

## Skills, knowledge and understanding for the course assessment

The following provides details of skills, knowledge and understanding sampled in the course assessment:

Algebraic and trigonometric skills	
Skills	Explanation
Manipulating algebraic expressions	<ul style="list-style-type: none"> <li>◆ factorising a cubic or quartic polynomial expression</li> <li>◆ simplifying a numerical expression using the laws of logarithms and exponents</li> </ul>
Manipulating trigonometric expressions	<ul style="list-style-type: none"> <li>◆ applying the addition formulae and/or double angle formulae</li> <li>◆ applying trigonometric identities</li> <li>◆ converting <math>a\cos x + b\sin x</math> to <math>k\cos(x \pm \alpha)</math> or <math>k\sin(x \pm \alpha)</math>, <math>k &gt; 0</math></li> </ul>
Identifying and sketching related functions	<ul style="list-style-type: none"> <li>◆ identifying a function from a graph, or sketching a function after a transformation of the form <math>kf(x)</math>, <math>f(kx)</math>, <math>f(x) + k</math>, <math>f(x + k)</math> or a combination of these</li> <li>◆ sketching <math>y = f'(x)</math> given the graph of <math>y = f(x)</math></li> <li>◆ sketching the inverse of a logarithmic or an exponential function</li> <li>◆ completing the square in a quadratic expression where the coefficient of <math>x^2</math> is non-unitary</li> </ul>
Determining composite and inverse functions	<ul style="list-style-type: none"> <li>◆ knowledge and use of the terms domain and range is expected</li> <li>◆ determining a composite function given <math>f(x)</math> and <math>g(x)</math>, where <math>f(x)</math> and <math>g(x)</math> can be trigonometric, logarithmic, exponential or algebraic functions</li> <li>◆ determining <math>f^{-1}(x)</math> of functions</li> </ul>

## Algebraic and trigonometric skills

Skills	Explanation
Solving algebraic equations	<ul style="list-style-type: none"><li>◆ solving a cubic or quartic polynomial equation</li><li>◆ using the discriminant to find an unknown, given the nature of the roots of an equation</li><li>◆ solving quadratic inequalities, <math>ax^2 + bx + c \geq 0</math> (or <math>\leq 0</math>)</li><li>◆ solving logarithmic and exponential equations</li><li>◆ using the laws of logarithms and exponents</li><li>◆ solving equations of the following forms for <math>a</math> and <math>b</math>, given two pairs of corresponding values of <math>x</math> and <math>y</math>: <math>\log y = b \log x + \log a</math>, <math>y = ax^b</math> and <math>\log y = x \log b + \log a</math>, <math>y = ab^x</math></li><li>◆ using a straight-line graph to confirm relationships of the form <math>y = ax^b</math>, <math>y = ab^x</math></li><li>◆ mathematically modelling situations involving the logarithmic or exponential function</li><li>◆ finding the coordinates of the point(s) of intersection of a straight line and a curve or of two curves</li></ul>
Solving trigonometric equations	<ul style="list-style-type: none"><li>◆ solving trigonometric equations in degrees or radians, including those involving the wave function or trigonometric formulae or identities, in a given interval</li></ul>

Geometric skills	
Skills	Explanation
Determining vector connections	<ul style="list-style-type: none"> <li>◆ determining the resultant of vector pathways in three dimensions</li> <li>◆ working with collinearity</li> <li>◆ determining the coordinates of an internal division point of a line</li> </ul>
Working with vectors	<ul style="list-style-type: none"> <li>◆ evaluating a scalar product given suitable information and determining the angle between two vectors</li> <li>◆ applying properties of the scalar product</li> <li>◆ using and finding unit vectors including <math>\mathbf{i}</math>, <math>\mathbf{j}</math>, <math>\mathbf{k}</math> as a basis</li> </ul>

Calculus skills	
Skills	Explanation
Differentiating functions	<ul style="list-style-type: none"> <li>◆ differentiating an algebraic function which is, or can be simplified to, an expression in powers of <math>x</math></li> <li>◆ differentiating <math>k \sin x</math> and <math>k \cos x</math></li> <li>◆ differentiating a composite function using the chain rule</li> </ul>
Using differentiation to investigate the nature and properties of functions	<ul style="list-style-type: none"> <li>◆ determining the equation of a tangent to a curve at a given point by differentiation</li> <li>◆ determining where a function is strictly increasing or decreasing</li> <li>◆ sketching the graph of an algebraic function by determining stationary points and their nature as well as intersections with the axes and behaviour of <math>f(x)</math> for large positive and negative values of <math>x</math></li> </ul>

Calculus skills	
Skills	Explanation
Integrating functions	<ul style="list-style-type: none"> <li>◆ integrating an algebraic function which is, or can be, simplified to an expression of powers of <math>x</math></li> <li>◆ integrating functions of the form <math>f(x) = (x + q)^n</math>, <math>n \neq -1</math></li> <li>◆ integrating functions of the form <math>f(x) = p \cos x</math> and <math>f(x) = p \sin x</math></li> <li>◆ integrating functions of the form <math>f(x) = (px + q)^n</math>, <math>n \neq -1</math></li> <li>◆ integrating functions of the form <math>f(x) = p \cos(qx + r)</math> and <math>p \sin(qx + r)</math></li> <li>◆ solving differential equations of the form <math>\frac{dy}{dx} = f(x)</math></li> </ul>
Using integration to calculate definite integrals	<ul style="list-style-type: none"> <li>◆ calculating definite integrals of functions with limits which are integers, radians, surds or fractions</li> </ul>
Applying differential calculus	<ul style="list-style-type: none"> <li>◆ determining the optimal solution for a given problem</li> <li>◆ determining the greatest and/or least values of a function on a closed interval</li> <li>◆ solving problems using rate of change</li> </ul>
Applying integral calculus	<ul style="list-style-type: none"> <li>◆ finding the area between a curve and the <math>x</math>-axis</li> <li>◆ finding the area between a straight line and a curve or two curves</li> <li>◆ determining and using a function from a given rate of change and initial conditions</li> </ul>

<b>Algebraic and geometric skills</b>	
<b>Skills</b>	<b>Explanation</b>
Applying algebraic skills to rectilinear shapes	<ul style="list-style-type: none"> <li>◆ finding the equation of a line parallel to and a line perpendicular to a given line</li> <li>◆ using <math>m = \tan \theta</math> to calculate a gradient or angle</li> <li>◆ using properties of medians, altitudes and perpendicular bisectors in problems involving the equation of a line and intersection of lines</li> <li>◆ determining whether or not two lines are perpendicular</li> </ul>
Applying algebraic skills to circles and graphs	<ul style="list-style-type: none"> <li>◆ determining and using the equation of a circle</li> <li>◆ using properties of tangency in the solution of a problem</li> <li>◆ determining the intersection of circles or a line and a circle</li> </ul>
Modelling situations using sequences	<ul style="list-style-type: none"> <li>◆ determining a recurrence relation from given information and using it to calculate a required term</li> <li>◆ finding and interpreting the limit of a sequence, where it exists</li> </ul>

<b>Reasoning skills</b>	
<b>Skills</b>	<b>Explanation</b>
Interpreting a situation where mathematics can be used and identifying a strategy	<ul style="list-style-type: none"> <li>◆ analysing a situation and identifying an appropriate use of mathematical skills</li> </ul>
Explaining a solution and, where appropriate, relating it to context	<ul style="list-style-type: none"> <li>◆ explaining why a particular solution is appropriate in a given context</li> </ul>