HSC Mathematics (Advanced)

Exam Planner

Your guide for exam goal-setting, preparation and success.

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Subject: Mathematics (Advanced)

EXAM DATE ....

GOAL ....

Topic: Functions	Do I have it in my notes?	Note-making deadline	Memorising deadline
Apply transformations to sketch functions of the form $y = kf(a(x+b))+c$, where $f(x)$ is a polynomial, reciprocal, absolute value, exponential or logarithmic function and a, b, c and k are constants			
Examine translations and the graphs of $y = f(x)+c$ and $y = f(x+b)$ using technology			
Examine dilations and the graphs of $y = kf(x)$ and $y = f(ax)$ using technology			
Recognise that the order in which transformations are applied is important in the construction of the resulting function or graph			
Use graphical methods with supporting algebraic working to solve a variety of practical problems involving any of the functions within the scope of this syllabus, in both real-life and abstract contexts AAM			
Select and use an appropriate method to graph a given function, including finding intercepts, considering the sign of $f(x)$ and using symmetry			
Determine asymptotes and discontinuities where appropriate (vertical and horizontal asymptotes only)			
Determine the number of solutions of an equation by considering appropriate graphs			
Solve linear and quadratic inequalities by sketching appropriate graphs			

Topic: Trigonometric functions	Do I have it in my notes?	Note-making deadline	Memorising deadline
Examine and apply transformations to sketch functions of the form $y = kf(a(x + b))+ c$, where a, b, c and k are constants, in a variety of contexts, where $f(x)$ is one of $\sin x$, $\cos x$ or $\tan x$, stating the domain and range when appropriate			
Use technology or otherwise to examine the effect on the graphs of changing the amplitude (where appropriate), $y = kf(x)$, the period, $y = f(ax)$, the phase, $y = f(x+b)$, and the vertical shift, $y = f(x)+c$			

Use k, a, b, c to describe transformational shifts and sketch graphs			
Solve trigonometric equations involving functions of the form $kf(a(x+b))+c$, using technology or otherwise, within a specified domain AAM			
Use trigonometric functions of the form $kf(a(x+b))+c$ to model and/or solve practical problems involving periodic phenomena AAM			
Topic: Differential Calculus	**Do I have it in my notes?**	**Note-making deadline**	**Memorising deadline**
Establish the formulae $\frac{d}{dx}(sin\,x) = cos\,x$ and $\frac{d}{dx}(cos\,x) = -sin\,x$ by numerical estimations of the limits and informal proofs based on geometric constructions (ACMMM102)			
Calculate derivatives of trigonometric functions			
Establish and use the formula $\frac{d}{dx}(a^x) = (\ln a)a^x$			
Using graphing software or otherwise, sketch and explore the gradient function for a given exponential function, recognise it as another exponential function and hence determine the relationship between exponential functions and their derivatives			
Calculate the derivative of the natural logarithm function $\frac{d}{dx}(\ln x) = \frac{1}{x}$			
Establish and use the formula $\frac{d}{dx}(a^x) = (ln\,a)a^x$			
Apply the product, quotient and chain rules to differentiate functions of the form $f(x)g(x), \frac{f(x)}{g(x)}$ and $f\big(g(x)\big)$ where $f(x)$ and $g(x)$ are any of the functions covered in the scope of this syllabus, for example xe^x, tan x , $\frac{1}{x^n}$, x sin x, e^{-x} $sin\,x$sin x and $f(ax+b)$ (ACMMM106)			
Use the composite function rule (chain rule) to establish that $\frac{d}{dx}\{e^{f(x)}\} = f'(x)e^{f(x)}$			
Use the composite function rule (chain rule) to establish that $\frac{d}{dx}\{ln\,f(x)\} = \frac{f'(x)}{f(x)}$			
Use the logarithmic laws to simplify an expression before differentiating			
Use the composite function rule (chain rule) to establish and use the derivatives of $sin(f(x))$, $cos(f(x))$ and $tan(f(x))$			

