Long Term Curriculum Map

Subject and Year: Year Y12 Mathematics | Specification (KS4/5 only): | VOCABULARY

Dates taught / curriculum time	PRIOR KNOWLEDGE What should they already know / when was this last visited	CORE KNOWLEDGE What will they know at the end of this topic Learn that...	 Learn how to...	MISCONCEPTIONS/ THRESHOLD CONCEPTS	AMBITION FOR ALL QUESTIONS	FORMAL ASSESSMENT
HT1 Surds and Indices Teacher A- Chapter 2 in Textbook 1 (p16-26)	How to evaluate expressions involving powers and roots **Eg Evaluate 2 x 2^3** Apply and use order of operations. **Eg Calculate 2 + 4 x 4** Work with fractional, negative and zero indices. **Eg $\sqrt[3]{27}$, 4^{-1}** Multiply out two brackets **Expand (2x+1)(2x-7)** Recognise and use the difference of two squares **Expand and simplify (2a+b)(2a-b)**	The laws of indices are: • a^m x a^n = a^{n+m} • $a^m \div a^n = a^{m-n}$ • $(a^m)^n = a^{m \times n}$ • $a^0 = 1$ • $a^{-n} = \frac{1}{a^n}$ • $a^{\frac{m}{n}} = (\sqrt[n]{a})^m = \sqrt[n]{a^m}$ Index laws can only be applied when the bases are the same. The power laws are: • $a^n \times b^n = (ab)^n$ • $a^n \div b^n = (\frac{a}{b})^n$ A surd is a number that can be expressed using roots. Standard results are: • $\sqrt{b}$ x $\sqrt{b}$ = b • $\sqrt{a}$ x $\sqrt{b} = \sqrt{ab}$ • $\sqrt{a} \div \sqrt{b} = \sqrt{\frac{a}{b}}$ Rationalising the denominator is the process of removing a surd from the denominator and we use the difference of two squares to help with this. If $a = (\sqrt{b} + c)$then the conjugate of a is ($\sqrt{b}$ - c)	Use an apply all index laws, including negative, fractional and zero examples. Use and apply the power laws. Express a root of any power as a fraction index. Solve equations involving fractional and negative powers of a variable Simplify, multiply, add and subtract surds. Rationalise an expression using the conjugate of the denominator.	Mixing up the laws of indices **Eg $(2^3)^4 = 2^7$ and not 2^{12}** Putting $x^0 = 0$ Mistakes with negative powers **$x^{-2} = -x^2$** Rationalising by multiplying by the surd and not the conjugate	What are the five laws of indices? What are the two power laws? Anything to the power of zero equals what? Write $\sqrt{3} + \sqrt{75}$ in the form $a\sqrt{b}$ Simplify $\frac{(3+2x)}{\sqrt{x}}$ in form $ax^p + bx^q$ Evaluate $81^{-0.25}$ $Solve\ x^{\frac{-5}{2}} = 32$ Write $3\sqrt{x}$ in the form ax^p Explain how to rationalise the denominator to remove a surd. Why do we do this? What is the conjugate of $(\sqrt{2} + 5)$? Rationalise $\frac{1}{2\sqrt{n}-3}$	Homework- Surds and Indices
HT1 Proof and Communicating Maths Teacher A- Chapter 1 in	Recall square numbers, square roots, cube numbers and cube roots. **What is $\sqrt{9}$?** Manipulate algebraic expressions **eg, factorise $4x^2 - 1$**	You can express mathematical ideas using descriptions such as diagrams, equations and identities. The symbol ⇒ means "implies" and that a subsequent statement follows the previous one.	Layout a mathematical argument clearly, using the correct notation. Signpost an argument correctly using the symbols ⇒ and ⇔ Use the terms identity and equations to describe mathematical objects.	Using the implied signs incorrectly- not realising double arrow means equivalent **Eg putting ⇒ instead of ⇔ in arguments.** Poor signposting and "floating" expressions-	What is the difference between the symbols ⇒ and ⇔? What is the difference between an equation and an identity. Can you give specific examples?	

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	Recall and use basic angle facts **(eg sum of angles in a triangle)** Be able to define rational and irrational numbers **Which of these numbers are irrational? (0.3, π, $\sqrt{2}$)** Work with function notation. **Eg f(x) = 3x – 6, find f(5)**	The symbol ⇔ means that a subsequent statement is the equivalent to the previous one An identity is true for all values of the unknown and is represented by the symbol ≡ You can represent solutions of inequalities using set notation or interval notation. In interval notation, the square bracket […] means the endpoint is included, and the round bracket (…) means the endpoint is not included. One counter example is sufficient to prove a statement is not always true. Proof by exhaustion involves checking all possibilities and is only feasible when there are a small amount of possibilities. Proof by deduction is a method of showing a statement is always true- this may include algebraic examples.	Use the method of proof by deduction, including specifically that $\sqrt{2}$ is irrational and that there are an infinite amount of prime numbers. Use the method of proof by exhaustion- specifically to prove that numbers are prime (Using the square root rule) Use the method of counter example to disprove a mathematical statement Apply algebraic methods and manipulation to prove identities.	not using implied signs in all lines of working. Putting an = sign instead of ≡ when writing a mathematical argument Putting the wrong bracket for limits and set notation.	What is an irrational number? Can you give three different examples. Why is $0.\dot{3}$ not irrational? Prove there are only 3 prime numbers between 10 and 20. What type of proof have you used here? Prove that $\sqrt{2}$ is irrational. What type of proof have you used here? Give an example of a statement we could prove by a counter example. When would this not be appropriate?	
HT 1 Quadratic Functions of Quadratics Teacher B- Chapter 3 in Textbook 1 (p27-54)	Multiply out single and double brackets **Expand** $(3x+8)(2x-5)$ Solve quadratic functions by factorising. **(eg** $x^2 + x - 20 = 0$ $2x^2 + 15x - 8 = 0$**)** How to use and apply the quadratic formula How to solve linear inequalities $5x - 1 > 2x + 5$	The key features of a quadratic graph are the roots (x-intercepts), the y-intercept, turning point and line of symmetry. The general form of a quadratic equation is given by $y = ax^2 + bx + c$ where c is the value of the y-intercept. We can find the x-intercepts by factorising and solving the quadratic equations, by using the quadratic formula and by completing the square. For quadratic equations where $a > 1$ the completed square form is given by $(a(x+p))^2 + q$ and the turning point given by $(-p, q)$ The x-coordinate of the turning point of a quadratic graph is the midpoint of the two roots.	Factorise a quadratic graph to find the roots and sketch the key features of a quadratic graph. To use and apply the quadratic formula, including examples where rearrangement is required. Solve inequalities, including examples with a variable on both sides and quadratic examples. How to use the discriminant of a quadratic to determine the number of roots of a quadratic equation and apply this to applied situations. Identify equations that are "hidden quadratics" and apply correct substitutions to transform these. Students then use these quadratics to solve the original problem.	Confusing roots and factorised form of a quadratic equation. Negative errors when substituting into the quadratic formula. Not rearranging a quadratic in standard form first and getting incorrect coefficients for the formula. Negative and change of sign errors when solving inequalities. Mistaking the conditions to find the roots of a	What are the main features of a quadratic graph? Draw these in a sketch. What conditions are needed to find the roots of a quadratic equation? Sketch the graph of $y = 2x^2 + 5x + 1$ showing all intercepts and minimum points. Solve $3 - 7x = -4x^2$ Solve $2x^2 + 3x - 5 < 0$ What is the definition of the discriminant of a quadratic equation? How can this be used to determine the	

