

Math SL PROBLEM SET 41

Section A (Short Answer)

1. **(C6.1 - N) (CA)** Evaluate the following limits (for all you IB 6/7 students, if possible, explain what is happening and why with these limits)

a. (i) $\lim_{x \rightarrow 1} (x + 1)$

(ii) $\lim_{x \rightarrow 1} \left(\frac{x^2 - 1}{x - 1} \right)$

b. (i) $\lim_{x \rightarrow -2} (x - 3)$

(ii) $\lim_{x \rightarrow -2} \left(\frac{x^2 - x - 6}{x + 2} \right)$

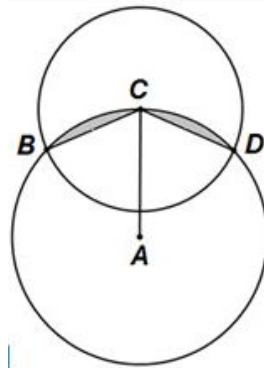
(iii) $\lim_{x \rightarrow 1} \left(\frac{x^2 - x - 6}{x + 2} \right)$

2. **(F2.4, C6.3 - R,N) (CI)** Find the extrema of the following functions and if possible, classify the extrema as maximums or minimums. Include your reasoning for classifying the extrema in each case. **(Cirrito 19.2.1, p609)**

a. $f(x) = x^2 - 2x + 3$

b. $g(x) = -\frac{2}{3}x^3 + x^2 + 12x - 1$

3. **(T3.1 - N) (CA)** The diagram shows two intersecting circles that have radii of 5 cm and 4 cm. The center, C , of the smaller circle lies on the circumference of the larger circle. The center of the larger circle is A and the two circles intersect at points B and D . Find the area of the shaded region. **(Cirrito 9.7.3, p311)**



4. **(T3.6 - E) (CA)** A small plane is flying due east at a constant altitude of 3 km and a constant speed of 120 km/hr. It is approaching a small control tower that lies to the South of the plane's path. At time t_0 the plane is on a bearing of 300° from the tower and elevated at 4.5° . How long does it take for the plane to be due North of the tower and what is its angle of elevation from the tower at this time? **(Cirrito 9.6, p308)**

5. **(V4.2 - N) (CA)** Given the lines $L_1: \mathbf{r}_1 = (-1, 3, 1) + \lambda(4, 1, 0)$ and $L_2: \mathbf{r}_2 = (-13, 1, 2) + \mu(12, 6, 3)$, find: **(Cirrito 12.6.1, p432)**

- a. their intersection point (if applicable);
b. the angle between these two lines.

6. **(A1.2 - N) (CA)** If $\log_B(M) = 5.42$ and $\log_B(N^2) = 3.78$, find the following: **(Cirrito 7.4, p219)**

a. $\log_B(\sqrt[3]{N})$

b. $\log_B\left(\frac{N^4}{\sqrt{M}}\right)$

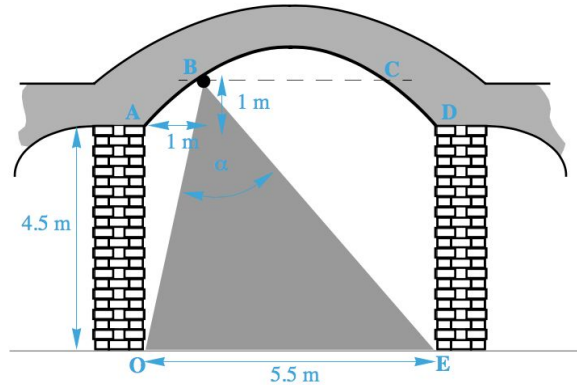
c. $\log_M(N)$

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Section B (Extended Response/Investigation)

7. **(F2.8, T3.6 - R) (CA)** An archway is constructed as shown in the attached diagram. A light source is located at B as shown. The archway can be modelled by a parabolic curve. **(Cirrito 3.1.3, p78)**

- Using O as the origin, determine the quadratic equation that produces a parabolic curve to pass through the points A , B , C and D .
- Find equations of the straight lines that form the “edges” of the light beams
(i) OB and (ii) BE
- Find the “tilting angle”, α , so that the light from B can spread from O to E , where the pillars meet the floor.



8. **(C6.3, C6.6 - N) (CI)** From the following distance-time graph, answer the following questions:

- Find the position of the red car as well as the black car at $t = 2$ sec.
- Find the position of the red car as well as the black car at $t = 6$ sec.
- Find the average rate of change of distance (speed) of each car between $t = 2$ s and $t = 6$ s.
- Find the instantaneous rate of change of distance (speed) each car at $t = 6$ s.