Topic: Applications of differentiation	Do I have it in my notes?	Note-making deadline	Memorising deadline
Use the first derivative to investigate the shape of the graph of a function			
Deduce from the sign of the first derivative whether a function is increasing, decreasing or stationary at a given point or in a given interval			
Use the first derivative to find intervals over which a function is increasing or decreasing, and where its stationary points are located			
Use the first derivative to investigate a stationary point of a function over a given domain, classifying it as a local maximum, local minimum or neither			
Determine the greatest or least value of a function over a given domain (if the domain is not given, the natural domain of the function is assumed) and distinguish between local and global minima and maxima			
Define and interpret the concept of the second derivative as the rate of change of the first derivative function in a variety of contexts, for example recognise acceleration as the second derivative of displacement with respect to time (ACMMM108, ACMMM109) AAM			
Understand the concepts of concavity and points of inflection and their relationship with the second derivative (ACMMM110)			
Use the second derivative to determine concavity and the nature of stationary points			
Understand that when the second derivative is equal to 0 this does not necessarily represent a point of inflection			
Use any of the functions covered in the scope of this syllabus and their derivatives to solve practical and abstract problems AAM			
Use calculus to determine and verify the nature of stationary points, find local and global maxima and minima and points of inflection (horizontal or otherwise), examine behaviour of a function as $x \to \infty$ and $x \to -\infty$ and hence sketch the graph of the function (ACMMM095)			
Solve optimisation problems for any of the functions covered in the scope of this syllabus, in a wide variety of contexts including displacement, velocity, acceleration, area, volume, business, finance and growth and decay AAM			
Define variables and construct functions to represent the relationships between variables related to contexts involving optimisation, sketching diagrams or completing diagrams if necessary			

Use calculus to establish the location of local and global maxima and minima, including checking endpoints of an interval if required			
Evaluate solutions and their reasonableness given the constraints of the domain and formulate appropriate conclusions to optimisation problems			
Topic: Integral calculus	**Do I have it in my notes?**	**Note-making deadline**	**Memorising deadline**
Define anti-differentiation as the reverse of differentiation and use the notation $\int f(x)\,dx$ for antiderivatives or indefinite integrals (ACMMM114, ACMMM115)			
Recognise that any two anti-derivatives of $f(x)$ differ by a constant			
Establish and use the formula $\int x^n\,dx = \frac{1}{n+1}x^{n+1} + C$, for $n \neq -1$ (ACMMM116)			
Establish and use the formula $\int f'(x)[f(x)]^n\,dx = \frac{1}{n+1}[f(x)]^{n+1} + c$ where $n \neq -1$ (the reverse chain rule)			
Establish and use the formulae for the anti-derivatives of $sin\,(ax+b)$, $cos\,(ax+b)$ and $sec^2(ax+b)$			
Establish and use the formulae $\int e^x\,dx = e^x + c$ and $\int e^{ax+b}\,dx = \frac{1}{a}e^{ax+b} + c$			
Establish and use the formulae $\int \frac{1}{x}dx = ln\lvert x\rvert + c$ and $\int \frac{f^1(x)}{f(x)}dx = ln\lvert f(x)\rvert + c$ for $x \neq 0$, $f(x) \neq 0$, respectively			
Establish and use the formulae $\int a^x\,dx = \frac{ax}{ln\,a} + c$			
Recognise and use linearity of anti-differentiation (ACMMM119)			
Examine families of anti-derivatives of a given function graphically			
Determine indefinite integrals of the form $\int f(ax+b)dx$ (ACMMM120)			
Determine $f(x)$, given $f'(x)$ and an initial condition $f(a) = b$ in a range of practical and abstract applications including coordinate geometry, business and science			