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		The discriminant of a quadratic graph is given by $b2-4ac$ and the value determines the number of roots of a quadratic equation • If $b^2-4ac\ >\ 0$ then the quadratic has two roots. • If $b^2-4ac=\ 0$ then the quadratic has one repeated root. • If $b^2-4ac<\ 0$ then the quadratic has no real roots. To solve quadratic inequalities, rearrange to make one side zero and then sketch the graph to find the regions. A substitution can transform an equation into a quadratic- this is called a hidden quadratic.		quadratic using the discriminant. Substituting the wrong value when using the hidden quadratic method.	number of roots the equation has? Find the values of k for which $2x^2-(k+1)x+5-k=0$ has two distinct roots Solve: $a^4\ -10a^2\ +21\ =\ 0$ What method have you sued to solve this? Can you give a different equation where we could/could not use this method?	
HT1 Simultaneous Equations, Graphs and Transformations Teacher B- Chapter 5 in Textbook 1 (p70-86)	How to solve quadratic equations. **Solve $x^2+x-1=0$** How to use the discriminant of a quadratic to determine the number of roots. How many solutions are there to the equation **Solve $x^2+4x+4=0$** How to solve simple linear equations by elimination **Solve the equations:** $x+2y=5$ $3x+4y=11$ How to solve equations involving indices and inequalities. **Solve $2^x=8$** Find equations for direct and inverse proportion.	You can use substitution to solve simultaneous equations, which allows you to find the intersection point of two curves. The number of intersection points of a straight line and quadratic curve can be determined using the discriminant. There are six main transformations of graphs: 1) $y=f(x)+c$ is a translation in the form $\begin{pmatrix}0\\c\end{pmatrix}$ 2) $y=f(x+d))$ is a translation in the form $\begin{pmatrix}-d\\0\end{pmatrix}$ 3) $y=pf(x)$ is a stretch parallel to the y-axis, scale factor = p 4) $y=f(q(x))$ is a stretch parallel to the x-axis, scale factor $\frac{1}{q}$ 5) $y=\ -f(x))$ is a reflection in the x-axis 6) $Y=f(-x)$ is a reflection in the y-axis. An asymptote is a line on a graph for which the curve gets closer and closer (tends towards) but never meets.	Solve simultaneous equations using substitution and elimination including examples involving quadratic graphs and circles. Use the link between solving simultaneous equations and intersecting graphs. Determine the number of intersections between a line and curve using the determinant of the combined equation. Apply the six transformations to any graph and sketch the resultant graph on a cartesian grid. Sketch and identify the key features of the graphs $y=\frac{1}{x}$ and $y=\frac{1}{x^2}$ including the asymptotes of the graphs. Use graphs and applications of direct and inverse proportion. To represent inequalities on graphs, we need to draw the associated equation on a graph, using dotted or solid lines, test a convenient point on one side of the curve to verify answers and shade the side that represents the inequality.	Mistakes in the elimination method (eg adding instead of subtracting). Negative errors when solving simultaneously. Only writing down one solution to a quadratic simultaneous equation (if distinct roots) Mixing up –f(x) and f(-x) Drawing curves which touch an asymptote Putting solid lines and not dotted for > and < when drawing inequalities. Negative errors when dividing by negative numbers in inequality (MUST teach taking negatives to the other	Sketch the graph of $x^2+\ y^2=36$ Solve the simultaneous equations: $x^2+\ y^2=25$ $x+y=7$ How many solutions can there be when we solve a quadratic and linear simultaneous equation? Draw graphs to show each situation. What is meant by a cartesian grid? Draw this. What are the six main transformations? What is the equation when $y=x^2$ is reflected in the x-axis? What is the equation when $y=x^2$ is translated by the vector $\begin{pmatrix}2\\3\end{pmatrix}$	

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	Understand and use function notation.	Direct proportion means that the ratio of two quantities is constant. If y is proportional to x then we write this as $y = kx$ where k is the constant of proportionality. Inverse proportion means that the product of two quantities is constant. If y is inversely proportional to x then we write this as $y = \frac{k}{x}$ where k is the constant of proportionality. You can represent inequalities on a number line and by drawing given regions on a graph. A solid line represents values included (eg ≥ or ≤) and a dotted line represents values not included (eg < or >)		side and NOT change the sign)	What is meant by an asymptote of a graph? What are the differences between the graphs $y = \frac{1}{x}$ And $y = \frac{1}{x^2}$ By sketching a graph, solve the inequality: $y < x^2 - 7x + 6$	
HT2 Trigonometric Functions and Equations Teacher A- Chapter 10 in Textbook 1 (p169-202)	Use SOHCAHTOA to fins missing lengths and angles in a right-angled triangle. Use and apply Pythagoras' Theorem $a^2 = b^2 + c^2$ Solve quadratic equations using the formula and factorising. Use the method of hidden quadratics to solve equations.	The sine function is periodic with period 360 degrees, it has amplitude of 1. This results in the identities: 1) $Sin\ x = sin\ (180 - x)$ 2) $Sin\ x = sin\ (x + 360)$ 3) $Sin\ (-x) = -sin(x)$ The cosine function is periodic with period 360 degrees, it has amplitude of 1. This results in the identities: 1) $Cos\ x = cos\ (-x)$ 2) $Cos\ x = cos\ (x + 360)$ The tangent function is the ratio between the sine and cosine function which gives the identity: $tan\ x = \frac{Sin\ x}{Cos\ x}$ The tangent function is periodic with period 180 degrees. There are asymptotes at 90 degrees and $90 + 180n$ degrees. The inverse of $sin\ x$ is $sin^{-1}x$, this function is mainly used to find missing angles. Consequent formulas follow for $cos\ (x)$ and $tan\ (x)$ Exact trig values are: |	$Sin\ x$	$Cos\ x$	$Tan\ x$		To define the functions of $sin\ (x)$ and $cos\ (x)$ by using the unit circle and use this to derive the main trigonometric identities. To solve equations involving $sin\ (x)$, $cos\ (x)$ and $tan\ (x)$, and use symmetry/periods of graph to find all solutions in a given range. This includes equations where a trigonometric transformation is applied first. How to use equilateral and isosceles triangles to derive the exact values of trig functions and apply these to non-calculator problems, leaving answers in terms of surds in their simplest form. Use the unit circle and basic trig rules to derive the identity: $Tan\ (x) = \frac{Sin\ (x)}{Cos\ (x)}$ Use the unit circle and Pythagoras' Theorem to derive the identity $sin^2x + cos^2x = 1$ Use trig identities and a scientific calculator to solve more complex equations, by changing the equation to one trig function and using hidden quadratics. Use trig identities to solve complex identities which could include manipulation of algebraic fractions, substitution or difference of two squares. To solve trig equations, involving transformations, by using the method:	Mixing up the graphs of each trigonometric graph. Marking the wrong number of degrees or the incorrect shape of the graph. Mistaking the inverse and reciprocal trig functions. Forgetting that there can be multiple answers to a trig equations within a given range. The calculator answer will give a principal answer which may be outside of the required range. Confusing the functions for a stetch parallel to the y-axis and a stretch parallel to the x-axis.	Draw the graphs of $y = sin(x)$, $y = cos(x)$ and $y = tan(x)$ What are the periods of all three trigonometric graphs? What are the two identities we use for trigonometry? How do you derive them? Solve $sin\ (x) = 0.6$ between $0 < x < 360$ Why does $cos(x) = 1.2$ have no solutions? Draw the graphs of $y = Sin(2x)$ and $y = 2\ cos\ (x)$ How many solutions will $sin(2x) = 0.7$ have between $0 < x < 360$?	

