**Subject outline changes for 2018**

**Mathematics Learning Area**

**Essential Mathematics, Stage 1**

Under Evidence of Learning, p 44

* Last paragraph deleted: ‘*It is anticipated that from 2018 all assessments will be submitted electronically.*’

Under Performance Standards, p 46

* Last paragraph deleted: ‘*Teachers can use a SACE Board school assessment grade calculator to help them to assign the subject grade. The calculator is available on the SACE website (www.sace.sa.edu.au).*’

**Essential Mathematics, Stage 2**

Under Subtopic 2.2: Area measure, p 17

* Corrected Simpson’s rule in the left-hand column by deleting subscript *n*:



* Inserted two new paragraphs in the right-hand column between the first and second paragraphs:

Students use the following formulae to find the area of a:

* triangle 
* square *A*  length × length
* rectangle *A*  base × height
* parallelogram *A*  base × perpendicular height
* trapezium 
* circle 
* sector of a circle 

Where other area formulae are available (e.g. Heron’s rule), their use is encouraged in order to provide variation and depth in class activities and in tasks for Assessment Type 2: Folio.

Under Subtopic 2.2: Area measure, p 18

* Inserted two new paragraphs at the end of the right-hand column:

Students use formulae to find the surface area of the following solids:

* + - cubes
		- rectangular-based prisms
		- triangular-based prisms
		- cylinders.

In Assessment Type 3: Examination, the formulae for the surface area of pyramids, cones, and spheres are provided where required.

Under Subtopic 2.3: Mass, volume, and capacity, p 19

* Inserted two new paragraphs in the right-hand column between the fourth and fifth paragraphs:

Students use formulae to find the volume of the following solids:

* cubes
* rectangular-based prisms
* triangular-based prisms
* cylinders.

In Assessment Type 3: Examination, the formulae for the volume of pyramids, cones, and spheres are provided where required.

Under Subtopic 5.2: Annuity investments, p 33

* Inserted new paragraph in the right-hand column between the third and fourth paragraphs:

In Assessment Type 3: Examination, the number of compounding periods per year is equivalent to the number of payments per year for calculations of future-value annuities. However, where technology permits, different payment and compounding periods can be investigated in class and considered in tasks for Assessment Type 2: Folio.

Under Subtopic 5.3: Loan investments, p 35

* Inserted new paragraph in the right-hand column between the second and third paragraphs:

In Assessment Type 3: Examination, the number of compounding periods per year is equivalent to the number of payments per year for calculations of present-value annuities. However, where technology permits, different payment and compounding periods can be investigated in class and considered in tasks for Assessment Type 2: Folio.

Under Evidence of Learning, p 38

* Last paragraph deleted: ‘*It is anticipated that from 2018 all assessments will be submitted electronically.*’

**General Mathematics, Stage 1**

Under Evidence of Learning, p 43

* Deleted ‘*It is anticipated that from 2018 all assessments will be submitted electronically*.’

Under Performance Standards, p 46

* Deleted ‘*Teachers can use a SACE Board school assessment grade calculator to help them to assign the subject grade. The calculator is available on the SACE website (www.sace.sa.edu.au).*’

**General Mathematics, Stage 2**

Under Subtopic 2.2: Application of matrices to transition problems, p 16

* Paragraph added to the bottom of the right-hand column:

*Note*: While  matrices are used to introduce transition matrices, it is expected that students will handle problems involving  or higher-order matrices in Assessment Type 1: Skills and Applications Tasks and Assessment Type 2: Mathematical Investigations.

Under Subtopic 3.1: Bivariate statistics, p 18

* Second dot point in the left-hand column reworded to read: ‘Independent and dependent variables’ (deleted ‘*explanatory and response variables’*)
* Second paragraph in the right-hand column reworded to read: ‘For these data sets students identify the independent (explanatory) and dependent (response) variables from the context (or recognise when two variables may be co-dependent — for instance, marks on mathematics and English tests).’ (deleted ‘the *explanatory and response* variables’)
* Last dot point in last paragraph in the left-hand column reworded to read: ‘identification and interpretation of the slope and intercept of the graph of the equation ’ (deleted ‘*interpretation of the values of ‘*a*’ and ‘*b*’*’)
* Last sentence in last paragraph of right-hand column reworded to read: ‘Students recognise and interpret the values of the parameters ‘a’/slope and ‘b’/*y*-intercept in the context of the problem.’

