Presentations01B

Consider the frustrum of a square based pyramid (a truncated pyramid) described as follows: A square based pyramid with base $b \times b$ is cut by a plane parallel to the base at a height h above the base and the planar cut is an $a \times a$ square. The region between this plane and the base is the truncated pyramid. The Egyptians knew that the volume of this solid is given by $$\frac{h}{3}(a^2 + ab + b^2)\,.$$ Show that this is correct; use the fact that the volume of a pyramid is one-third the area of the base times the height.	1
The Babylonian formula for the truncated pyramid of the above problem was: $$h\left[\left(\frac{a+b}{2}\right)^2 + \frac{1}{3}\left(\frac{a-b}{2}\right)^2\right].$$ Show that this is correct.	2
Suppose that m and n are positive integers with $n < m$ and : $$x = 2mn$$ $$y = m^2 - n^2$$ Find a value for z so that: $$x^2 + y^2 = z^2.$$ This gives us a way to find Pythagorean integral triples. This method for finding triples was apparently known to the Babylonians.	3
Look up Babylonian mathematics (e.g. Wiki) and explain the techniques used in some of the quadratic equations they were able to solve. What about cubic equations?	4
Show how to calculate the height of the pyramids using shadows. Thales supposedly did this.	5
Show how to calculate the distance of a ship from the shore using similar triangles. Thales supposedly did this.	6
Prove that vertical angles are congruent. (A theorem due to Thales.)	7
	8
Prove that an angle inscribed in a semi-circle is a right angle. (A theorem due to Thales.)	9
Give a simple proof of the Pythagorean theorem.	10
Find the formula for the n^{th} triangular number.	11
Find the formula for the n^{th} pentagonal number.	12

Show that the n^{th} square number is the sum of two triangular numbers.	13
Show that the sum of the angles of a triangle is 180^{o}.	14