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<tr><th>Learn that…</th><th>Learn how to…</th></tr>
<tr><td></td><td></td><td>
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<tr><td>30</td><td>0.5</td><td>$\frac{\sqrt{3}}{2}$</td><td>$\frac{1}{\sqrt{3}}$</td></tr>
<tr><td>45</td><td>$\frac{\sqrt{2}}{2}$</td><td>$\frac{\sqrt{2}}{2}$</td><td>1</td></tr>
<tr><td>60</td><td>$\frac{\sqrt{3}}{2}$</td><td>0.5</td><td>$\sqrt{3}$</td></tr>
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We denote $sin\,x \times sin\,x$ as $sin^2 x$ and the identity $sin^2 x + cos^2 x = 1$ can be used to change an equation to only one trigonometric function.

Graph transformation rules can be applied to trigonometric functions, in particular:
1) $a\,sin\,(x)$ is a stretch parallel to the y-axis scale factor = a (this changes the amplitude of the graph but not the number of solutions in a given interval)
2) $sin\,(ax)$ is a stretch parallel to the x-axis scale factor = $\frac{1}{a}$(this changes the period of the graph and the number of solutions in a given interval)</td><td>1) make a substitution
2) change the given interval
3) Solve equation in usual way
4) Transform solutions back to original variable.</td><td></td><td></td><td></td></tr>
<tr><td>HT2
Triangle Geometry
Teacher A – Chapter 11 in Textbook 1 (p203 – 219)</td><td>How to use trigonometry in right-angled triangles.

How to use three figure bearings
Point A is on a bearing of 290^0 from B. Find the bearing of B from A

How to solve quadratic functions using the formula and factorising.
Solve $x^2 + 5x + 4 = 0$

How to solve trigonometric equations.</td><td>The sine rule is given by:
$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$ where A and a are angle and length pairs etc.

When using the sine rule to find an angle, there may be two possible answers: A and 180-A

The cosine rule is given by:
$a^2 = b^2 + c^2 - 2bc\,Cos\,A$ and is used when we have three given lengths and find a missing angle or an angle when given an angle and the surrounding two lengths.

The area of a triangle is given by the formula:
$$Area = \frac{1}{2}abSinC$$</td><td>How to apply the cosine and sine rules to find missing angles in non-right-angled triangles

How to rearrange the cosine rule to help find a missing angle including finding the ambiguous case where an obtuse angle is found.

How to logically eliminate answers in ambiguous cases of the cosine rule.

To apply the rules of bearings and the sine and cosine rules to find missing angles and lengths.

How to use basic trig facts to derive the formula for area of a triangle and apply this formula to find areas of any triangle.</td><td>Negative errors when substituting into the formulae

Rearranging errors when calculating an angle in the cosine formula.

Forgetting about potential obtuse solutions in the cosine rule.

Not setting a bearing clockwise and from due north.</td><td>What is the formula for the cosine rule?

In which situations would you use the cosine rule? Draw two triangles to show this.

What is the sine rule?

In which situations would you use the sine rule? Draw two triangles to represent this.

How do you rearrange the cosine rule when finding an angle?

What is the formula for the area of a triangle?</td><td></td></tr>
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		Learn that…	Learn how to…			
Teacher B – HT 2 Polynomials Textbook 1 – Chapter 4 p55-69	How to work with indices **Simplify $x^2 \times x^4$** Multiply brackets and collect like terms **Expand and simplify (2x+1)(x-3)** How to factorise quadratic expressions. **Factorise $x^2 - 8x$ +15** Solve quadratic equations using the quadratic formula **Solve $x^2 + 4x + 2 = 0$**	A polynomial is a function made up of a sum of terms containing non-negative integers of an unknown, such as x. The highest power of a polynomial is called the degree. The main polynomials consist of constant functions (degree = 0), linear functions (degree = 1), quadratic functions (degree = 2), cubic functions (degree = 3) and quartic functions (degree = 4) Polynomial division is a way of dividing a polynomial by a factor to find the other factors or remainders. The factor theorem states that if $(x - a)$ is a factor of $f(x)$ then $f(a) = 0$ Furthermore, $(ax - b)$ is a factor of $f(x)$ if and only if $f(\frac{b}{a})$=0 To sketch the graph of a polynomial function: 1) Decide on the basic shape by considering the order (degree) and the lead coefficient. 2) Set $x = 0$ to find the y-intercept 3) Write in factorised form if possible 4) Find the x-intercepts 5) Decide on how the curve meets the x-axis at each intercept 6) Connect all this information with a smooth curve To find the equation of a polynomial form its graph: 1) Use the shape of the graph and position of the x-intercepts to write down the factors of the polynomial. 2) Use any other point to find the constant factor.	To define a polynomial of any degree up to degree = 4. Find the product of two polynomials. Find the product of three polynomials. Find the quotient of two polynomials by using polynomial division, including examples where there are remainders. Find the factors of a polynomial by performing a factor search and the factor theorem. Sketch accurately any polynomial up to degree 4 ensuring all intercepts and roots are labelled and the general shape of the curve is correct.	Minus errors when expanding double and triple brackets. Forgetting the middle term when expanding $(x+3)^2$ Forgetting to pull down the new term in the next step of polynomial division. Forgetting the change of sign in the factor theorem. Not plotting repeat roots correctly. (Not reflecting off the x-axis)	Sketch the general shape of a linear, quadratic, cubic and quartic equations. What is the degree of the equation $x^4 + x^2 + 2x = 7$? Give a definition for the term "polynomial" How would you expand (x+2)(X-3)? How would you expand (x+3)(x-5)(x-9)? Describe the steps involved in polynomial division. What is the difference between a factor search and polynomial division? What are the advantages of each method? What is the factor theorem? When would you use it? If F(3) = 0 what would a factor of f(x) be? If f(0.5)=0 what would a factor of f(x) be?	
HT3 Radian Measure, Arc	Be able to define trigonometric functions, beyond acute angles, including exact values.	A radian is the measure of angle created by a circle, radius r, with arc length r also. This is approximately equal to 57 degrees.	What the radian measure is and how to convert between degrees and radian measure using a scientific calculator.	Mistakes in converting between degrees and radians. Eg pi = 360 degrees.	What is the value of one radian?	

