SUMMER CALC OK HL1 *[55 marks]*

1a. Antonio and Barbara start work at the same company on the same day. *[3 marks]* They each earn an annual salary of 8000 euros during the first year of employment. The company gives them a salary increase following the completion of each year of employment. Antonio is paid using plan A and Barbara is paid using plan B.

Plan A: The annual salary increases by 450 euros each year.

Plan B: The annual salary increases by 5% each year.

Calculate

i)   Antonio's annual salary during his second year of employment;

ii)   Barbara's annual salary during her second year of employment.

1b. Both Antonio and Barbara plan to work at the company for a total of 15 *[7 marks]* years.

i)   Calculate the **total amount** that **Barbara** will be paid during these 15 years.

ii)   Determine whether Antonio earns more than Barbara during these 15 years.

The first three terms of a geometric sequence are $u_1 = 486, u_2 = 162, u_3 = 54$.

2a. Find the value of r, the common ratio of the sequence.   *[2 marks]*

2b. Find the value of n for which $u_n = 2$.   *[2 marks]*

2c. Find the sum of the first 30 terms of the sequence.   *[2 marks]*

Let $f(x) = \frac{3x}{x-q}$, where $x \neq q$.

3.   The vertical and horizontal asymptotes to the graph of f intersect at the *[6 marks]* point $Q(1, 3)$.

Hence find the coordinates of the points on the graph of f that are closest to $(1, 3)$.

A child's wooden toy consists of a hemisphere, of radius 9 cm , attached to a cone with the same base radius. O is the centre of the base of the cone and V is vertically above O.
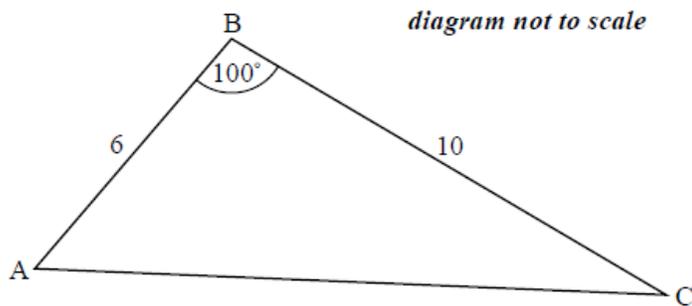
Angle OVB is $27.9°$.

Diagram not to scale.
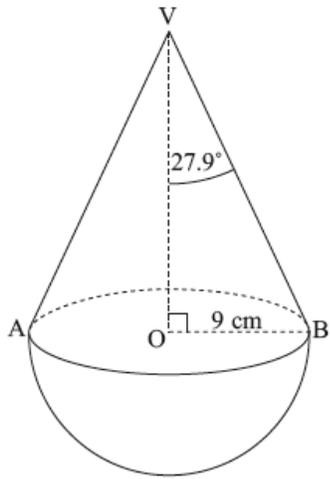
4a. Calculate OV, the height of the cone.   *[2 marks]*

4b. Calculate the volume of wood used to make the toy.   *[4 marks]*

The following diagram shows triangle ABC.

$AB = 6\,cm$, $BC = 10\,cm$, and $A\hat{B}C = 100°$.

5a. Find AC.   *[3 marks]*

5b. Find $B\hat{C}A$.   *[3 marks]*

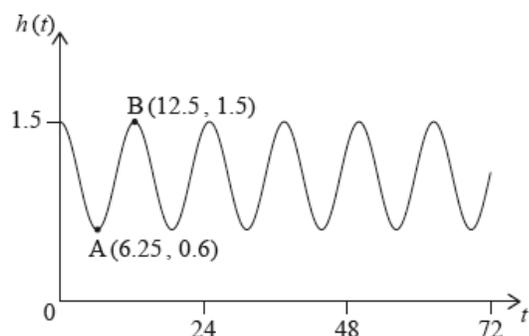Given that $\sin x = \frac{3}{4}$, where x is an obtuse angle,

6a. find the value of $\cos x$; [4 marks]

6b. find the value of $\cos 2x$. [3 marks]

At Grande Anse Beach the height of the water in metres is modelled by the function $h(t) = p\cos(q \times t) + r$, where t is the number of hours after 21:00 hours on 10 December 2017. The following diagram shows the graph of h , for $0 \leqslant t \leqslant 72$.

The point $A(6.25, 0.6)$ represents the first low tide and $B(12.5, 1.5)$ represents the next high tide.

7a. How much time is there between the first low tide and the next high tide? [2 marks]

7b. Find the difference in height between low tide and high tide. [2 marks]

7c. Find the value of p; [2 marks]

7d. Find the value of q; [3 marks]

7e. Find the value of r. [2 marks]

7f. There are two high tides on 12 December 2017. At what time does the second high tide occur? [3 marks]