ST BERNARD'S HIGH SCHOOL

Year 13 Mathematics Curriculum Pathway Map

A2 PURE & STATISTICS (2 x 100-minutes per fortnight)

	TOPIC/PROGRAMME OF STUDY	Resources
01	**P2-Ch1-Algebraic Methods-Lesson 1** (1) Proof by contradictionThis topic builds on the earlier proof from Year 12, but with specific reference to proof by contradiction. They should know how to complete the proof for infinite primes, and show that $\sqrt{2}$ is irrational. (2) Addition and subtraction of rational expressions Simplifying rational expressions. Factorising and cancelling. Multiplication and division. Homework	PM 2 Ex 1A PM2 Ex 1C PM2 Ex 1B Homework
02	**P2-Ch1-Algebraic Methods-Lesson 2** (1) Partial Fractions with distinct linear factors. (2) Partial Fractions with repeated factors.	PM2 Ex 1D PM2 Ex 1E
03	**P2-Ch1-Algebraic Methods-Lesson 3** (1) Algebraic division (2) Partial fractions requiring algebraic division, or method of equating coefficients.	PM2 Ex 1F PM2 Ex 1G Mixed Ex 1

A2 PURE & MECHANICS (3 x 100-minutes per fortnight)

	TOPIC/PROGRAMME OF STUDY	Resources
01	**P2-Ch3-Sequences and Series-Lesson 1** (1) Arithmetic progressions. Deriving and using the nth term formula, Un = a + (n – 1)d Examples should include finding the number of terms of an AP, finding the first term and common difference, using the idea of a common difference to form and solve equations to find the sequence. (2) Sum of an AP. $Sn = \frac{n}{2}\{2a + (n - 1)d\}$ and $Sn = \frac{n}{2}(a + l)$ where l is the last term. Students to know how to prove the formulae, and use them in problems.	PM2 Ex 3A PM2 Ex 3B
02	**P2-Ch3-Sequences and Series-Lesson 2** (1) Geometric progressions, nth term $\boldsymbol{Un = ar^{n-1}}$ Examples should include finding the first term and common ratio, and the number of terms of a GP using logs if necessary. Using the idea of a common ratio to form and solve equations to find the sequence. (2) Sum of a GP for r > 1 and r < 1. Problems on GPs should include finding the number of terms needed for the sum to equal or exceed a value, and investment with a fixed amount being invested at the start of each year. (3) Sum of an infinite GP, and mixed problems.	PM2 Ex 3C PM2 Ex 3D PM3 Ex 3E
03	**P2-Ch3-Sequences and Series-Lesson 3** (1) Use of the Σ notation. Problems on APs and GP's should include using the formulae found in previous lessons. (2) Recurrence relation formulae. Generating terms and generating formulae from sequences, or nth term formulae. Increasing, decreasing or periodic sequences. Use of the Σ notation. Problems on APs and GP's should include using the formulae found in previous lessons	PM3 Ex 3E PM3 Ex 3F PM3 Ex 3G

04	**P2-Ch4-Binomial Expansion-Lesson 1** (1) Expansion for fractional and negative indices in the form $(1 + ax)^n$. Range for validity. (2) Cover problems involving two binomial expansions and approximations.	PM2 Ex 4A PM2 Ex 4B Q1h
05	**P2-Ch4-Binomial Expansion-Lesson 2** (1) Further Range for validity. Problems including approximations. (2) Expansion of expressions using partial fractions **(1 of 2) S02 Binomial Expansion Formative Assignment / Solutions**	PM2 Ex 4B remaining questions PM2 Ex 4C
06	**P2-Ch5-Radians-Lesson 1** (1) Definition of radian. Converting degrees to radians and radians to degrees. Trig functions of special angles in radians. Sketching trigonometric functions in radians including transformations.	PM2 Ex 5A PM2 Ex 5B
07	**(2 of 2) AOF S02 Binomial Expansion Formative Assignment / Solutions** **P2-Ch5-Radians-Lesson 2** (1) Length of an arc using radians (2) Area of a sector and segment using radians	PM2 Ex 5C PM2 Ex 5D
08	**P2-Ch5-Radians-Lesson 3** (1) Solving Trigonometric equations involving radians. Equations up to the level of those undertaken in degrees in Year 12, eg Eg. $3\sin(2x) = 0.6$, and those requiring $tanx \equiv \frac{sinx}{cosx}$ and $\sin^2 x + \cos^2 x \equiv 1$ **(1 of 2) S03 Radians Formative Assignment / Solutions**	PM2 Ex 5E

