(x)$ stating the domain if each part, and also state the range of $g(x)$	Find the equation of the tangent to the circle $x^2 - 6x + y^2 - 4y = 0$ at the point $(5,5)$. Find also where this tangent intersects the $x-$ axis.	Sketch the graphs of $y = \sin(x)$ and $y = \tan(x)$ for $0° \le x \le 360°$	Prove $(n + 5)^2 - (n + 3)^2$ is divisible by 4 for all integers n.
Show that $(x + 1)$ is a factor of $x^3 + 2x^2 - 5x - 6$	Rationalise the denominator of $\frac{2\sqrt{3}}{3 - 2\sqrt{5}}$	Given that $\begin{pmatrix} 2 & 1 \\ b & 4 \end{pmatrix}\begin{pmatrix} a & 3 \\ 2 & 4 \end{pmatrix} = \begin{pmatrix} 4 & 10 \\ 8 & 16 \end{pmatrix}$ find a and b.	Identify the turning point of the quadratic $y = 2x^2 + 5x - 7$	Find the stationary points of $y = \frac{x^3}{3} - \frac{x^2}{2} - 6x + 5$
Factorise fully $t^7 - 49t^3$	Find the equation of the tangent to $y = x^2 + 2x$ at $x = 2$.	The straight line $y = 2x - 10$ intersects the circle $(x - 2)^2 + (y + 1)^2 = 25$. Find the points of intersection.	The point $(2,1)$ is transformed by the matrix $\begin{pmatrix} 1 & 0 \\ 1 & 1 \end{pmatrix}$ to the point A. This is then transformed to the point B by the matrix $\begin{pmatrix} 3 & 0 \\ 0 & 3 \end{pmatrix}$. Find B.	Factorise, fully, $x^2 - 4x - 9y^2 - 36y - 32$

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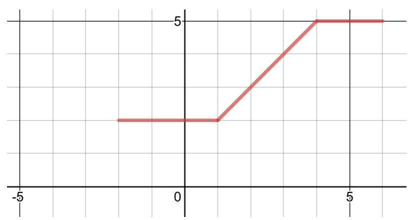
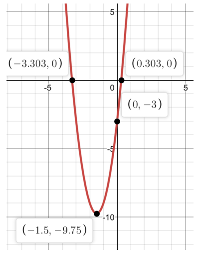
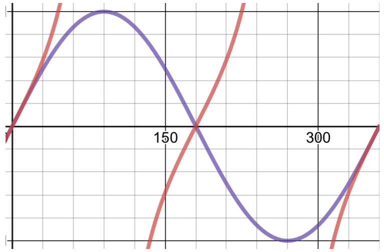
$\frac{dy}{dx} = 3x^2 - 4x - 3$	$\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$	If $(x - a)$ is a factor of the polynomial $p(x)$, then $p(a) = 0$ and $x = a$ is a root of the equation $p(x) = 0$. Conversely if $p(a) = 0$, then $(x - a)$ is a factor of $p(x)$.	$\frac{d^2y}{dx^2} = 4(9x^2 - 4)$	When $n = 5$, $u_n = \frac{17}{10}$. As $n \to \infty$, $u_n \to \frac{3}{2}$.
By completing the square the centre is $(2, -3)$ and the radius is 3.		Use the identity $\sin^2(x) + \cos^2(x) = 1$ to find $(2\sin(x) - 1)(\sin(x) + 2) = 0$. Hence $x = 30°$ or $150°$	$6b^2c$	
$x = \frac{20}{\tan(13°)}$ $x = 86.6$m	$g(x) = \begin{cases} 2 & -2 \le x \le 1 \\ x + 1 & 1 \le x \le 4 \\ 5 & 4 \le x \le 6 \end{cases}$ Range of $g(x)$ is $2 \le g(x) \le 5$	Circle has centre (3,2) and radius $\sqrt{13}$. Equation of tangent at (5,5) is $2x + 3y = 25$. The tangent meets the x−axis at (12.5,0).		Expanding and simplifying we have $(n+5)^2 - (n+3)^2 = n^2 + 10n + 25 - n^2 - 6n - 9$ $= 4n + 16$ $= 4(n+4)$ which is divisible by 4.
$f(-1) = 0$ and so $(x - 1)$ is a factor.	$\frac{-6\sqrt{3} - 4\sqrt{5}}{11}$	This leads to two simultaneous equations $2a + 2 = 4$ and $ba + 8 = 8$ which lead to $a = 2$ and. $b = 0$.	Completing the square we have $y = 2\left(x + \frac{5}{4}\right) - \frac{81}{8}$ so the turning point has coordinate $\left(-\frac{5}{4}, -\frac{81}{8}\right)$	Maximum at $\left(-2, \frac{37}{3}\right)$ and minimum at $\left(3, -\frac{17}{2}\right)$
$t^3(t^2 - 7)(t^2 + 7)$	$y = 6x - 4$	$(2, -6)$ and $(6,2)$	$B = \begin{pmatrix} 6 \\ 9 \end{pmatrix}$	Factorising the x and y terms separately we have $(x-2)^2 - 3(y+2)^2$. Noticing this is a difference of two squares we obtain $(x - 3y - 8)(x + 3y + 4)$ as the factorised form.