1701. Rearrange so as to take out a common factor of $\sin x$ on the RHS.

1702. Use a symmetry argument: consider the fact that $(a, \mathrm{g}(a))$ and $(b, \mathrm{g}(b))$ must be reflections in the line of symmetry of $y = \mathrm{g}(x)$.

1703. In each case, write the RHS as a single logarithm, then exponentiate to $y = ...$

1704. It is correct.

1705. (a) These are APs.
(b) c_n is the product of a_n and b_n.
(c) Using parts (a) and (b), set $c_n = 1000$.

1706. Set the numerator to zero and solve by factorising. You needn't worry about the denominator.

1707. (a) The point of tangency splits the side of the rhombus into two parts. Show that the two parts have lengths $\tan\theta$ and $\cot\theta$.
(b) Take the expression from (a) and equate it to 4, then multiply by $\tan\theta$.
(c) Solve the quadratic for $\tan\theta$.

1708. Consider the period of $\sin(2\pi x)$.

1709. In each case, split the integral up, writing it in terms of the definite integral whose value you know. What remains you can integrate directly.

1710. This is a quartic in 2^x. You might want to use the substitute $z = 2^x$.

1711. The rows and columns are, as far as the rook is concerned, symmetrical. So, the first rook can be placed anywhere, without loss of generality.

1712. Write $y = -\frac{1}{2^x}$ as $y = -2^{-x}$. A rotation can be expressed as the composition of two reflections.

1713. Set up $n^3 + (n+1)^3 + (n+2)^3$ and simplify with the binomial expansion. Use the factor theorem to prove the second result.

1714. Solve simultaneously and test the gradient.

1715. Call the lengths x and y. Differentiate both sides of $A = xy$ with respect to t, using the product rule. Then sub in the four values.

1716. This just needs a bit of a brute force. Substitute values and solve a set of three equations in a, b, c. To solve three equations in three unknowns, use two pairs to eliminate the same variable (c). Then solve two equations in two unknowns (a and b).

1717. Cubing preserves sign.

1718. To find the stationary value, first find the input x at which the stationary value occurs.

1719. Perform the same calculation twice, with $s_y = 0$ and $s_y = -1$.

1720. Four, five, six is more probable. Explain why, in terms of number of successful outcomes.

1721. Neither (a) nor (b) is necessarily true. The hard part here is explaining why (c) must be true for this particular set of data; you need to consider the locations of the various quartiles.

1722. (a) The curve has a stationary point of inflection; only one type of cubic has such a point.
(b) Use the fixed point information to set up an equation in c.

1723. Solve each factor separately. You are looking for four roots.

1724. If you find it easier, replace (p, q) with (x, y). Plot a quadratic, and show that it is always above a line.

1725. Draw a force diagram for the wood.

1726. Assume, for a contradiction, that every exterior angle of a hexagon satisfies $\beta > \frac{\pi}{3}$ radians.

1727. Show first that u_n itself is increasing. Then show algebraically that neither the differences nor the ratios are constant.

1728. Multiply up, and take care with minus signs. You might want to set $z = \sqrt{x}$ before you begin.

1729. Use the terms "sample" and "population".

1730. If in doubt, sketch graphs.

1731. Sketch the lines, determining which is parallel to which.

1732. The centre of rotation must be the midpoint of the vertices of the two graphs. Complete the square to use this fact.

1733. To prove this rigorously, let F and G be polynomial functions such that $\mathrm{F}'(x) = \mathrm{f}(x)$ and $\mathrm{G}'(x) = \mathrm{g}(x)$. Proceed algebraically from the integral identity. Once you've simplified the integrals, differentiate both sides.

1734. (a) Fixed points satisfy $\mathrm{g}(x) = x$.
   (b) Use the ANS button on a calculator.
   (c) Use the factor theorem.

1735. Solve the inequalities separately over $\mathbb{R}^+$. Then combine them over $\mathbb{N}$.

1736. Draw a tree diagram if you need it. Either way, you are visualising paths through a tree diagram.

1737. Find the space diagonal AB using 3D Pythagoras. Then use the cosine rule, or split $\triangle AMB$ into two right-angled triangles.