04	**P2-Ch2-Functions and Graphs-Lesson 1** (1) Types of relationship. Definition of M-1 and 1-1 functions. Notation. Domain, codomain and range. Graphical interpretation. Examples. Restricting the domain. Stating the range.	PM3 Ex 2B
04	**P2-Ch2-Functions and Graphs-Lesson 2** (1) Composition of functions. (2) Definition of inverse for 1-1 functions. Graphical interpretation and examples.	PM3 Ex 2C PM3 Ex 2D
05	**P2-Ch2-Functions and Graphs-Lesson 3** (1) Definition of |x|. Linear modulus functions and their graphs. Solving simple modular equations and inequalities with the aid of sketches. (2) Sketching graphs for functions of the type y=|f(x)| and y=f|x|.	PM3 Ex 2A PM3 Ex 2E
06	**P2-Ch2-Functions and Graphs-Lesson 4** (1) Compound Transformations. f(x+a), f(x)+a, f(-x), -f(x), f(ax), afx (2) Solving problems involving modulus functions. Using methods learnt in previous lessons to sketch more difficult equations such as f(x)=3|x-1|-2. Stating ranges of values for which an equation has zero, one or two solutions, etc. **(1 of 2) M02 Functions and Graphs Formative Assignment / Solutions**	PM3 Ex 2F PM3 Ex 2G
07	**M2-Ch5-Dynamics, Friction and Inclined Planes-Lesson 1** (1) Adding forces using the triangle law of addition for two forces Resolving forces horizontally and vertically (2) Resolving forces parallel and perpendicular to an inclined plane	SM2 Ex 5A SM2 Ex 5A

09	**S2-Ch1-Regression, Correlation & Hypothesis Testing-Lesson 1** (1) Exponential relationships, and the use of coding to form a regression line. Decoding the linear relationship to undertake estimations of the original variables. (2) Students must be able to calculate and interpret a product moment correlation coefficient. They are expected to use the statistical function on their calculator to do this and are not required to know the formula. Students should also understand how calculating the PMCC could help them interpret whether an exponential model would be a good fit for the data.	SM2 Ex 1A SM2 Ex 1B
10	**(2 of 2) AOF S03 Radians Formative Assignment / Solutions** **S2-Ch1-Regression, Correlation & Hypothesis Testing-Lesson 2** (1) Students should be able to undertake a hypothesis test on the validity of the correlation. They will need to use the tables provided in the text book (or formula booklet in the exam). (2) Mixed Exercise to practise skills particularly involving the use of coding to lines and the use of the PMCC to then help establish the strength of correlation in non-linear data. **(1 of 2) S05 Regression, Correlation and Hypothesis Testing Formative Assignment / Solutions**	SM2 Ex 1C
11	**P2-Ch6-Trigonometric Functions-Lesson 1** (1) Definition of sec x, cosec x, cot x and their graphs including transformations.	PM2 Ex 6A PM2 Ex 6B

08	**M2-Ch5-Dynamics, Friction and Inclined Planes-Lesson 2** (1) Friction and the coefficient of friction plane (3) Further practice **(1 of 2) M03 Dynamics, Friction and Inclined Planes Formative Assignment / Solutions**	SM2 Ex 5B SM2 Ex 5C
09	**(2 of 2) AOF M02 Functions and Graphs Formative Assignment / Solutions** **M2-Ch6-Projectiles-Lesson 1** (1) The constant acceleration formulae for a projectile in a vertical plane HORIZONTAL MOTION (2) The constant acceleration formulae for a projectile in a vertical plane GENERAL MOTION	SM2 Ex 6A **Heinemann M2 Ex 1A Q1-6, 9-12, 15-18** SM2 Ex 6B **Pearson P112 Ex 6B Q1, 3, 5, 7** **Heinemann M2 Ex 1A Q7, 8, 13, 14**
10	**M2-Ch6-Projectiles-Lesson 2** (1) Projection at any angle, range, flight time, angles of projection to reach a point Release at an angle from a given height;	**Pearson P112 Ex 6B** **Heinemann M2 Ex 1B** SM2 Ex 6B
11	**(2 of 2) AOF M03 Dynamics, Friction and Inclined Planes Formative Assignment / Solutions** **M2-Ch6-Projectiles-Lesson 3** (1) Projected particles from above the ground (2) Projectile Formulae	SM2 Ex 6C