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	Solve trigonometric equations involving sin, cos and tan. Identify graph transformations and apply to trigonometric examples. To use the cosine and sine rules	A full turn = 360 degrees = 2π *radians* To convert from degrees to radians, we divide by 180 and multiply by π. To convert from radians to degrees, we divide by π and multiply by 180. We can represent the graphs of $y = \sin x$, $y = \cos x$ and $y = \tan x$ using radian measures. We can solve trigonometric equations in terms of radian measure. The length of an arc is given by l=rϴ, where r= radius and ϴ=angle of the arc measured in radians. The area of a sector of a circle is given by A=$\frac{1}{2}$r^2 ϴ, where r=radius and ϴ is the angle of the sector. For small values of ∅, measured in radians: 1) $\sin\emptyset = \emptyset$ 2) $\cos\emptyset = 1 - \frac{1}{2}\emptyset^2$ 3) $\tan\emptyset = \emptyset$ These are called small angle approximations.	The main special angles for trig functions in terms of radians- these include $\frac{\pi}{2}, \frac{\pi}{3}, \frac{\pi}{4}$ and $\frac{\pi}{6}$ radians and then multiples of these. To use symmetry of trig graphs to find solutions of trig equations in exact value and to a set level of accuracy (usually 2d.p.) in terms of radians. To find the arc lengths and sector areas of circles and to apply this knowledge to find the perimeter and areas of complex shapes within a circle. In particular, how to find the segment of within a circle. Trigonometric functions can be approximated by polynomials using the small angle approximations. To use small angle approximations in binomial expansions involving trigonometric functions.	Not realising that radians can be in decimal values and not always multiples of pi. Mistaking arc length and sector formula- not giving answers in terms of radians. Mixing up stretches in x and y axis leading to incorrect solutions to trig equations. Mixing up small angle approximation formula and not recognising situation they are useful.	How is the value of a radian derived? What is the value of 90 degrees in radians? What is the value of 2pi radians in degrees? What symbols do we use for radians? Solve sin x = 0.9 in radians, for the domain 0-2pi What is the formula for the area of a sector using radians?	
HT2 Coordinate Geometry Teacher B – Chapter 6 Textbook 1 (p87-112)	Know how to find the equation of a straight line through the formula y=mx + c Parallel lines have the same gradients Solve linear and quadratic simultaneous equations and explain the meaning of the results. Complete the square for an algebraic expression	The distance between the points (x_1, y_1) and (x_2, y_2) is $\sqrt{((x_2 - x_1))^2 - (y_2 - y_1)^2}$ The midpoint of (x_1, y_1) and (x_2, y_2) is $((x1 + x2)/2, \frac{y1+y2}{2})$ The line with gradient m through point $(x_1, y_1$ has equation y-y1 = m(x – x1) The equation of a straight line can also be expressed in the form $ax + by + c = 0$ If a line has gradient m, the gradient of any perpendicular line is $m_1 = \frac{-1}{m}$ Two lines with gradients m_1 and m_2 are perpendicular if $m_1 m_2$ = -1	To calculate the midpoints, gradients and equations of a linear graph. Use and manipulate the equations of a line. To find the equations of lines perpendicular and parallel to a given linear graph. To sketch circles of any given radius and centre. Use substitution and elimination to solve simultaneous equations involving lines and circles.	Not rearranging straight line equations into form given in question. Calculating perpendicular gradients to make 1 and not -1 Incorrect transformation shift when sketching circles. Eg shift left instead of right.	What are the two formulae to find the equation of a straight line? What is gradient? What formula are associated with gradient? How do you calculate the distance between two points? What are the three general forms of a straight line that answers are asked for?	

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		The circle with centre (a, b) and radius r has equation $(x-a)^2 - (y-b)^2 = r^2$ A straight line and circle can intersect once, twice or no times- we can use the discriminant of the combined equations to check his. The tangent to a circle is perpendicular to the radius at the point of contact. The normal is the line containing the point of contact and the centre of the circle.			What do the gradients of parallel lines have in common? What do the gradients of perpendicular lines multiply to make? What is the general equations of a circle? What is the equation of a circle with radius 5 and centre (6,-2)?	
HT2 Vectors Teacher B – Chapter 12 in Textbook 1 (p220-246)	How to represent vectors on a grid and write them as column vectors How to use Pythagoras' Theorem and trigonometry in right-angled triangles. Solve quadratic equations and recognise when a quadratic has no solutions.	Vector quantities have both magnitude (size) and direction. Real life examples of vectors include velocity and force) Scalar quantities have magnitude but no direction and included measurements such as mass and speed. The unit or base vectors I and j are represented y the following column vectors: **I** = $\binom{1}{0}$ and **j** = $\binom{0}{1}$ Any vector can be represented by a combination of these base vectors **Eg $AB = 4i - 3j$ is the vector 4 units to the right and 3 units down.** The magnitude or modulus of a vector a = $\binom{p}{q}$ is denoted by $\left\|\sqrt{p^2+q^2}\right\|$ The direction of a vector is the angle it makes with the horizontal direction. It can be found from the right-angled triangle formed by the vector and its component. A unit vector has magnitude equal to one. We denote the unit vector of vector $\boldsymbol{a}$ as $\hat{\boldsymbol{a}}$ You can perform the operations addition, subtraction and multiplication with vectors but not division.	How to use Pythagoras' Theorem to find the magnitude of a vector. How to use the tangent function to find the angle between a vector and the horizontal.	Mistaking speed and velocity as vector quantities. Forgetting to divide by the modulus when calculating the unit vectors. Thinking you can divide vectors. Forgetting to square root the end result when finding the modulus of a vector.	What is the difference between a vector and a scalar quantity? What is a unit vector? How would we convert a vector into a unit vector? What do I, j and k represent in vector form? What is the link between the modulus of a vector and Pythagoras' theorem? What operations can you apply to vectors? What operation can you not apply to vectors?	

