

# Math SL PROBLEM SET 21

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## Section A (Short Answer)

1. **(F2.1, F2.4 - R) (CI)** For the following quadratic functions, (i) factor the equation and (ii) then hence or otherwise determine the minimum/maximum value of the quadratic function. *(Cirrito 2.4.2, p44)*

a.  $f(x) = 3x^2 + 11x - 4$

b.  $g(x) = -4x^2 + 9x - 2$

2. **(A1.2 - E) (CI)** Write each expression as the logarithm of a single quantity: *(Cirrito 7.4, p221)*

a.  $\log(6) + \log(x)$

b.  $\log_3(M) + \log_3(N) - 2\log_3(P)$

c.  $\log_b 12 - \frac{1}{2} \log_b(9)$

3. **(A1.2, F 2.6 - R) (CI)** For each pair of functions, state their domains and ranges and then determine the equation for  $(f \circ g)(x)$  and also the equation for  $(g \circ f)(x)$ . *(Cirrito 2.4.2 p44; 5.3.3, p131; C5.3.4, p138)*

a.  $f(x) = \sqrt{x-1}$  and  $g(x) = 1 + 2x^2$

b.  $f(x) = e^x - 1$  and  $g(x) = 2\ln(x+1)$

4. **(A1.2, F 2.6 - R) (CI)** For the following functions, determine the equation(s) of the asymptotes as well as the  $x$ - and  $y$ -intercept(s) and then sketch the functions. State the transformations that have been applied to the “parent” function for each question. *(Cirrito 5.3.3, p131; Cirrito 5.3.4, p138)*

a.  $y(x) = -\ln(x + 4)$

b.  $y(x) = -e^{-x} + 2$

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5. **(SP5.1, SP5.2, SP5.3 - R) (CA)** A survey is carried out to find the waiting times for 100 customers at a supermarket. The results are summarized in the table below: *(Oxford 8.5, p171; Cirrito 13.5, p482)*

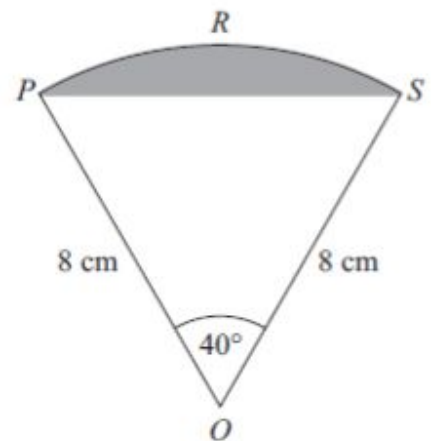
Waiting Time (sec)	0 - 20	20 - 40	40 - 60	60 - 80	80 - 100	100 - 120	120 - 140	140 - 160
Number of customers	5	15	33	21	11	7	5	2

- Calculate an estimate for the mean waiting time
  - Estimate the value of the standard deviation as well as the variance of the waiting time.
  - Draw a cumulative frequency graph (CFG) using graph paper
  - Use the CFG to estimate the interquartile range.
6. **(T3.2, T3.5 - E) (CI)** For the following trigonometric equations, start by (i) drawing the two special right triangles and (ii) drawing one cycle of a sine and a cosine curve and labeling the five critical points on each graph. *(Cirrito 10.4, p351)*
- Solve  $\sqrt{2} \cos(x) - 1 = 0$  on the domain of  $-2\pi \leq x \leq 2\pi$
  - Solve  $2\cos^2(x) - \cos(x) - 1 = 0$  on the domain of  $0 \leq x \leq 720^\circ$

7. **(T3.1 - N) (CA)** The diagram shows a sector of a circle with centre O. The radius of the circle is 8 cm. PRS is an arc of the circle. PS is a chord of the circle. Angle POS =  $40^\circ$ .

Calculate the: *(Cirrito 9.4, p 287; Cirrito 9.7, p309)*

- perimeter of the sector
- area of the shaded section



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## Section B (Extended Response/Investigation)

8. **(A1.2 - E) (CI)** To find the solutions for the following equations, the use of logarithms is required, either in isolating exponents or in requiring the use of the laws of logarithms. *(Cirrito 7.4, p219)*
- Solve  $2 = e^{0.075x}$
  - Solve  $3^{x-4} = 24$
  - $\log_3(2x - 5) = 2$
  - $\log_2(x) + \log_2(10 - x) = 4$
  - $\ln(x - 2) + \ln(2x - 3) = 2\ln(x)$
9. **(T3.4 - R) (CI)** The number of empty bird nests in a park is approximated by the sinusoidal model  $N(t) = 74 + 42\sin\left(\frac{\pi}{12}t\right)$ , where  $t$  is the number of hours after midnight. *(Cirrito 10.5, p361)*
- Determine the equation of the sinusoidal axis (axis of the curve) and explain its meaning in the context of this problem.
  - Determine the period of the function.
  - Given the domain of two days, determine the maximum and minimum number of empty bird nests and at what times these occur.
  - At what times of the day is the number of bird nests equal to 95?
  - Sketch a graph of the function, labeling the maximum(s) and minimum(s)