[redacted]			12	**M2-Ch6-Projectiles-Lesson 4** (1) Clearing an obstacle **(1 of 2) M04 Projectiles Formative Assignment / Solutions**	SM2 Ex 6D
[redacted]			13	**P2-Ch9-Differentiation-Lesson 1** (1) Small angle approximations. Powerpoint available in schemes of work folder to aid in definitions (although double angles not completed at this time), or use the challenge section on p135 of PM2 textbook. Using small angle approximations to find new approxmations. Using the idea of a common ratio to form and solve equations to find the sequence. (2) Differentiation of sine and cosine functions from first principles. Students must be clear on the process (this may be tested in the exam). Link to the small angle approximations covered in the last lesson. Use standard results for the derivative of y=sin(kx) and y=cos(kx)	PM2 Ex 5F PM2 Ex 9A
Year 13 Mock 1 Summative Assessment Paper 1: Pure (DATE TBD)					
Year 13 Mock 1 Summative Assessment Paper 2: Statistics & Mechanics (DATE TBD)					
12	**(2 of 2) AOF S05 Regression, Correlation and Hypothesis Testing Formative Assignment / Solutions** **P2-Ch6-Trigonometric Functions-Lesson 2** (1) Simplifying expressions, solving basic equations and proving new identities using reciprocal functions. (2) Pythagorean identities. Students must be able to prove these, and use them to form new identities and solve equations. (3) Definition of inverse trig functions. Principal values and their graphs. ***Not really in the A Level, if they get arcsin()=.. they will convert to sin()=..*** **(1 of 2) S04 Trigonometric Functions Formative Assignment / Solutions**	PM2 Ex 6C PM2 Ex 6D PM2 Ex 6E (Set as Student Support Task)	14	**P2-Ch9-Differentiation-Lesson 2** (1) Differentiation of any exponentials and natural logarithms. Students to be able to prove the standard derivative of $y = a^x$ (2) Chain rule. Students to be able to differentiate functions of the type (ax+b)n. Equations of tangents and normals.	PM2 Ex 9B PM2 Ex 9C
13	**P2-Ch7-Further Trigonometry and Modelling-Lesson 1** (1) Introduction to addition formulae. Students need to understand how to use a geometrical approach to proving the formulae. They must also become familiar with the formulae during this lesson to aid in the next lesson.	PM2 Ex 7A	15	**(2 of 2) AOF M04 Projectiles Formative Assignment / Solutions** **P2-Ch9-Differentiation-Lesson 3** (1) Product rule. Students to be able to differentiate functions including polynomials, exponentials, natural logarithms and trigonometry using the product rule. Equations of tangents and normal, max and min etc.	PM2 Ex 9D