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HT2 Differentiation Teacher B- Chapter 13 in textbook 1 (p247-269)	How to work with indices How to solve linear and quadratic equations How to find the gradient of a straight line	The gradient of a curve at point P is the gradient of the tangent to the curve at that point. The derivative (or gradient function) of a function $f(x)$ is another function that gives the gradient of the graph of $y = f(x)$ at any point and is denoted by $f'(x)$ or $\frac{dy}{dx}$. The process is called differentiation. 1) When a graph is increasing then the gradient is positive if $\frac{dy}{dx} > 0$ 2) When a graph is decreasing then the gradient is negative if $\frac{dy}{dx} < 0$ 3) When the gradient is horizontal the gradient is zero and this is a stationary point. This occurs when $\frac{dy}{dx} = 0$ $\frac{dy}{dx}$ is the gradient function of the graph of y against x and measures how fast y changes when x changes- called the rate of change The line segment between two points on a curve is called a chord. A method of finding the gradient at a general point on any function $f(x)$ is called differentiation by first principles and is given by the formula: $f'(x) = \lim_{h\to\infty}\left(\frac{f(x+h)-f(x)}{h}\right)$ If $y = kf(x)$ then $y' = kf'(x)$ If $y = f(x) + g(x)$ then $y' = f'(x) + g'(x)$ The second derivative of a function $f(x)$ if the derivative of $\frac{dy}{dx}$ and denoted $f''(x)$ or $\frac{d^2y}{dx^2}$ and gives the rate of change of a gradient.	To estimate a gradient of a non-linear graph by taking a tangent at a given point. To use notation for functions and differentiation and write a coherent argument. To evaluate limits of a function by considering what happens as it tends to infinity or zero in either direction. To apply the formula of differentiation by first principles to find the gradient function. To find the derivative of basic polynomials **eg** $\boldsymbol{y = x^3}$ and also to fractional and negative examples. To calculate when a function is increasing or decreasing by looking at the result of the derivative. Explain what this means in context of the variables. To calculate the rate of change of a derivative to find the second derivative.	Not understanding the role of a chord when completing first principles. Using notation h=0 instead of limits when suing first principals. Mistaking that differentiation means finding the gradient instead of the gradient function. Treating constants as variables eg when differentiating pi. Using incorrect notation when not differentiation in terms of x and y . Not interpreting the sign of the second derivative correctly to identify the nature of stationary points. Not giving the y-coordinates of a stationary point when asked for coordinates. Not converting 1/x correctly before differentiating.	What is the gradient of the line y=2x+7? What happens to the gradient of y=x2 as x gets larger? How would we estimate the gradient at a given point? What is differentiation? When would we use it? How do you differentiate the function y=6x2 +9x? Write down the two different ways we can denote differentiation. What is a stationary point? How is it linked to differentiation? What are the three types of stationary points? How are they linked to differentiation results? Explain the process of differentiation by first principles. What is the formula used? What is the second derivative of a function? What can it show?	

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		Learn that…	Learn how to…			
HT3 Applications of Differentiation Teacher B- Chapter 14 in Textbook 1(p270-289)	Differentiate functions involving xn You should know how to evaluate second derivatives How to find the equation of a straight line You should know how to find the equation of a perpendicular to a line.	The normal to a curve is a straight line that crosses the curve and is perpendicular to the tangent. The gradient of a tangent m_1 and the gradient of a normal m_2 are connected by the equation $m_1 m_2$ = -1 A stationary point of a curve is defined by $\frac{dy}{dx}$= 0 and these can be maximum points, minimum points or points of inflection. To determine the nature of a stationary point we use the second derivative $\frac{d^2y}{dx^2}$ 1) When $\frac{d^2y}{dx^2}$ < 0 we have a maximum point 2) When $\frac{d^2y}{dx^2}$ > 0 we have a minimum point 3) When $\frac{d^2y}{dx^2}$ = 0 then we cannot draw any conclusions. We can use knowledge of derivatives and second derivatives to answer maximisation problems such as maximum surface area.	To calculate the equation of normal to a curve at a given point. To determine the stationary points of a curve by using the first derivative. To evaluate the nature of a stationary point by finding the second derivative To apply differentiation skills to find the maximum or minimum of a practical problem. **Eg maximising a volume when given a specific surface area.**	Not using dy/dx >0 for an increasing function, but instead trying to work with y-values. Using incorrect notation when not differentiation in terms of x and y . Not connecting two formula when solving maximisation problems to eliminate a variable.	What is the difference between normal and tangent of an equation? If two lines are perpendicular what do their gradients multiply to make? What is the result used for stationary points? What are the three types of stationary points and in what conditions do they arise? Can you explain the main process of a maximisation problem?	Formal assessment at the end of HT5 50 marks – mixture of AO1, AO2 and AO3 including prior content
HT3 Integration Teacher B- Chapter 15 (p290-314)	How to solve quadratic equations and factorising. How to differentiate expressions of the form $y = x^n$ Know how to covert expressions into the form $y = x^n$ in order to differentiate **(eg 3x$\sqrt{x}$)**	Integration is the reverse of differentiation and allows us to find areas underneath curves. The fundamental theorem of calculus: $\int f(x)\ dx = F(x)$ + c means that $f(x) = \frac{d}{dx}F(x)$ $\int x^n$ dx = $\frac{1}{n+1}x^{n+1}$ + c for any n≠ -1 $\int kf(x)$ dx = k$\int f(x)$ dx where k is a constant $\int f(x)$ + g(x) dx = $\int f(x)$ dx + $\int g(x)$ dx We use square brackets to show a function which has been integrated.	How to integrate functions in the form $y = x^n$ including examples with negative and fractional powers. Expand brackets and simplify fractions to get a function in the form $y = x^n$ so that we can integrate. Find the equation of a curve given its derivative and point on the curve. Find the area between a curve and the x-axis. Recognise that curves which go above and below the x-axis will need to be integrated in sections. Find areas between two curves by integrating twice or subtracting the functions first. To integrate with respect to y in order to find areas around the y-axis.	Not including the constant of integration when evaluating an indefinite integral. Not splitting a graph into negative and positive parts when evaluating an area of a curve that crosses the x-axis. Mistaking a negative result as a negative area- not that it is below the x-axis. Putting the lowest limit on the top of an integral.	What is the inverse of differentiation called? What is the difference between definite and indefinite integration? Why do we need a constant of integration? What situation is this needed? Evaluate $\int 2x^5\, dx$ Evaluate $\int 2\sqrt{x}\, dx$ Draw a picture to represent: $\int_1^3 x^2 + 1\, dx$	

