

Math SL PROBLEM SET 29

Section A (Short Answer)

1. **(T3.4 - R) (CI & CA)** The depth, $d(t)$ meters, of water at the entrance of a harbour at t hours after midnight on a particular day is given by $d(t) = 12 + 3\sin\left(\frac{\pi}{6}t\right)$, $0 \leq t \leq 24$. **(Cirrito 10.5, p364)**

- a. (CI) Sketch a graph of $y = d(t)$ for $0 \leq t \leq 24$
b. (CI) for what value(s) of t will

i. $d(t) = 10.5$, for $0 \leq t \leq 24$.

ii. $d(t) \geq 10.5$, for $0 \leq t \leq 24$.

Boats requiring a minimum depth of K meters are only permitted to enter the harbour when the depth of water is at least $K + 0.5$ meters for a continuous period of one hour.

- c. (CA) Find the largest value K , correct to 2 decimal places which satisfies the given condition.

2. **(A1.2, F2.6, F2.7 - R) (CA & CI)** Solve the following exponential equations. Present BOTH exact (hence CI) and approximate solutions (hence CA). **(Cirrito p226, Ex 7.22)**

a. $2^{x+1} = 3^{x-1}$

b. $6^{\frac{x}{2}} = 5^{1-x}$

3. **(T3.5 - E) (CI)** Solve the following equations: **(Cirrito 10.4, p351)**

a. $\tan\left(x - \frac{\pi}{6}\right) = -\frac{1}{\sqrt{3}}$ on the domain of $-2\pi \leq x \leq 2\pi$.

b. $\sin(2x) - \cos(2x) = 0$ on the domain of $-2\pi \leq x \leq 2\pi$.

4. **(A1.1 - R) (CA)** The fourth and seventh terms of a geometric sequence are 18 and $\frac{729}{8}$ respectively. **(Cirrito 8.2.2, p257)**

a. Is $\frac{59049}{128}$ a term of this sequence? If so, which term is it?

b. If these terms were part of a infinite series, what would the sum of this infinite series be?

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5. **(C6.1 - N) (CA)** For the following functions, determine the value of $f(2)$ as well as determining an expression for $f(2 + h)$, then use these values to determine the value of the difference quotient $\frac{f(2+h)-f(2)}{(2+h)-(2)}$: **(Cirrito 18.3, p592)**
- The function $f(x) = 2x + 5$.
 - The function $f(x) = x^2 - 3x$
 - The function $f(x) = x^3 - x + 3$
6. **(T3.4 - R,N) (CI)** Sketch a graph of the following trigonometric functions and label all extrema and intercepts and if necessary all asymptotes on two periods of a positive domain: **(Cirrito 16.3.2, p341)**
- The function $g(x) = -2\cos(3x) + 2$
 - The function $h(x) = \tan\left(\frac{1}{2}\left(x - \frac{\pi}{3}\right)\right)$

Section B (Extended Response/Investigation)

7. **(V4.3 - N) (CI)** Find the vector equation of the line passing through the points A and B. Express your equations in vector form, parametric form and Cartesian form as well as slope-intercept (linear functions form) **(Cirrito 12.7.1, p447)**
- A(2,3) and B(4,8)
 - A(4,-3) and B(-1,-2)
8. **(V4.3 - N) (CI)** Find the vector equation of the line passing through the points A and B. Express your equations in vector form, parametric form and Cartesian form. **(Cirrito 12.7.1, p447)**
- A(2,3,5) and B(-1,4,8)
 - A(-2,4,-3) and B(-1,0,-2)