Y	Q	Differentiation
2022	13	A function is defined as $f(x)=\dfrac{\sec x}{\tan x+1}$, where $0\le x<\dfrac{\pi}{2}$. (a) Show that $f'(x)=f(x)\left(\dfrac{\tan x-1}{\tan x+1}\right)$, given that $1+\tan^2 x=\sec^2 x$. **3** (b) Hence find $\displaystyle\int\frac{\tan x-1}{\tan x+1}dx$. **2**
2019	2	(a) If $f(x)=xe^{-3x}$, find the exact value of $f'(-1)$. **3** (b) Given $g(t)=\dfrac{3t}{(2t+1)^2}$, find $g'(t)$, simplifying your answer. **3**
2019	7	A function, f, is defined on a suitable domain by $f(t)=\ln(\sec 2t+\tan 2t)$. Differentiate $f(t)$ and simplify your answer. **4**
2019	10	A curve is defined implicitly by $3y+x^2e^{2y}=9,\ x>0$. Find the gradient of the tangent to the curve when $y=0$. **4**
2018	4	A function is defined as $f(x)=e^{\sec^2 x}$ where $0\le x<\dfrac{\pi}{2}$. Find the exact value of $f'\left(\dfrac{\pi}{4}\right)$. **3**
2018	8	The motion of a particle is defined by the equations $x=t(t+4)$ and $y=t(1-t)^3$ where t is the time elapsed since the start of motion. Find the speed of the particle when $t=3$. **4**
2017	2	(a) If $f(x)=\dfrac{\ln x}{2x^2}$, $x\neq 0$, find $f'(x)$. Fully simplify your answer. **3** (b) If $y=\text{cosec}^2 3x$, show that $\dfrac{dy}{dx}+6y\cot 3x=0$. **3**
2017	11	A curve is defined by $3y^2-x^2y=4,\quad x\ge 0,\ y\ge\dfrac{2}{\sqrt{3}}$. Use implicit differentiation to find the gradient of the tangent when $x=2$. **5**
2016	4	Find the equation of the tangent to the curve $y=x\ln x$ at the point where $x=e$. **3**

2016	10	A stone is thrown from the top of a cliff and the subsequent motion can be modelled in the $x\,y$ plane by the equations $x=4t$ **and** $y=20+2t-5t^2$. (a) Use parametric differentiation to find $\frac{dy}{dx}$ in terms of t. **2** (b) (i) Find the angle of projection of the stone. **2** (ii) By considering $\frac{dy}{dx}$ find the value of t when the stone is moving at 45° below the horizontal. **2**
2016 Spec	2	Given $y=e^{x^2}\cos x$ find $\frac{dy}{dx}$. **3**
2016 Spec	7	Calculate the gradient of the tangent to the curve $xy^2 - 4xy = 5$ at the point (1,5). **4**