

HL Paper 1

Revision Village Prediction Exam for IB Maths Higher Level (HL) – May 2018



Q1

[Maximum mark: 4]




Solve the equation $\log_3 x - \log_3 5 = 3 + \log_3 4$ for x .

Difficulty: Easy

[Mark Scheme](#)

[Video Solution](#)

Q2

[Maximum mark: 6] 


Find the Cartesian equation of the plane Π containing the points $A(3, -1, 3)$ and $B(4, 1, -1)$ and perpendicular to the plane $2x - 5y + z = 10$.

Difficulty: Medium

[Mark Scheme](#)

[Video Solution](#)

Q3

[Maximum mark: 5] 


In the expansion of $x(2x + 1)^n$, the coefficient of the term in x^3 is $20n$, where $n \in \mathbb{Z}^+$. Find n .

Difficulty: Hard

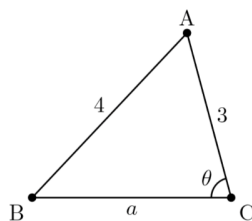
[Mark Scheme](#)

[Video Solution](#)

Q4

[Maximum mark: 6] 

- (a) Find the set of values of h that satisfy the inequality $2h^2 - 3h - 14 > 0$. [2]
- (b) The triangle ABC is shown in the following diagram. Given that $\cos \theta > 0.25$, find the range of possible values of a . [4]




Difficulty: Medium

Mark Scheme

(a) [Video Solution](#)

(b) [Video Solution](#)

Q5

[Maximum mark: 5] 


A particle moves in a straight line such that at time t seconds ($t \geq 0$), its velocity is given by $v = 18t^3e^{-3t^2}$. Find the exact distance travelled by the particle in the first two seconds.

Difficulty: Hard

[Mark Scheme](#)

[Video Solution](#)

Q6

[Maximum mark: 8] 

- (a) Sketch the curve $y = -\left|\frac{5}{x-2}\right|$ and line $y = -x - 4$ on the same axes, clearly indicating any x and y intercepts and any asymptotes. [3]
- (b) Find the exact solutions to the equation $x + 4 = \left|\frac{5}{x-2}\right|$. [5]


Difficulty: Hard

[Mark Scheme](#)

[\(a\) Video Solution](#)

[\(b\) Video Solution](#)

Q7

[Maximum mark: 7] 

The curve C is defined by the equation $x^2y + \ln(xy) = 1$, $x > 0$, $y > 0$.

- (a) Find $\frac{dy}{dx}$ in terms of x and y . [4]
- (b) Determine the equation of the tangent to C at the point $(1, 1)$. [3]


Difficulty: Medium

[Mark Scheme](#)

[\(a\) Video Solution](#)

[\(b\) Video Solution](#)

Q8

[Maximum mark: 7] 

(a) Using the substitution $x = \cot \theta$, show that $\int_0^1 \frac{1}{(x^2 + 1)^2} dx = \int_{\frac{\pi}{4}}^{\frac{\pi}{2}} \sin^2 \theta d\theta$. [4]

(b) Hence find the value of $\int_0^1 \frac{1}{(x^2 + 1)^2} dx$. [3]

Difficulty: Medium

Mark Scheme

(a) Video Solution

(b) Video Solution

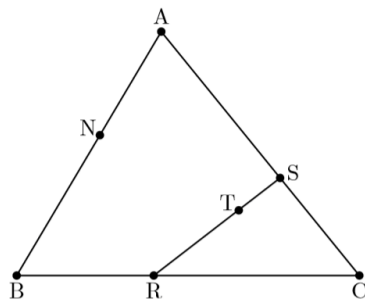
Q9

[Maximum mark: 14]



The position vectors of the points A, B and C are \mathbf{a} , \mathbf{b} and \mathbf{c} , respectively, relative to the origin O.

The following diagram shows the triangle ABC and points N, R, S and T.



N is a point on AB such that $\overrightarrow{AN} = \frac{3}{7} \overrightarrow{AB}$.

R is a point on BC such that $\overrightarrow{BR} = \frac{2}{5} \overrightarrow{BC}$.

S is a point on CA such that $\overrightarrow{CS} = \frac{2}{5} \overrightarrow{CA}$.

T is a point on RS such that $\overrightarrow{RT} = \frac{2}{3} \overrightarrow{RS}$.

(a) (i) Express \overrightarrow{AN} in terms of \mathbf{a} and \mathbf{b} .

(ii) Hence show that $\overrightarrow{CN} = \frac{4}{7} \mathbf{a} + \frac{3}{7} \mathbf{b} - \mathbf{c}$. [4]

(b) (i) Express \overrightarrow{RC} in terms of \mathbf{b} and \mathbf{c} and \overrightarrow{CS} in terms of \mathbf{a} and \mathbf{c} .

(ii) Hence show that $\overrightarrow{RT} = \frac{4}{15} \mathbf{a} - \frac{6}{15} \mathbf{b} + \frac{2}{15} \mathbf{c}$ [5]

(c) Prove that T lies on CN. [5]

Difficulty: Hard


Mark Scheme

(a) Video Solution

(b) Video Solution

(c) Video Solution

Q10

[Maximum mark: 21] 

Let $f(x) = (x - 1)e^{x/3}$, $x \in \mathbb{R}$.

- (a) Find $f'(x)$. [2]
- (b) Prove by induction that $\frac{d^n f}{dx^n} = \left(\frac{3n + x - 1}{3^n}\right) e^{x/3}$ for $n \in \mathbb{Z}^+$. [7]
- (c) Find the coordinates of any local maximum and minimum points on the graph of $y = f(x)$. Justify whether such point is a maximum or a minimum [5]
- (d) Find the coordinates of any points of inflexion on the graph of $y = f(x)$. Justify whether such point is a point of inflexion. [5]
- (e) Hence sketch the graph of $y = f(x)$, indicating clearly the points found in parts (c) and (d) and any intercepts with the axes. [2]

Difficulty: Hard

Mark Scheme

(a) [Video Solution](#)


(b) [Video Solution](#)

(c) [Video Solution](#)

(d) [Video Solution](#)

(e) [Video Solution](#)

Q11

[Maximum mark: 22] 

(a) Solve $2 \sin(x + 120^\circ) = \sqrt{3} \cos(x + 60^\circ)$ for $x \in [0, 180^\circ]$. [5]

(b) Show that $\sin 75^\circ + \cos 75^\circ = \frac{\sqrt{6}}{2}$. [3]

(c) Let $z = \sin 4\theta + i(1 - \cos 4\theta)$, $z \in \mathbb{C}$, $\theta \in [0, 90^\circ]$.

(i) Find the modulus and argument of z in terms of θ .

(ii) Hence find the fourth roots of z in modulus-argument form. [14]

Difficulty: Hard

Mark Scheme

[\(a\) Video Solution](#)

[\(b\) Video Solution](#)

[\(c\) Video Solution](#)

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