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		Learn that…	Learn how to…			
		Indefinite integration requires a constant c whilst definite integration will have limits and give a number answer. $\int_b^a f(x)\ dx$ a and b are known as limits of integration. This integration will find the area under the curve between the two limits. An area underneath the x-axis will give a negative value. If we have area above and below in the same curve we need to integrate these separately and then add them together.			Evaluate the integral. A curve has gradient $\frac{dy}{dx} = 3x - \sqrt{x}$ and passes through the point (4,-1). Find the equation of the curve.	
HT3 Teacher B Logarithms- Textbook 1 Chapter 7 (p113-127)	How to work with expressions involving exponents. How to evaluate fractional and negative powers. How to use the laws of indices. Solve equations involving fractions. How to solve quadratic equations.	We can convert between index and logarithm for by using: a=b^c ⇔ c = $\log_b a$ The logarithm of a negative number or zero is not a real number. $\log_{10} x$ is written as $\log x$ (base ten is the standard base used as default) $\log_e x$is written as $ln\ x$ (the natural log) Standard results for logarithms: 1) $\log_a(a^x) = x$ 2) $a^{\log_a x} = x$ 3) $\log_a(xy) = \log_a x + \log_a y$ 4) $\log_a(\frac{x}{y})$= $\log_a x$-$\log_a y$ 5) $\log_a x^k = k \log_a x$ For any base $a > 0, \log_a a = 1$, the logarithm of 1 is always 0, irrespective of the base. $\log_a 1 = 0$ To solve an equation with the unknown in the power, take logarithms (to any base) of both sides. Some equations can be turned into quadratic equations by using a substitution of the form $y = a^x$	Evaluate logarithms of any base. Including examples with negative and fractional answers. Undo exponential functions using an operation of a logarithm Use the laws of logarithms, including examples where multiple laws need to be applied. Use logarithms to find exact solutions of some exponential equations. Use the function e to solve logarithmic equations.	Errors in the laws of logarithms. Eg thinking that log (a+b) = log a x log b Not simplifying ln e or e^ln(x) Mistakes when expanding (e^x +e^-x)^2 Poor sketching of a log graph- not showing that the graph tends to the asymptote and doesn't touch it. Not giving full explanations in "show that" questions or proofs. Eg llog2-log4 = -log2	Sketch the graphs of y=ln(x). Where are the asymptotes of the graph? What values of x is the graph valid for? For $\log_2 4$ what is the base? What is the value of ln(e)? Simplify the expression $\ln(e^5)$ Evaluate the following: a) $\log_3 27$ b) $\log_5 5$ c) $\log_{15} 1$ d) $\log_{25} 0.2$ What does $\log_a a$ always equal for any value of a? Simplify: $\log_a 4 + 2\log_a 5a$ Solve the equation: $\ln x = 2ln9 - \ln 3$ Find the exact solutions of $4^x + 2^x = 12$ Find the exact solutions to $e^x + e^{-x} = 4$	

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HT4 Teacher A Further Trigonometry Textbook 2 – Chapter 8	Identify transformations on graphs including trigonometric functions. Use the basic trigonometric identities. Use graphs of trigonometric functions, in degrees and radians Solve trigonometric equations in degrees and radians.	The compound angle identities are: 1) $\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$ 2) $\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$ 3) $\tan(A \pm B) = \frac{\tan A + \tan B}{1 \mp \tan A \tan B}$ If we set $A = B$ then we can transform the compound angle identities into the double angle identities. These are: 1) $\sin 2A \equiv 2 \sin A \cos A$ 2) $\cos 2A \equiv 2Cos^2 A - 1$ 3) $\cos 2A \equiv 1 - 2sin^2 A$ 4) $\cos 2A \equiv cos^2 A - sin^2 A$ 5) $\tan 2A \equiv \frac{2 \tan A}{1 - tan^2 A}$ To write $a \sin x \pm b \cos x$ in the form $R\ \sin(x \pm \propto)$ or $R \cos(x \pm \propto)$: 1) Expand the brackets using compound angle identities. 2) Equate coefficients of $\sin x$ and $\cos x$ to get equations for R $\sin \propto$ and $R \cos \propto$ 3) Use $R^2 = a^2 + b^2$ 4) To get $\tan \propto$, divide $\sin \propto$ equation by the $\cos \propto$ equation. The reciprocal functions are: 1) The secant function: $\sec x = \frac{1}{\cos x}$ 2) The cosecant function: $cosec(x) = \frac{1}{\sin x}$ 3) The cotangent function: $\cot(x) = \frac{1}{\tan(x)}$ We can use the identity $\tan \theta = \frac{\sin \theta}{\cos \theta}$ to derive the identity $\cot(\emptyset) = \frac{\cos \emptyset}{\sin \emptyset}$ We can use the identity $sin^2 x + cos^2 x = 1$ to derive the identities: 1) $\sec^2(x) \equiv 1 + tan^2(x)$ 2) $cosec^2(x) \equiv 1 + cot^2(x)$	Find trigonometric functions of sums and differences of two angles To transform graphs in the form $a \sin x \pm b \cos x$ into forms that we can sketch and describe their transformations. Solve problems involving graphs in the form $a \sin x \pm b \cos x$ such as finding maximum/minimum values. Sketch the graphs of the reciprocal functions, including intercepts and asymptotes. Solve equations involving the reciprocal functions in both degrees and radians. , including examples involving graph transformations. Use previous trigonometric identities to derive identities involving the reciprocal functions, use these to solve set identities, solve equations and draw graphs.		What are the small angle approximations for each trigonometric function? What is the approximate value of $\sin 0.2$? When would small angle approximations not be valid? Write $\frac{\sin 4\emptyset}{1+\cos \emptyset}$ in terms of $\emptyset$ What are the double angle formula? What are the addition formula? Write $4\sin x + 6 \cos x$ in the form $R\ \sin(x \pm \propto)$	

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HT4 Teacher A Calculus of Trig and Exponential Functions.		The chain rule is defined: If $y = f(u)$, where $u = g(x)$, then $\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$ The derivatives of the trigonometric functions are: 1) $\frac{d}{dx}(\sin kx) = k\cos kx$ 2) $\frac{d}{dx}(\cos kx) = -k\sin kx$ 3) $\frac{d}{dx}(\tan kx) = k\,sec^2\,kx$				
HT4 Teacher B Exponential Models Textbook 1 Chapter 8	Be able to use the number e and the natural logarithm Use the laws of logarithms Transform graphs Work with equations of straight lines	For exponential graphs in the form $y = a^x$ • The y-intercept is always $(0,1)$ because $a^0 = 1$ • The graph of the function lies entirely above the x-axis • The x-axis is an asymptote. • If $a > 1$, then as x increases so does y. This is called exponential growth. • If $0 < a < 1$, then as x increases, y decreases. This is called exponential decay. For the graph $y = e^x$ the gradient function is also given by $y' = e^x$. This is an example of a self-differentiating function. The gradient of $y = e^{kx}$ is given by $y' = ke^{kx}$ The graph of $y = ln(x)$ passes through the point $(0,1)$ and has y-axis as a vertical asymptote. The graph is the inverse of $y = e^x$ and therefore there is a line of reflection $y = x$ between them. Many real-life situations can be modelled by the exponential function, such as: population changes, chemical reactions and compound interest/depreciation. For a function in the form $y = Ae^{kt}$ • The initial value (when $t = 0$) is A • The rate of growth is $ky = kAe^{kt}$	To draw and recognise exponential graphs and pick out their key features including: intercepts, asymptotes and general shapes. Find the gradient functions of graphs in the form $y = e^x$ and $y = e^{kx}$ by applying the chain rule. Extend to any function of $y = e^x$ Use the natural logarithm (ln) to solve exponential equations. Sketch the graph $y = ln(x)$ and sketch relevant transformations of this graph. To analyse real life situations which fit an exponential model, find initial values and find rates of change of the model. To use logarithms to transform a model of exponential growth or decay into a straight line and analyse this graph including extrapolation to make future predictions.			