Know that 'the area under a curve' refers to the area between a function and the x-axis, bounded by two values of the independent variable and interpret the area under a curve in a variety of contexts AAM			
Determine the approximate area under a curve using a variety of shapes including squares, rectangles (inner and outer rectangles), triangles or trapezia			
Consider functions which cannot be integrated in the scope of this syllabus, for example $f(x) = \ln x$, and explore the effect of increasing the number of shapes used			
Use the notation of the definite integral $\int_a^b f(x)\,dx$ for the area under the curve $y = f(x)$ from $x = a$ to $x = b$ if $f(x) \geq 0$			
Use the Trapezoidal rule to estimate areas under curves AAM			
Use geometric arguments (rather than substitution into a given formula) to approximate a definite integral of the form $\int_a^b f(x)\,dx$, where $f(x) \geq 0$, on the interval $a \leq x \leq b$, by dividing the area into a given number of trapezia with equal widths			
Demonstrate understanding of the formula $\int_a^b f(x)\,dx \approx \frac{b-a}{2n}[f(a) + f(b) + 2\{f(x_1) + \cdots + f(x_{n-1})\}]$ where $a = x_0$ and $b = x_n$, and the values of $x_0, x_1, x_2, \ldots, x_n$ are found by dividing the interval $a \leq x \leq b$ into n equal subintervals			
Use geometric ideas to find the definite integral ^b a ∫ $f(x)\,dx$ where $f(x)$ is positive throughout an interval $a \leq x \leq b$ and the shape of $f(x)$ allows such calculations, for example when $f(x)$ is a straight line in the interval or $f(x)$ is a semicircle in the interval AAM			
Understand the relationship of position to signed areas, namely that the signed area above the horizontal axis is positive and the signed area below the horizontal axis is negative			
Using technology or otherwise, investigate the link between the anti-derivative and the area under a curve			
Interpret $\int_a^b f(x)\,dx$ ^b a ∫ $f(x)\,dx$ as a sum of signed areas (ACMMM127)			
Understand the concept of the signed area function $F(x) = \int_a^x f(t)\,dt$ (ACMMM129)			
Use the formula $\int_a^b f(x)\,dx = F(b) - F(a)$ where $F(x)$ is the anti-derivative of $f(x)$, to calculate definite integrals (ACMMM131) AAM			

Understand and use the Fundamental Theorem of Calculus, $F'(x) = \frac{d}{dx}\left[\int_a^x f(t)\,dt\right] = f(x)$, and illustrate its proof geometrically (ACMMM130)			
Use symmetry properties of even and odd functions to simplify calculations of area			
Recognise and use the additivity and linearity of definite integrals (ACMMM128)			
Calculate total change by integrating instantaneous rate of change			
Calculate the area under a curve (ACMMM132)			
Calculate areas between curves determined by any functions within the scope of this syllabus (ACMMM134) AAM			
Integrate functions and find indefinite or definite integrals and apply this technique to solving practical problems AAM			

Topic: Financial Mathematics	**Do I have it in my notes?**	**Note-making deadline**	**Memorising deadline**
Solve compound interest problems involving financial decisions, including a home loan, a savings account, a car loan or superannuation AAM			
Identify an annuity (present or future value) as an investment account with regular, equal contributions and interest compounding at the end of each period, or a single-sum investment from which regular, equal withdrawals are made			
Use technology to model an annuity as a recurrence relation and investigate (numerically or graphically) the effect of varying the interest rate or the amount and frequency of each contribution or a withdrawal on the duration and/or future or present value of the annuity			
Use a table of interest factors to perform annuity calculations, eg calculating the present or future value of an annuity, the contribution amount required to achieve a given future value or the single sum that would produce the same future value as a given annuity			
Know the difference between a sequence and a series			
Recognise and use the recursive definition of an arithmetic sequence: $T_n = rT_{n-1}$, $T_1 = a$ AAM			