1738. (a) Consider the signs of the two factors, if they are to multiply to a non-positive number.
   (b) Test the origin.

1739. For both parts, find the sum of the interior angles of a pentagon, and consider the fact that an AP is symmetrical about its mean.

1740. Show that the range is given by

$$d = \frac{2u^2 \sin\theta \cos\theta}{g}.$$

Then consider scaling the value of the gravitational acceleration g by $\frac{1}{6}$.

1741. Start with a, matching the coefficient 12, then work your way down the terms.

— Alternative Method —

Rearrange to make x the subject, substitute and simplify.

1742. (a) Use symmetry.
   (b) And again!

1743. This can be done graphically, by considering the first statement as one about area, or algebraically, using $\mathrm{g}(y) = ay + b$.

1744. Use the factor theorem.

1745. (a) Split the triangle in half.
   (b) Rearrange the first equation to make a the subject, and substitute.
   (c) Use a polynomial solver.

1746. Multiply out before differentiating, or use the product rule.

1747. Consider the line of the form $y = x + k$ which passes through the point $(3, 2)$. Find out where this intersects the square.

1748. Use index laws.

1749. Draw the boundary lines first, and then consider the relevant inequalities.

1750. (a) Differentiate to show that $m = \pm 2k + 1$. Then use the formula $y - y_1 = m(x - x_1)$.
   (b) Set $x = 0$ in each tangent equation.

1751. Use the cosine rule, having chosen an angle β. This will give you one diagonal length. To find the other, use $\cos(180° - \beta) \equiv -\cos\beta$.

1752. (a) Consider the case $y = x^2$.
   (b) Consider a linear relationship $y = px + q$.

1753. (a) These concern the pulleys and the strings.
   (b) Consider the fact that the system, which is in equilibrium, has $a = 0$ throughout.
   (c) Resolve along the strings for the entire system.

1754. Integrate and use exact trig values.

1755. (a) ${}^n\mathrm{C}_r$ is the relevant tool.
   (b) Use ${}^n\mathrm{C}_2 = \frac{1}{2}n(n-1)$.

1756. Use the fact that the shortest path must be along a perpendicular to the line.

— Alternative Method —

Minimise the squared distance using calculus.

1757. Take natural logs of both sides, and use log laws.

1758. For a conditioning approach, place 1 first, without loss of generality. Then consider the placement of the number 2. Once the 1 and 2 are placed, there is only one successful outcome remaining.

— Alternative Method —

For a combinatorial approach, consider, out of a possibility space of 6!, the number of successful outcomes.

1759. There are many ways of finding the area. Perhaps easiest is to bound the quadrilateral in a rectangle whose sides are parallel to the x and y axes.

1760. (a) Draw a force diagram for the last instant at which the wheels are in contact with the ground. Consider both horizontal and vertical $F = ma$.
   (b) Use *suvat*.

1761. This is the infinite sum of a GP. Use $S_\infty = \dfrac{a}{1-r}$.

1762. Sketch the normal distribution.

1763. (a) $f(x)$ is the integral of $g(x)$.
   (b) Take the factor of $\frac{1}{3}$ out of the integral, and integrate term by term.

1764. Find the angle subtended at the centre, using the cosine rule. Then calculate the area of the sector and subtract the area of the triangle.

1765. (a) The mod calculates the magnitude.
   (b) Sketch two mod graphs.

1766. Rearrange to $y = \ldots$ and take out a factor of k. Then set the first derivative to zero and solve.

1767. (a) "Conditioned on rain/no rain" means that the first pair of branches are rain/no rain.
   (b) This is an absolute probability i.e. it is a non-conditional probability.
   (c) This is a conditional probability, so you need to restrict the possibility space.

1768. This equivalent to proving that $\sqrt{2}$ is an irrational number. Assume, for a contradiction, that (a, a, b) is a Pythagorean triple, such that $a^2 + a^2 = b^2$.