14	**(2 of 2) AOF S04 Trigonometric Functions Formative Assignment / Solutions** **P2-Ch7-Further Trigonometry and Modelling-Lesson 2** (1) Further use of addition formulae. This does not necessarily include solving equations and proving new identities at this stage, but students must begin to work more fluently with the formulae, find exact values for trig ratios such as sin 75, and find the likes of cos(A-B) if the ratios for sinA and cos B are known. **This will include Non-Calculator Exact Angle Questions.** (2) Double angle formulae. Students to be familiar with how to derive these from the addition formula, and to work with to become fluent. Proofs of new identities and solving of equations are covered in further lessons.	PM2 Ex 7B PM2 Ex 7C	16	**P2-Ch9-Differentiation-Lesson 4** (1) Quotient rule. Students to be able to differentiate functions including polynomials, exponentials, natural logarithms and trigonometry using the product rule. Equations of tangents and normal, max and min etc. (2) Further differentiation of trigonometric functions. Use of quotient rule for tan x and chain rule for reciprocal functions. Mixed problems involving all 3 techniques from previous lessons.	PM2 Ex 9E PM2 Ex 9F
15	**P2-Ch7-Further Trigonometry and Modelling-Lesson 3** (1) Solving trigonometric equations using addition and double angle formulae. (2) Use of the formulae Rcos(θ±α) and Rsin(θ±α) to rewrite expressions of the form acosx ± bsinx. **(1 of 2) S06 Further Trigonometry and Modelling Formative Assignment / Solutions**	PM2 Ex 7D PM2 Ex 7E	17	**M2-Ch4-Moments (Part 1)-Lesson 1** (1) Definition and concept for the moment of a force Sum of Moments (Parallel forces acting on a body)	SM2 Ex 4A SM2 Ex 4B
16	**P2-Ch8-Parametric Equations-Lesson 1** (1) Drawing curves from parametric equations. Sketching simple curves from the parametric equations Conversion to Cartesian equations (not with trigonometric ratios). Sketch the curves from the Cartesian equation. Ensure your examples cover finding the range of the equation. (2) Parametric equations involving trigonometric ratios. Explain why it is better to use the identities they have learnt rather than rearranging to t. Link to equations of circles and ellipses, etc.	PM2 Ex 8C Q1-4c PM2 Ex 8A PM2 Ex 8B	18	**M2-Ch4-Moments (Part 1)-Lesson 2** (1) Equilibrium of parallel forces acting on a rigid uniform body (2) Equilibrium of parallel forces acting on a non- uniform rigid body	SM2 Ex 4C SM2 Ex 4D

17	**(2 of 2) AOF S06 Further Trigonometry and Modelling Formative Assignment / Solutions** **P2-Ch8-Parametric Equations-Lesson 2** (1) Points of intersection with the coordinate axes, and intersection of a curve with a line/curve in cartesian form. (2) Modelling with parametric equations. Links to projectiles in mechanics. Further practice of examination style questions with links to problem solving. **(1 of 2) S07 Parametric Equations Formative Assignment / Solutions**	PM2 Ex 8D PM2 Ex 8E
18	**S2-Ch2-Conditional Probability-Lesson 1** (1) Students to understand basic set notation and its use within probability and Venn diagrams (2) Students to use the notation and formula, when appropriate, for conditional probability. Link this to the test for independence.	SM2 Ex 2A SM2 Ex 2C (Venn Diagrams)
19	**M2-Ch4-Moments (Part 1)-Lesson 3** Tilting Problems	SM2 Ex 4E
20	**P2-Ch9-Differentiation-Lesson 5** (1) Parametric Differentiation; Equations of tangents and normal. Find the coordinates of stationary points but the identification of the nature of the stationary points is not needed. (1)	PM2 Ex 9G
21	**P2-Ch9-Differentiation-Lesson 6** (1) Implicit differentiation including the use of the product rule. Equations of tangents and normal. Find the coordinates of stationary points but the identification of the nature of the stationary points is not needed.	PM2 Ex 9H
22	**P2-Ch9-Differentiation-Lesson 7** (1) Using second derivatives to establish whether the curve is convex or concave and to identify points of inflection.	PM2 Ex 9I
23	**M2-Ch8-Further Kinematics-Lesson 1** (1) Solving problems involving objects moving with constant velocity Solving problems involving objects moving with constant acceleration (2) Vector methods with projectiles	SM2 Ex 8A SM2 Ex 8B