Establish and use the formula for the nth term (where n is a positive integer) of an arithmetic sequence: $T_n = a(n-1)d$, where a is the first term and d is the common difference, and recognise its linear nature AAM			
Establish and use the formulae for the sum of the first n terms of an arithmetic sequence: $S_n = \frac{a(1-r^n)}{1-r} = \frac{a(r^n-1)}{r-1}$ where l is the last term in the sequence and $s_n = \frac{n}{2}\{2a + (n-1)d\}$ AAM			
Identify and use arithmetic sequences and arithmetic series in contexts involving discrete linear growth or decay such as simple interest (ACMMM070) AAM			
Recognise and use the recursive definition of a geometric sequence: $T_n = rT_{n-1}, T_1 = a$ (ACMMM072) AAM			
Establish and use the formula for the nth term of a geometric sequence: $\overline{I_n} = ar^n - 1$, where a is the first term, r is the common ratio and n is a positive integer, and recognise its exponential nature (ACMMM073) AAM			
Establish and use the formula for the sum of the first n terms of a geometric sequence: $s_n = \frac{a(1-r^n)}{1-r} = \frac{a(r^n-1)}{r-1}$ (ACMMM075) AAM			
Derive and use the formula for the limiting sum of a geometric series with |r| < 1: $s = \frac{a}{1-r}$ AAM			
Understand the limiting behaviour as $n \to \infty$ and its application to a geometric series as a limiting sum			
Use the notation $\lim_{n\to\infty} r^n = 0$ for |r| < 1			
Use geometric sequences to model and analyse practical problems involving exponential growth and decay (ACMMM076) AAM			
Calculate the effective annual rate of interest and use results to compare investment returns and cost of loans when interest is paid or charged daily, monthly, quarterly or six-monthly (ACMGM095)			
Solve problems involving compound interest loans or investments, eg determining the future value of an investment or loan, the number of compounding periods for an investment to exceed a given value and/or the interest rate needed for an investment to exceed a given value (ACMGM096)			

Recognise a reducing balance loan as a compound interest loan with periodic repayments, and solve problems including the amount owing on a reducing balance loan after each payment is made			
Solve problems involving financial decisions, including a home loan, a savings account, a car loan or superannuation AAM			
Calculate the future value or present value of an annuity by developing an expression for the sum of the calculated compounded values of each contribution and using the formula for the sum of the first n terms of a geometric sequence			
Verify entries in tables of future values or annuities by using geometric series			
Topic: Statistical Analysis	**Do I have it in my notes?**	**Note-making deadline**	**Memorising deadline**
Classify data relating to a single random variable			
Organise, interpret and display data into appropriate tabular and/or graphical representations including Pareto charts, cumulative frequency distribution tables or graphs, parallel box-plots and two-way tables AAM			
Compare the suitability of different methods of data presentation in real-world contexts (ACMEM048)			
Summarise and interpret grouped and ungrouped data through appropriate graphs and summary statistics AAM			
Calculate measures of central tendency and spread and investigate their suitability in real-world contexts and use to compare large datasets			
Investigate real-world examples from the media illustrating appropriate and inappropriate uses or misuses of measures of central tendency and spread (ACMEM056) AAM			
Identify outliers and investigate and describe the effect of outliers on summary statistics			
Use different approaches for identifying outliers, for example consideration of the distance from the mean or median, or the use of below $Q1 - 1.5 \times IQR$ and above $Q3 + 1.5 \times IQR$ as criteria, recognising and justifying when each approach is appropriate			