1769. Find the intersections of the curves, then set up a single definite integral with integrand $y_1 - y_2$.

1770. Parts (a) and (b) are the components of the total force in (c), which must counteract the weight.

1771. Since there are infinitely many points satisfying the equations, the two lines must be the same.

1772. You don't need to think about the ellipses here; determining the image of a single point is enough. You might want to consider $x^2 + 3y^2 = 1$ as a stepping stone between the two ellipses.

1773. Using the solution set, determine the boundary equation, in the form $3x^2 + px + q = 0$. Use the value of q to find $b - a$.

1774. (a) Enter the data and get a value more accurate than 2dp.
   (b) The hypotheses should both refer to ρ, which is the correlation coefficient in the population, not r, the correlation coefficient in the sample.
   (c) Remember not to be too sure.
   (d) Definitely not!

1775. Split the kite vertically, into two triangles. Then use the cyclic quadrilateral theorem, and the fact that $\sin(180° - \theta) \equiv \sin\theta$.

1776. Use the vector $\binom{3}{6}$ to calculate the gradient, then sub $(x_1, y_1) = (1, 5)$ into $y - y_1 = m(x - x_1)$.

1777. Find, in terms of a, the gradient $m_\pm$ at the generic points $(\pm a, 3a^2 \mp 5a + 2)$. Substituting these points into $y = m_\pm x + c_\pm$, find $c_\pm$ in terms of a. You need to show that the $c_\pm$ values for each tangent line are the same.

1778. The best way of dealing with inlaid fractions is to multiply top and bottom of the main fraction by the denominator(s) of the inlaid fractions.

1779. Use the $\mu \pm 2\sigma$ definition for outliers.
   Using a cumulative normal distribution, calculate the probability that any particular datum is not an outlier. Then find $\mathbb{P}(\text{at least one outlier})$ as being equal to $1 - \mathbb{P}(\text{no outliers})$.

1780. (a) Split the fraction up.
   (b) The two transformations are a stretch and a translation, both in the y direction.
   (c) Consider the effect of the transformations in (b) on the asymptotes of $y = 1/x$.

1781. This is a quadratic in 3^{-x}.

1782. Start with the LHS, and factorise.

1783. (a) Each diagram should have four forces.
   (b) Resolve horizontally for the combined sledge and load.
   (c) Consider the load alone.

1784. There are infinitely many to choose from! To find one, take the decimal expansions of the boundaries to e.g. 2dp, and convert them into fractions.

1785. The main indicator here is the number of pieces of information you are given.

1786. Both terms must be differentiated using the chain rule, as per implicit differentiation. Both x and y should be thought of as implicitly depending on t.

1787. Sketch the scenario carefully. Then consider the fourth line in the form $y = 2x + c$. Find c to make the lengths match.

1788. Find the area of the hexagon by subdividing it into equilateral triangles. Find the combined area of the six sectors by adding them to form a whole number of circles.

1789. Two of the answers are the same; the other can be written down immediately.

1790. Define x to be the side opposite $\arccos \frac{7}{8}$. Then calculate the other lengths in terms of x, using the sine rule. Equate the sum to 9 and solve.

1791. (a) Consider that $\mathbf{a}$ is a unit vector.
   (b) Solve simultaneously for $\mathbf{i}$ and $\mathbf{j}$.
   (c) Calculate the gradients.
   (d) The vectors $\mathbf{a}, \mathbf{b}$ are rotated versions of the vectors $\mathbf{i}, \mathbf{j}$.

1792. Put the fraction in its lowest terms before taking the limit.

1793. Since the population is large, the probability that any particular datum sampled from it lies between the quartiles is 50%.

1794. Use a difference of two squares twice on the LHS. Then look for common factors, considering the symmetry of four numbers in AP.

1795. The implications in (a) and (c) aren't true.

1796. Use the quadratic formula: consider its symmetry around $x = \frac{-b}{2a}$.

1797. Consider a truncated square.

1798. Consider any possible overlap at b.

1799. Visualise the possibility space as an $n \times 6$ rectangle.

1800. Find the common difference. Then find number of terms in the sequence, in terms of p. Then use the arithmetic partial sum formula.

——— End of 18th Hundred ———