19	**(2 of 2) AOF S07 Parametric Equations Formative Assignment / Solutions** **S2-Ch2-Conditional Probability-Lesson 2** (1) Students to be familiar with the addition and multiplication formulae and their use within probability problems (2) Tree Diagrams without replacement (students could undertake this as a homework exercise) Further practice on questions to allow students to determine for themselves the correct choice on approach, eg tree diagram or venn diagram for instance? **(1 of 2) S08 Conditional Probability Formative Assignment / Solutions**	SM2 Ex 2D SM2 Ex 2E	24	**M2-Ch8-Further Kinematics-Lesson 2** (1) Variable acceleration in one dimension. The only difference between this and last year's topic is that students have now been taught some further calculus, so it is worth revisiting this topic with these more advanced questions. (2) Variable acceleration in two dimensions (differentiation problems)	SM2 Ex 8C SM2 Ex 8D
20	**S2-Ch3-Normal Distribution-Lesson 1** (1) Introduction to Normal Distribution / Shape / 68%, 95% & 99.7% rules. (2) Using the calculator obtain the Normal Distribution Values. *The old S1 Normal Distribution tables may support this.*	SM2 Ex 3A SM2 Ex 3B		**M2-Ch8-Further Kinematics-Lesson 3** (1) Variable acceleration in two dimensions(integration problems)	SM2 Ex 8E
21	**(2 of 2) AOF S08 Conditional Probability Formative Assignment / Solutions** **S2-Ch3-Normal Distribution-Lesson 2** (1) Inverse Normal Distribution (2) Using the standard normal distribution.	SM2 Ex 3C SM2 Ex 3D	25	**P2-Ch11-Integration (Part 1)-Lesson 1** (1) Integration as a reverse process of the standard derivatives learnt in the course so far. Introducing the idea of standard integrals. (2) Integrals of the form f(ax+b) including the use of natural logarithms, i.e $\int '(ax+b)dx = \frac{1}{a}\int (ax+b)+c$	PM2 Ex 11A PM2 Ex 11B
22	**S2-Ch3-Normal Distribution-Lesson 3** (1) Problems finding μ, or σ, or both (2) Approximating a Binomial Distribution	SM2 Ex 3E SM2 Ex 3F	26	**P2-Ch11-Integration (Part 1)-Lesson 2** (1) Using trigonometric identities to integrate expressions (pythagorean, compound and double angles) (2) Reverse chain rule method. Harder examples than those covered in integration from inspection method, including general cases. Include $\int \frac{kf'(x)}{f(x)}dx$ and $\int kf'(x)[f(x)]^2dx$ *Note that Q6 of Ex 11D covers* $\int tanxdx$ *and* $\int cotxdx$ *but this needs to be covered and highlighted as key in the students notes.*	PM2 Ex 11C PM2 Ex 11D

23	**S2-Ch3-Normal Distribution-Lesson 4** (1) Hypothesis Test of the sample mean using the Normal Distribution. (2) Normal Distribution & Conditional Probability	SM2 Ex 3G
24	**P2-Ch12-3D Vectors-Lesson 1** (1) Key skills in 3D vectors, ie finding $(AB)^{\rightarrow}$, finding the magnitude of a vector in 3D, finding a unit vector in a direction, parallel vectors. All of these are skills learnt in year 12 but extended into 3D vectors The "new" key skill to be learnt in this lesson involves finding the angle between a vector and a coordinate axis.	
25	**P2-Ch12-3D Vectors-Lesson 2** (1) Solving geometric problems with vectors. (Note, leave examples 11 and 12 from the Pearson textbook on equal vectors until lesson 3 below)	
27	**P2-Ch11-Integration (Part 1)-Lesson 3** (1) Using partial fractions to integrate expressions.	PM2 Ex 11G
28	**P2-Ch11-Integration (Part 2)-Lesson 1** (1) Integration by substitution. Definite and indefinite integration but simple cases (leave trigonometric and u2 substitutions until first half of lesson 2 below). Students might be given a substitution in the exam, but if the substitution is a simple choice, they may need to choose that themselves. (2) Integration by substitution using trigonometric and u^2 substitutions	PM2 Ex 11E PM2 Ex 11E
29	**P2-Ch11-Integration (Part 2)-Lesson 2** (1) Introduce integration by parts, derivation of formula and simple cases initially (2) Further integration by parts, using parts twice and definite integration. Ensure that students are aware of the common error on definite integrals, ie leaving the answer in terms of a function because they have not found the "value" of uv.	PM2 Ex 11F PM2 Ex 11F
	Year 13 Mock 2 Summative Assessment Paper 1: Pure (DATE TBD)	
	Year 13 Mock 2 Summative Assessment Paper 2: Statistics & Mechanics (DATE TBD)	
30	**P2-Ch11-Integration (Part 2)-Lesson 3** (1) Trapezium Rule (2) Finding the area between two curves, using the techniques of integration learnt in previous lessons. This is an opportunity for students to recognise which method of integration to choose, try to give them as much time to work on questions as possible.	PM2 Ex 11I
31	**P2-Ch11-Integration (Part 2)-Lesson 4** (1) Finding the area under a curve using parametric equations (note this was a late addition to the textbook)	PM2 TBD