Investigate and recognise the effect of outliers on the mean, median and standard deviation			
Describe, compare and interpret the distributions of graphical displays and/or numerical datasets and report findings in a systematic and concise manner AAM			
Construct a bivariate scatterplot to identify patterns in the data that suggest the presence of an association (ACMGM052)			
Use bivariate scatterplots (constructing them where needed), to describe the patterns, features and associations of bivariate datasets, justifying any conclusions AAM			
Describe bivariate datasets in terms of form (linear/non-linear) and in the case of linear, also the direction (positive/negative) and strength of association (strong/moderate/weak)			
Identify the dependent and independent variables within bivariate datasets where appropriate			
Describe and interpret a variety of bivariate datasets involving two numerical variables using real-world examples in the media or those freely available from government or business datasets			
Calculate and interpret Pearson's correlation coefficient (r) using technology to quantify the strength of a linear association of a sample (ACMGM054)			
Model a linear relationship by fitting an appropriate line of best fit to a scatterplot and using it to describe and quantify associations AAM			
Fit a line of best fit to the data by eye and using technology (ACMEM141, ACMEM142)			
Fit a least-squares regression line to the data using technology (ACMGM057)			
Interpret the intercept and gradient of the fitted line (ACMGM059)			
Use the appropriate line of best fit, both found by eye and by applying the equation of the fitted line, to make predictions by either interpolation or extrapolation AAM			
Distinguish between interpolation and extrapolation, recognising the limitations of using the fitted line to make predictions, and interpolate from plotted data to make predictions where appropriate			

Solve problems that involve identifying, analysing and describing associations between two numeric variables AAM			
Construct, interpret and analyse scatterplots for bivariate numerical data in practical contexts AAM			
Demonstrate an awareness of issues of privacy and bias, ethics, and responsiveness to diverse groups and cultures when collecting and using data			
Use relative frequencies and histograms obtained from data to estimate probabilities associated with a continuous random variable (ACMMM164)			
Understand and use the concepts of a probability density function of a continuous random variable AAM			
Know the two properties of a probability density function: $f(x) \geq 0$ for all real x and $\int_{-\infty}^{\infty} f(x)dx = 1$			
Define the probability as the area under the graph of the probability density function using the notation $P(X \leq r) = \int_a^r f(x)\,dx$, where $f(x)$ is the probability density function defined on $[a, b]$			
Examine simple types of continuous random variables and use them in appropriate contexts			
Explore properties of a continuous random variable that is uniformly distributed			
Find the mode from a given probability density function			
Obtain and analyse a cumulative distribution function with respect to a given probability density function			
Understand the meaning of a cumulative distribution function with respect to a given probability density function			
Use a cumulative distribution function to calculate the median and other percentiles			
Identify the numerical and graphical properties of data that is normally distributed			
Calculate probabilities and quantiles associated with a given normal distribution using technology and otherwise, and use these to solve practical problems (ACMMM170) AAM			

Identify contexts that are suitable for modelling by normal random variables, eg the height of a group of students (ACMMM168)			
Recognise features of the graph of the probability density function of the normal distribution with mean μ and standard deviation σ, and the use of the standard normal distribution (ACMMM169)			
Visually represent probabilities by shading areas under the normal curve, eg identifying the value above which the top 10% of data lies			
Understand and calculate the z-score (standardised score) corresponding to a particular value in a dataset AAM			
Use the formula $z = \frac{(x-\mu)}{\sigma}$, where μ is the mean and σ is the standard deviation			
Describe the z-score as the number of standard deviations a value lies above or below the mean			
Use z-scores to compare scores from different datasets, for example comparing students' subject examination scores AAM			
Use collected data to illustrate the empirical rules for normally distributed random variables			
Apply the empirical rule to a variety of problems			
Sketch the graphs of $\int (x) = e^{-x^2}$ and the probability density function for the normal distribution $f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$ using technology			
Verify, using the Trapezoidal rule, the results concerning the areas under the normal curve			
Use z-scores to identify probabilities of events less or more extreme than a given event AAM			
Use statistical tables to determine probabilities			
Use technology to determine probabilities			
Use z-scores to make judgements related to outcomes of a given event or sets of data AAM			

Practice Schedule

PRACTICE EXAM	DEADLINE
Practice Exam 1	
Practice Exam 2	
Practice Exam 3	
Practice Exam 4	
Practice Exam 5	
EXAM DATE:	

Congratulations!

You're ready! Now relax and think about how good it will feel leaving the exam room knowing the hard work has paid off. Congratulations and good luck (not that you need it)!

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