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		Learn that…	Learn how to…			
		The use of logarithms can transform an exponential graph into a straight-line model. If $y = ax^n$ then $y = \log a + n \log x$ The graph of $\log y$ against $\log x$ is a straight line with gradient n and y-intercept $\log a$				
HT 4 Teacher B Binomial Expansion- Integer Values	Evaluate expressions involving powers, including the correct order of operations. How to use the laws of indices. Expand single, double and triple brackets. Solve quadratic equations using the formula or factorising.	A binomial expression is one which contains two terms, for example $a + b$ Binomial expansion is the process of expanding brackets in the form $(a + b)^n$ The binomial theorem states that for any positive integer n, then $(a+b)^n = \cdots$.. Binomial coefficients can be found using the nCr button on your calculator or from Pascal's triangle nCr can also be written as $\binom{n}{r}$ $n! = n \times (n-1) \times \ldots \times 2 \times 1$ for $n \epsilon$N. Specifically 0! = 1 This is called the factorial function. Binomial coefficients can be written in terms of the factorial function. Specific results are: • nCr = $\frac{n!}{r!(n-r)!}$ • nC0 = 1 • nC1 = n • nC2 = $\frac{n(n-1)}{2}$ For the binomial expansions in the form $(a+x)^n$ if the value of x is close to zero then large power of x will be extremely small.	To use the C (choose) function to find binomial expansion coefficients. Eg evaluate 3C8 or $\binom{3}{8}$ Use Pascal's triangle to also find binomial expansion coefficients. Expand binomial expressions in the form $(a+b)^n$ in its entirety and for specific coefficients. Use the factorial functions and apply this to binomial expansions. Combine two binomial expansions to find specific powers. Use suitable values of x and the binomial expansion to find approximations to powers.		Expand $(2x+5)^4$ in increasing powers of x up to x^2 Find the x coefficient of the expansion $(2x-1)^2(3x+2)^3$ What binomial expansion could you sue to estimate the value of 8.02^5	
HT5 Teacher A Stats- Working with Data	How to interpret basic statistical diagrams such as bar charts and pie charts How to calculate the mean, median and mode of a set of data	A histogram is a useful visual summary of data, giving an immediate impression of centre and spread. A histogram has a continuous horizontal scale to cover all values within a sample. The y-axis is always frequency density where:	To construct accurate histograms using the formula for frequency density. Analyse histograms to find specific frequencies and estimate the mean. Explain the meaning of data being represented in the histogram.	•		

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	How to calculate the range and interquartile range of a set of data. The difference between discrete and continuous data.	$Frequency\ desity = \frac{Frequency}{Class\ Width}$ A cumulative frequency chart shows the total number of data items less than or equal to a particular value. They are useful for finding the median and inter-quartile range and facilitate in the constructions of box plots. Standard deviation (σ) is the "root mean square deviation from the mean" and shows how consistent a data set is. The formula is given by: • $\sigma = \sqrt{\frac{\Sigma(x-x\ bar)^n}{n}}$ • $\sigma = \sqrt{\frac{\Sigma x^2}{n} - x\ bar^2}$ The square of the standard deviation is called the variance. Bivariate data involves two variables which we can investigate a potential relationship between- often through a scatter graph. A regression line can be drawn only when there is a significant linear correlation and not too much extrapolation. The correlation coefficient, r, shows the strength and type of correlation between two variables: • When r=1 – strong positive linear correlation • When r=0 – no linear correlation • When r=-1 – strong negative linear correlation. Graphs or calculations can be used to identify outliers in data, which may need to be removed.	Draw accurate cumulative frequency charts and use this to estimate the means, upper quartile, lower quartiles or any given percentile. To use a data set or cumulative frequency chart to draw accurate box plots. Compare two box plots and explain what the data is representing. In particular, describing the differences in spread and median. Calculate the mean and standard deviation of a data set and frequency chart using the formula and a scientific calculator. Draw accurate scatter graphs, identify anomalous values, draw regression lines when appropriate and extrapolate the line to make predictions. Interpret what a correlation coefficient means in terms of the data context. Identify outliers within a data set, analyse the effects of these and remove them to create a true picture of the data set.			

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Teacher A Probability Textbook 1 Chapter 17 p359-383	Find probabilities by listing outcomes of a single event or combination of two events. Use tree diagrams to determine probabilities of successive events and combined events. How to calculate factorials and binomial coefficients **Evaluate: 7!, 10C5,** $\binom{12}{3}$	Events A and B are mutually exclusive if it is impossible for both of them to happen at the same time. In other words $\boldsymbol{P(A \text{ and } B) = 0}$ If events are mutually exclusive, their probabilities can be added: $\boldsymbol{P(A \text{ or } B) = P(A) + P(B)}$ Events A and B are independent if knowing the outcomes of A does not affect the probability of B $\boldsymbol{P(A \text{ and } B) = P(A) \; x \; P(B)}$ The compliment of an event A s the event "not A" or A' $\boldsymbol{P(A) + P(A') = 1}$ If A and B are independent then A' and B' are also independent, as are A and B' and B and A' The total of all the probabilities of a probability distribution must always equal 1. The binomial distribution models the number of successful outcomes from repeated trials, provided the following conditions are satisfied: 1) The number of trials are fixed 2) Each outcome can be classified as either success or failure 3) The trials are independent to each other 4) The probability of success is the same in each trial. If n is the number of trials, p s the probability of success and X denotes the number of successes, you can write $X \sim B(n, p)$ and $P(X = x) = \binom{n}{x} p^x (1-p)^{n-x}$	Calculate probabilities when you are interested in more than one outcome Use probability trees and Venn diagrams to find probabilities of conditional and unconditional events. Construct and use a table showing probabilities of all possible outcomes in a given situation. Calculate missing values in a distribution. (Including two-way tables) To represent relevant events as a binomial distribution and explain and apply the conditions for this to be the case. Calculate the probability of events that can be represented by a binomial distribution, including finding specific values and range of values. Use a scientific calculator and the binomial function to calculate probabilities in a binomial distribution. Interpret these results in a real-life context.	•		
Teacher B Introduction to Kinematics	How to find the gradient of a straight line connecting two points Differentiate polynomials	We can use mathematical modelling to represent real-life situations. Assumptions need to be made so that the situation can be shown mathematically.	Use the basic concepts in kinematics: displacement, distance, velocity, speed and acceleration.	•		