	(2) Further geometric problems with vectors. Cover questions like those of example 11 and 12 from the PM2 textbook. Application to mechanics. Working with forces, vectors, equations of motion.	
26	**P2-Ch10-Numerical Methods-Lesson 1** (1) Sketching known graphs to identify how many solutions exist, and an approximate value for the root. Finding roots in an interval using the sign change method. Students should understand the limitations of this method (refer to graphs) (2) Iteration method. Students to have an understanding of why the method works. Students may be expected to have a knowledge of how the process relates to a graph (staircase and cobweb diagrams).	PM2 Ex 10A PM2 Ex 10B
27	**P2-Ch10-Numerical Methods-Lesson 2** (1) Newton Raphson Method. Students should understand the limitations of this method (refer to graphs) (2) Applications in modelling	PM2 Ex 10C PM2 Ex 10D

32	**M2-Ch7-Application of Forces-Lesson 1** (1) Static Particles. Students should understand that they could use a closed triangle to solve problems involving 3 forces, and should also be able to resolve forces horizontally and vertically, if necessary, to solve problems (include modelling questions). (2) Modelling static problems involving inclined planes with or without friction. Consider problems which involve calculating the max or minimum forces required to allow objects to remain static.	SM2 Ex 7A SM2 Ex 7B
33	**M2-Ch7-Application of Forces-Lesson 2** (1) Dynamics problems and inclined planes (2) Vector methods with projectiles	SM2 Ex 7C SM2 Ex 7E
34	**M2-Ch7-Application of Forces-Lesson 3** (1) Connected Particles and Inclined Planes	SM2 Ex 7F
35	**M2-Ch4-Moments (Part 2)-Lesson 1** (1) Calculating the moment of a force on a rigid body (forces non parallel) (2) Ladder Problems	Old M2 Pearson Ex 5A Collins Year 2 Book Ex 17.3A
36	**M2-Ch4-Moments (Part 2)-Lesson 2** (1) Non Parallel forces on other bodies, such as a rod freely hinged to a surface and a beam resting on a smooth peg. (2) Further Mixed Practice. Students are likely to find this a challenge and questions can easily take 10-15 mins so give them the time they need in this lesson to consolidate.	Collins Year 2 Book Ex 17.3B SM2 Ex 7D

			37	**P2-Ch9&11-Differential Equations-Lesson 1** (1) Connected rates of change. Students must be able to solve problems connecting two or three rates of change. Forming differential equations from information given in a question (involving proportionality) (2) Finding general solutions to differential equations by separating variables. Show a family of solutions graphically.	PM2 Ex 9J Pm2 Ex 11J Q1 & Q5
			38	**P2-Ch9&11-Differential Equations-Lesson 2** (1) Finding particular solutions to differential equations when given the necessary boundary conditions. Include problems involving partial fractions. (2) Modelling with differential equations (3) Examination practise. This is a very important phase and allows students to test their understanding of a variety of topics such as connected rates of change, integration techniques, partial fractions, exponentials and logarithms, etc. It forms a good basis for the start of the revision phase, so please allow time for this if it is helpful for your students.	PM2 Ex11J PM2 Ex 11K PM2 Mixed Ex 11 Q12-15, Q17,19, 21, 22, 24, 26, 27
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Wednesday 4th June 2025 (PM) Paper 1: Pure Mathematics (2 hours)

Thursday 12th June 2025 (PM) Paper 2: Pure Mathematics (2 hours)

Thursday 19th June (PM) Paper 3: Statistics & Mechanics (2 hours)