Under Subtopic 3.1: Bivariate statistics, p 19

* Added the following to the end of the third paragraph: ‘(i.e. ‘*a*’ as the initial value and ‘*b*’ as the proportional rate of change expressed as a percentage increase or decrease).’
* Added the following to the end of the fourth paragraph: ‘If the technology they are using only gives the  form, students will need to be taught how to calculate .’
* First sentence in fifth paragraph reworded to read: ‘Once the model for the relationship between the variables has been determined, values of the independent (explanatory) variable are used to predict values for the dependent (response) variable (and vice versa), either between the known data limits (interpolation) or outside the known data limits (extrapolation).’ (deleted ‘values of the *explanatory* variable are used to predict values for the *response*’)

Under Subtopic 4.1: Models for saving, p 23

* Note added to the bottom of the right-hand column:

*Note*: In Assessment Type 3: Examination, the number of compounding periods per year will be equivalent to the number of payments per year for calculations of future value annuities and present value annuities. However, where technology permits, different payment and compounding periods can be investigated in class and considered for Assessment Type 2: Mathematical Investigations.

Under Subtopic 4.2: Models for borrowing, p 24

* Note added after the sixth paragraph in the right-hand column:

*Note*: In Assessment Type 3: Examination, the number of compounding periods per year will be equivalent to the number of payments per year for loan calculations. However, where technology permits, different payment and compounding periods can be investigated in class and considered for Assessment Type 2: Mathematical Investigations.

Under Subtopic 4.2: Models for borrowing, p 24 [now p 25]

* Note added after the seventh paragraph in the right-hand column:

*Note*: When calculating a comparison rate for a loan that attracts fees, the one-off set-up fee should be added to the initial present value, and the ongoing regular charges should be added to the payment figure.

Under Subtopic 5.1: Critical path analysis, p 26 [now p 27]

* Second dot point reworded to read: ‘Drawing directed networks’
* First sentence of the second paragraph in the right-hand column reworded to read: ‘From a precedence table, a directed network can be drawn to represent the task.’
* Third paragraph in the right-hand column reworded to read: ‘It is sometimes necessary to use dummy links’, deleted ‘*dummy’ arcs*

Under Subtopic 5.2: Assignment problem p 27 [now p 28]

* First paragraph in the right-hand column reworded to read: ‘Assignment problems deal with allocating tasks in a way that minimises ‘costs’ (note that ‘costs’ can be measurements such as time or distance, as well as money).’
* Second paragraph, point 2, reworded to read: ‘Cover the zero elements with the minimum number of straight lines. If the number of lines used is the same as the order of the array …’ (deleted ‘If *this minimum ...*’)
* Second paragraph, point 4, reworded to read: ‘There is an optimum assignment using only zeros in the augmented array. Apply this pattern to the original array. Note that there may be more than one optimal solution.’ (deleted ‘optimum *solution*’)

**Mathematics, Stage 1**

Under Evidence of Learning, p 63

* Last paragraph deleted: ‘*It is anticipated that from 2018 all assessments will be submitted electronically.*’

Under Performance Standards, p 66

* Last paragraph deleted: ‘*Teachers can use a SACE Board school assessment grade calculator to help them to assign the subject grade. The calculator is available on the SACE website (www.sace.sa.edu.au).*’

**Mathematical Methods, Stage 2**

Under Subtopic 1.1: Introductory differential calculus, p 10

* Second paragraph in the left-hand column reworded to read: ‘Establish the formula  from first principles when, where *n* is a rational number’
* Dot points in the left-hand column reworded to read:
	+ The derivative of a function can be used to find the slope of tangents to the function, and hence the equation of the tangent and/or normal at any point on the function
	+ When an object’s displacement is described by a function, the derivative can be used to find the instantaneous velocity
	+ The sign diagram of the derivative function can be used to find when the function is increasing, decreasing, and stationary
	+ The derivative of a function can be used to determine the rate of change, and the position of any local maxima or minima

Deleted ‘*and when the function is increasing or decreasing*’