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	If $y = 3x^5 + 6x - 7$ find $\frac{dy}{dx}$ Find areas of triangles and trapeziums Use integration to find the areas under a graph and find the value of a constant of integration. Interpret displacement-time and velocity-time graphs.	The particle model assumes that an object occupies a single point in space and moves as one. Scalar quantities (eg time, distance, speed) have only magnitude whereas a vector quantity (eg displacement, velocity) has magnitude and direction. $$Average\ speed = \frac{total\ distance}{time}$$ $$Average\ velocity = \frac{final\ disp - initial\ disp}{time}$$ Velocity is defined as the rate of change of displacement. Instantaneous velocity is defined as $v(t) = \frac{dx}{dt}$ or $v(t) = \int a(t)dt$ Acceleration is defined as the rate of change of velocity, Instantaneous acceleration is defined as $a(t) = \frac{dv}{dt} = \frac{d^2x}{dt^2}$ or $a(t) = \int v(t)dt$ The change of displacement between time t_1 and t_2 can be found using the definite integral: $$s = \int_{t1}^{t2} v\ dt$$ On a displacement-time graph: 1) Average velocity is the gradient of the chord between two points 2) Instantaneous velocity is the gradient of the tangent to the graph. On a velocity-time graph: 1) The gradient is the acceleration 2) The total area between the graph and the horizontal axis is the distance travelled.	Use differentiation and integration to relate displacement, velocity and acceleration. Use correct calculus notation to represent this. Use correct units for each kinematic situation. Represent motion on a travel graph. Including drawing and interpreting distance/displacement-graphs and speed/velocity graphs. Describe what is happening at each stage of a graph. Solve more complicated problems in kinematics, for example involving two objects or several stages of motion.			
Teacher B Motion with Constant	Use integration to find velocity and displacement from acceleration	We use the following letters to represent the variables: 1) $S = displacement$ 2) $U = initial\ velocity$ 3) $V = final\ velocity$	Derive the formulae of constant acceleration by using integration and form a straight line velocity-time graph.			

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	How to solve quadratic equations. **Solve $4.2t^2 - 11.5t + 2.6 = 0$** How to find the vertex of a parabola **Find the coordinates of the parabola** $y = 12.2x - 36.1x^2$	4) $A = acceleration$ 5) $T = time$ Negative acceleration is called deceleration. The equations of constant acceleration are: 1) $v = u + at$ 2) $s = ut + \frac{1}{2}at^2$ 3) $s = \frac{1}{2}(u + v)t$ 4) $v^2 = u^2 + 2as$ 5) $s = vt - \frac{1}{2}at^2$ Assumptions that air resistance can be ignored and g is constant. Gravitational acceleration acts on a falling object. This is the same regardless of the mass of the object. This is given by $g = 9.8\, ms^{-2}$ For an object thrown upwards: 1) The time taken to return to the ground is twice the time to the highest point. 2) The speed of the object when it hits the ground equals its initial speed. 3) The object reaches maximum height when $v = 0$	Use the constant acceleration equations to find set variables. Rearrange these equations accordingly and use the correct units for the final result. Apply the constant acceleration formula to vertical motion under gravity. Including examples where objects fall further than the original starting point. Apply all the formulae to multi-step problems.			
Teacher A Statistical Hypothesis Testing Textbook 1- Chapter 18 p384-402	How to calculate cumulative probabilities for a binomial distribution Given that $X \sim B(25, 0.6)$ find $P(x<15)$ Deduce parameters of a binomial distribution in context.	Simple random sampling is a procedure where every possible sample (of a given size) has an equal chance of being selected. Opportunity sampling involves choosing respondents based upon their availability and convenience. Systematic sampling means taking participants at regular intervals from a list of the population, with the starting point chosen at random. Stratified sampling is splitting the population into groups based on factors relevant to the research, then random sampling from each group in proportion to the size of that group.	To use all the methods of sampling- argue the best method to use in a given situation and evaluate the advantages and disadvantages of each method. Write a binomial distribution event using null and alternative hypothesis values. Use a hypothesis test for a population proportion by using the following steps: 1) State H_0 and H_1 2) Decide on the significance level 3) State the distribution of the test statistic 4) Calculate the probability of observing the test statistic- the p-value. 5) Compare the p-value to the significance level and accept/reject the null hypothesis. 6) Interpret the conclusion in context of the event	•		

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		Quota sampling is splitting the population into groups based on factors relevant to the research, then opportunity sampling from each group until a required number of participants are found. Cluster sampling is splitting the population into clusters based on convenience, then randomly choosing some clusters to study further. A hypothesis test is a procedure for answering a question of the following type: does a sample provide significant evidence that a population parameter (mean/spread/proportion) has changed from a previous known or assumed value? The null hypothesis, denoted by H_0, specifies the previous or assumed population proportion The alternative hypothesis, denoted by H_1, specifies how you the proportion may have changed. The critical region for a hypothesis test is the set of values of the test statistic that leads us to reject the null hypothesis. The remining values form the acceptance region. In a one-tailed test, H_1 is in the form $p < a$ or $p > a$ and you need to compare the p-value to the significance level. In a two-tailed test, H_1 is in the form $p \neq a$ and you need to compare the p-value to half the significance level. The critical region is made up of two parts.				
Teacher B Force and Motion Textbook 1-	How to use the constant of acceleration formulae. Work with vectors in component form	Newton's 1st law: An object continues to move with constant velocity, or remains at rest, unless acted on by an external force. Newton's 2nd Law: the force, **F** Newtons, required to make an object of mass m kg	To model the forces on a particle using arrows and component notation. Using the correct units for force and mass.	Mistaking gravity as a force and not an acceleration. Confusing the terms mass and weight.		

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	Find the magnitude and direction of a vector form its components.	with acceleration **a** ms^{-2} is given by the equation $\boldsymbol{F} = m\boldsymbol{a}$ The resultant or net force is a single force that produces the same acceleration as several forces acting together, It is found by adding vectors representing the original forces. Some of most common forces include: driving force, braking force, friction, air resistance, tension, thrust and weight. The weight of an object is $W = mg$, where m is the object's mass and g is the gravitational acceleration. The mass of an object is fixed but it's weight depends on its location in the universe. An object is in equilibrium if the resultant force is zero. When working with force vectors, you consider the horizontal and vertical components separately.	To calculate a resultant force when several forces are acting on a particle using component notation- in all directions. To use the forces of trust and tension when a particle is being moved along a surface. To apply the force of weight to a model where a particle is suspended using the formula $F = ma$ To analyse whether a particle is in equilibrium in both vertical, horizontal situations and where components of both need to be taken.			
Teacher B Objects in Contact Textbook 1- Chapter 22 p506-535	Find a resultant force and use it in Newton's second law. How to calculate and use the weight of an object That a particle is in equilibrium when the resultant force is zero. How to sue the constant acceleration formulae.	Newton's 3rd Law: If object A exerts a force on object B, then object B exerts a force on object A, with the same magnitude but opposite direction. Whenever an object is in contact with a surface the surface exerts a normal reaction force on it. This force acts in the direction perpendicular to the surface and away from it. If two objects are connected by light, inextensible strings then 1) The tension is the same throughout the string. 2) The tension points away from the object 3) The two objects have equal acceleration 4) If the string passes a smooth pulley then the tension does not change.	How to apply Newton's 3rd law and represent this in diagrams. Calculate the contact force between two objects Find the tension in a string or rod connecting two objects Analyse the motion of particles connected by a string passing over a pulley.			

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		Learn that…	Learn how to…			
		If the string is replaced by a light rod, then the force can be a trust as well as a tension. The trust force is directed towards the object. Two connected objects move with the same acceleration and same speed. To find acceleration you can treat them as a single particle, but to find the normal reaction or tension force you need to consider each object separately.				