Higher Maths Self Evaluation

Applications

Applications: The Straight Line	☺	😐	☹
Find the gradient of a line using: • $\frac{y_2 - y_1}{x_2 - x_1}$ • $m = \tan\theta$			
Know the equation of a straight line of the form $y - b = m(x - a)$			
Know an equation of a straight line of the form $ax + by + c = 0$			
Know the features of gradients of: • parallel lines • perpendicular lines			
Determine the equation of a straight line given: • one point and the gradient • two points			
Find the distance between two points using the distance formula			
Recognise the term locus			
Find the equations of: • medians • altitudes • perpendicular bisector			
Know the concurrency properties of: • medians • altitudes • perpendicular bisectors			

Applications: Recurrence Relations	☺	😐	☹
Know the meanings of the terms: sequence, nth term, limit as n tends to infinity			
Use the notation U_n for the nth term of a sequence			
Define and interpret a recurrence relation of the form ($u_{n+1} = au_n + b$)			
Know the condition for the limit of a sequence ($-1 < a < 1$)			
Find and interpret the limit of a sequence from a recurrence relation			

Applications: Differentiation	☺	😐	☹
Know that: • If $f(x) = x^n$ then $f'(x) = nx^{n-1}$ • If $f(x) = g(x) + h(x)$ then $f'(x) = g'(x) + h'(x)$ • If $f(x) = ax^n$ then $f'(x) = nax^{n-1}$			
Know how to use Leibniz notation to differentiate $\left(\frac{dy}{dx}\right)$			
Know that f'(x) is: • rate of change of f at x • gradient of the tangent to the curve at x			
Know how to find the equation of the tangent to a curve $y = f(x)$ at $x = a$			
Know how to find the points on a graph where the gradient of a tangent has a particular value			
Know that when: • $f'(x) < 0$ the function is decreasing • $f'(x) > 0$ the function is increasing • $f'(x) = 0$ the function is stationary			
Know how to find the stationary points on a curve and determine their nature			
Know how to sketch curves by finding: • stationary points and their nature • intersection with the axes			
Know how to sketch the graphs of derived functions			
Know how to find the maximum and minimum values of a function on a given interval			
Know how to solve optimization problems using differential calculus			

Applications: Integration	☺	😐	☹
Know the meaning of the terms integral, integrate, constant of integration, definite integral, limits of integration, indefinite integral and the area under a curve			
Know that if $f(x) = F'(x)$ then $\int f(x)\,dx = F(x) + C$			
Know that if $f(x) = F'(x)$ then $\int_a^b f(x)\,dx = F(b) - F(a)$			
Know how to integrate polynomial expressions, $f(x) = px^n$, for all rational n, except n= -1 and the sum or difference of such functions e.g integrate with respect to x, $x^3 + 1 + \frac{1}{x^2}$			
Know how to evaluate definite integrals			
Know how to determine the area between a curve $y = f(x)$, x-axis and the lines $x = a$ and $x = b$			
Know how to determine the area bounded between two curves			
Know how to solve differential equations of the form $\frac{dy}{dx} = f(x)$ for all suitable $f(x)$			

Applications: The Circle	☺	😐	☹
Know that the equation of a circle centre (a,b) and radius r is $(x-a)^2 + (y-b)^2 = r^2$			
Know that the equation $x^2 + y^2 + 2gx + 2fy + c = 0$ represents a circle with centre $(-g, -f)$ and radius $\sqrt{g^2 + f^2 - c}$ provided $g^2 + f^2 - c > 0$			
Know how to determine the equation of a circle			
Know how to find the points of intersection of a straight line with a circle			
Know how to determine whether a line is a tangent to the circle			
Know how to solve problems involving the intersection of a straight line with a circle, and a tangent to the circle			
Know how to determine whether two circles touch each other			

Applications: Quadratics	☺	😐	☹
Know how to complete the square for $ax^2 + bx + c \rightarrow a(x+b)^2 + c$			
Know that the roots of the quadratic equation, $ax^2 + bx + c = 0$, are $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$			
Know how to solve quadratic inequalities (graphically)			
Know that the discriminant of $ax^2 + bx + c = 0$ is $b^2 - 4ac$			
Know how to use the discriminant to determine the nature of the roots of a quadratic equation			
Know how to use the discriminant to find the conditions that the roots of a quadratic equation are real, real and equal or real and unequal			
Know the conditions for tangency – the intersection of a straight line and a parabola			

Expressions and Functions

Expressions and Functions: Functions and Graphs	☺	😐	☹
Know the meaning of the terms: domain and range of a function, inverse of a function and composite function.			
Know how to find $f(g(x))$ and $g(f(x))$ given $f(x)$ and $g(x)$			
Know the general features of the graphs of $f: x \rightarrow a^x$ and $f: x \rightarrow \log_a x$			
Recognise the form of a function from its graph			
Given the graph of f(x), draw graphs of related functions for: $y = f(x) + a$			
$y = f(x + a)$			
$y = -f(x)$			
$y = f(-x)$			
$y = kf(x)$			
$y = f(kx)$			
Know the features of the graphs of $f: x \rightarrow \sin(ax + b)$ and $f: x \rightarrow \cos(ax + b)$ for suitable constants a and b			
Know the meaning of the terms amplitude and period			
Know that π radians= 180°			
Know exact values (in degrees and radians)			
Know how to solve trigonometric equations algebraically			
Know how to find the inverse of a function			