Under Subtopic 1.3: Exponential functions, p 13

* First dot point about Derivatives in the left-hand column reworded to read:
	+ find the slope of tangents to the graphs of exponential functions, and hence the equation of the tangent and/or normal at any point on the function

Under Subtopic 1.4: Trigonometric functions, p 14

* First dot point in the left-hand column reworded to read:
	+ Graphing sine and cosine functions in Topic 3: Trigonometry and Topic 10: Further trigonometry, Stage 1 Mathematics introduced the concept of radian angle measure, the use of sine and cosine to define different aspects of the position of a moving point on a unit circle, and the ability to solve trigonometric equations

Under Subtopic 1.4: Trigonometric functions, p 15

* Fourth dot point in the left-hand column reworded to read:
Derivatives can be used to:
	+ find the slope of tangents to the graphs of trigonometric functions, and hence the equation of the tangent and/or normal at any point on the function

Deleted the word ‘*graphs*’ after‘*…* trigonometric …’

* Last paragraph reworded to read: ‘Use trigonometric functions and their derivatives to solve practical problems where trigonometric functions model periodic phenomena’. Deleted ‘*actual situations*’ after ‘… trigonometric functions model …’

Under Subtopic 1.5: The second derivative, p 16

* New dot point in the left-hand column under ‘How can the first and second derivative of a function be used to locate stationary points and points of inflection?’:
	+ The sign diagram of the first and second derivative provides information to assist in sketching the graphs of functions
* Last paragraph in the right-hand column deleted: ‘*Interpreting sign diagrams of the first and second derivative provides information to assist in sketching the graphs of functions.*’

Under Subtopic 2.1: Discrete random variables, p 18

* The formula in the first dot point in the left-hand column under ‘How can the expected value of a discrete random variable be calculated and used?’ recast to read:
	+ The expected value of a discrete random variable is calculated using, where is the probability function for achieving result x and is the mean of the distribution

Under Subtopic 3.1: Anti-differentiation, p 23

* Added to the bottom of the right-hand column, opposite ‘Reversing the differentiation processes and consideration of the chain rule…’:
‘The use of substitution to find the integral of nested functions is not required.’

Under Subtopic 4.1: Using logarithms for solving exponential equations, p 28

* Reworded the first dot point under ‘How are natural logarithms used to find the solutions for problems involving applications of differential calculus with exponential functions?’:
Derivatives are used to:
* find the slope of tangents to the graphs of logarithmic functions, and hence the equation of the tangent and/or normal at any point on the function

Under Subtopic 4.2: Logarithmic functions and their graphs, p 29

* In the third dot point and in the last line of the right-hand column, changed ‘… graph of  …’ to ‘… graph of … ’

Under Subtopic 5.2: Normal distributions, p 33

* The number *π* added to the denominator of the equation in the right-hand column to give:



Under Evidence of Learning, p 41

* Last paragraph deleted: ‘*It is anticipated that from 2018 all assessments will be submitted electronically.*’

**Specialist Mathematics, Stage 2**

Under Subtopic 1.1: Proof by mathematical induction, p 10

* New dot point added to the bottom of the right-hand column:
	+ Mathematical induction proofs that use inequalities and recursion formulae are not a requirement of this course

Under Subtopic 2.2: The complex (Argand) plane, p 14

* In the right-hand column, deleted ‘*Note the connection between matrices and vectors in Topic 11 Matrices in Stage 1 Mathematics.*’ and inserted:

Another approach is to use polar form:



Under Subtopic 2.4: Factorisation of polynomials, p 17

* Deleted the fifth paragraph from the right-hand column: *‘(The existence of a formula for the roots of a cubic and a quartic, but not polynomials of higher degree, can be mentioned as background.)*’.

Under Subtopic 3.1 Composition of functions, p 19

* Inserted at the end of the first paragraph in the right-hand column:

For example: given  and , 

Since  is the domain of 

 for  to exist.

Hence  or 

Under Subtopic 3.2 One-to-one functions, p 20

* Second paragraph in the right-hand column reworded to read: ‘The vertical line test (used to determine whether a relation is a function) is mentioned in Subtopic 1.4: Functions, Stage 1 Mathematics. A further property of functions that can be applied is that a one-to-one function has an inverse. The horizontal line test can be used to provide some evidence that a function is a zone-to-one function. If the graph of a function fails the horizontal line test, then the function is not one-to-one and will not have an inverse.’
* Third paragraph in the right-hand column reworded to read: ‘Appreciate that an inverse function for f can only be defined when each element of the range corresponds to a unique value in the domain.’

Under Subtopic 3.3: Sketching graphs, p 21

* Final paragraph in the right-hand column, added the word ‘… may …’

Under Subtopic 4.2: Vector and Cartesian equations, p 24

* The second paragraph in the right-hand column reworded to read: ‘Geometric considerations lead to the vector equation of a line. From this it is possible to derive the parametric form and the Cartesian form. Exercises highlight the construction of parallel lines, perpendicular lines, and the phenomenon of skewness.’ Deleted ‘*(less importantly)*’.

Under Subtopic 4.2: Vector and Cartesian equations, p 25

* Deleted ‘… *both vector and* …’ from the first key question in the left-hand column [now at the end of page 24]
* Reworded the first two paragraphs in the right-hand column to read:

Derive the equation of a plane in Cartesian form, . This form is developed using the dot product of a vector in the plane and a normal to the plane. [now on page 24]

Students explore the following relationships: intersection of a line and a plane, angle between a line and a plane, and lines parallel to or coincident with planes.

Students find the coordinates of a point on a given plane  that is closest to a given point  in space. The distance between these two points is given by the formula:



Under Subtopic 5.1: Integration techniques, page 28

* Third dot point reworded to read:
	+ Use the formula
	

Deleted ‘*Establish and*’ before ‘…use…’.

Under Subtopic 5.2: Applications of integral calculus, page 29

* Reworded the third paragraph in the right-hand column to read:

The volume of the solid that is obtained when the region of the graph of the function that is bounded by the lines *x* = *a* and *x* = *b* is rotated about the *x*-axis is given by



Deleted ‘…*obtained by rotating the region bounded by its graph on [a, b] about the
x-axis is* …’

* Reworded the fourth paragraph in the right-hand column to read:

If  is one-to-one, and is positive on the interval  then the volume of the solid that is obtained when the region of the graph of  that is bounded by the lines  and  is rotated about the y‑axis is .

Deleted ‘…*by rotating the region bounded by the function and* …’

Under Subtopic 6.2: Differential equations, page 32

* Recast the equation for the chain rule as: 
* Reworded paragraph three in the right-hand column to read:

An example of calculating  and the derivative of 

*  might be the length of the side of a square that is changing over time, and its area
* The function  relates the length of the side of a square to its area.

Deleted ‘•* might be the length of the side of a cube and its volume.*’

Under Subtopic 6.3: Pairs of varying quantities — polynomials of degree 1 to 3, page 34

* Reworded dot point in right hand column to read:
	+ Degree 3 polynomials where  feature in computer-aided design. The use of Bézier curves …

Under Subtopic 6.3: Pairs of varying quantities — polynomials of degree 1 to 3, page 35

* Deleted all the information on this page:
	+ *Although the curves can be drawn interactively and intuitively by the designer, an accurate mathematical description is needed for editing the curve, zooming in by the program, and passing the design on to be printed or processed by specialised machining equipment.*
	+ *Bézier curves can be constructed in two or three dimensions.*

Under Subtopic 6.4: Related rates, velocity, and tangents, page 36 [now page 35]

* Reworded the third paragraph in the right-hand column to read:

The chain rule  shows that  and hence that the velocity vector is a tangent to the graph. Since effectively every curve is the graph of a function, the velocity vector is always tangent to the curve traced out by a moving point.

Deleted ‘’, ‘…*the ratio of* *is*  …’, and ‘… *(by rotation
 if necessary)* …’.

Under Subtopic 6.5: Trigonometric parameterisations, page 37 [now page 36]

* Added the following Key concept and consideration to the end of this subtopic:

|  |  |
| --- | --- |
| * Other forms of parametric equations where  and  are trigonometric functions that may not result in circular motion
 | For example, a moving particle’s position may be given by which results in a non-circular path. |

Under Evidence of Learning, p 38 [now page 37]

* Last paragraph deleted: ‘*It is anticipated that from 2018 all assessments will be submitted electronically.*’