Expressions and Functions: Trigonometric Equations	☺	😐	☹
Solve trig equations of the form asinx + b = c, acosx + b = c			
Solve trig equations of the form $a\sin^2 x = b$, $a\cos^2 x = b$			
Solve trig equations of the form asinbx = c, acosbx = c			

Expressions & Functions: Vectors	☺	😐	☹
Know the meaning of the terms vector, magnitude (length), direction, position vector, unit vector, component and scalar product			
Know the properties of vector addition and multiplication of a vector by a scalar (scalar multiple)			
Know how to determine the distance between two points in 3 dimensional space			
Know and apply the equality fact: $\begin{pmatrix} a \\ b \\ c \end{pmatrix} = \begin{pmatrix} d \\ e \\ f \end{pmatrix} \Rightarrow a = d,\ b = e,\ c = f$			
Know and apply the fact that if $\underline{\mathbf{u}}$ and $\underline{\mathbf{v}}$ are vectors that can be represented as parallel lines then $\underline{\mathbf{u}} = \mathbf{k}\underline{\mathbf{v}}$ where k is a constant			
Know and apply the fact that if A, P and B are collinear points such that $\frac{AP}{PB} = \frac{m}{n}$ then $\overrightarrow{\mathrm{AP}} = \frac{m}{n}\overrightarrow{\mathrm{PB}}$			
Know how to determine whether three points are collinear			
Know and apply the basis vectors $\underline{\mathbf{i}}$, $\underline{\mathbf{j}}$, and $\underline{\mathbf{k}}$			
Know the scalar product facts $a.b = \lvert a\rvert\lvert b\rvert\cos\theta$			
$a.b = a_1\ b_1 + a_2\ b_2 + a_3\ b_3$			
$a.(b + c) = a.b + a.c$			
Know how to determine if two vectors are perpendicular			
Know how to use the scalar product to find the angle between two vectors			

Expressions & Functions: Wave Function	☺	😐	☹
Know how to express $a\cos\theta + b\sin\theta$ in the form $r\cos(\theta \pm \alpha)$ *or* $r\sin(\theta \pm \alpha)$			
Know how to solve equations of the form $a\cos\theta + b\sin\theta = c$ by first expressing in one of the forms above			
Know how to find the maximum and minimum values of the expressions of the form $a\cos\theta + b\sin\theta$			
Know how to sketch graphs of the form $f(x) = a\cos\theta + b\sin\theta$			

Expressions & Functions: Logarithmic and Exponential Functions	☺	😐	☹
Know that $a^y = x \Leftrightarrow \log_a x = y$ *where a>1 and x>0*			
Know the following laws of logarithms: $\log_a 1 = 0$, $\log_a a = 1$			
$\log_a bc = \log_a b + \log_a c$			
$\log_a \left(\frac{b}{c}\right) = \log_a b - \log_a c$			
$\log_a b^n = n\log_a b$			
Know how to simplify numerical expressions using the laws of logarithms			
Know how to solve simple logarithmic and exponential equations			
Know how to solve for, a and b, equations of the following form when given the corresponding values of x and y: $\log y = a\log x + b$			
$y = ax^b$			
$y = ab^x$			
Know how to use a straight line graph, involving logs, to confirm relationships of the form $y = ax^b$ and $y = ab^x$			
Know how draw graphs of logy against logx from experimental data and deduce the values of a and b such that $y = ab^x$			

Expressions and Functions: Addition Formulae	☺	😐	☹
Know and apply the addition formulae $\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$ $\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$			
Know how to solve problems involving the addition formulae			
Know how to solve equations involving the addition formulae			

Relationships and Calculus

Relationships and Calculus: Polynomials and Quadratics	☺	😐	☹
Know how to use the remainder theorem to find the remainder of a polynomial expression when divided by $(ax-h)$			
Know how to find the roots of a polynomial equation			
Know how to use the factor theorem to determine factors of a polynomial equation			
Know how to prove that a polynomial equation has a root between two given values and find the root to a given number of decimal places			
Know how to determine the equation of a quadratic from given roots using $y = k(x-a)(x-b)$			

Relationships & Calculus: The double angle formulae	☺	😐	☹
Recognise and be able to use the double angle formulae $\sin 2A = 2\sin A\cos A$ $\cos 2A = \cos^2 A - \sin^2 A$, $\cos 2A = 1 - 2\sin^2 A$, $\cos 2A = 2\cos^2 A - 1$			
Solve Trig equations involving a combination of sin2x or cos2x terms using factorization.			

Relationships and Calculus: Further Calculus	☺	😐	☹
Know how to apply the following facts for differentiating and integrating trigonometric functions $f(x) = \sin x \Rightarrow f'(x) = \cos x$ *and* $\int \cos x\, dx = \sin x + C$ $f(x) = \cos x \Rightarrow f'(x) = -\sin x$ *and* $\int \sin x\, dx = -\cos x + C$			
Know and apply the fact that: $f(x) = g(h(x)) \Rightarrow f'(x) = g'(h(x)) \times h'(x)$ (chain rule)			
Know how to integrate functions of the form $f(x) = (px+q)^n$ for all rational n except n = -1 and the sum or difference of such functions where p and q are constants			
Know how to integrate functions of the form $f(x) = p\cos(qx+r)$ and the sum or difference of such functions where p, q and r are constants			