

Standard form, exponents and logarithms

12 questions · 71 marks

Answer all questions. The marks available are shown against each part. Every question is taken unaltered from a past paper; the source is noted beneath it. Some questions are taken from higher level papers, where they examine the same standard level content.

1.

[Maximum mark: 4]

4 marks

The diameter of a spherical planet is $6 \times 10^4 \text{ km}$.

(a) Write down the radius of the planet.

[1]

The volume of the planet can be expressed in the form $\pi(a \times 10^k) \text{ km}^3$ where $1 \leq a < 10$ and $k \in \mathbb{Z}$.

(b) Find the value of a and the value of k .

[3]

— IB 2221 - 7109 Maths AA · May 2021 Paper 1 TZ1 SL, Question 2

[illegible]

2.

[Maximum mark: 5]

5 marks

Solve the equation $\log_3 \sqrt{x} = \frac{1}{2\log_2 3} + \log_3(4x^3)$, where $x > 0$.

— IB 8821 – 7101 Maths AA · November 2021 Paper 1 HL, Question 3

3.

[Maximum mark: 5]

5 marks

Write each of the following expressions in the form $\ln k$, where $k \in \mathbb{Z}^+$.

(a) $\ln 3 + \ln 4$ [1]

(b) $3 \ln 2$ [2]

(c) $-\ln \frac{1}{2}$ [2]

— IB 2225 – 7109 Maths AA · May 2025 Paper 1 TZ1 SL, Question 1

4.

5 marks

[Maximum mark: 5]

It is given that $\log_{10} a = \frac{1}{3}$, where $a > 0$.

Find the value of

(a) $\log_{10} \left(\frac{1}{a} \right);$ [2]

(b) $\log_{1000} a.$ [3]

— IB 2224 – 7104 Maths AA · May 2024 Paper 1 TZ1 SL, Question 3

5.

5 marks

[Maximum mark: 5]

Let $\log_{10} 2 = p$ and $\log_{10} 3 = q$.

(a) Find an expression for $\log_{10} 24$ in terms of p and q . [3]

(b) Find an expression for $\log_3 8$ in terms of p and q . [2]

— IB 2225 – 7119 Maths AA · May 2025 Paper 1 TZ3 SL, Question 2

6.

5 marks

[Maximum mark: 5]

It is given that $\log_{10} a = \frac{1}{3}$, where $a > 0$.

Find the value of

(a) $\log_{10} \left(\frac{1}{a} \right);$ [2]

(b) $\log_{1000} a.$ [3]

— IB 2224 – 7101 Maths AA · May 2024 Paper 1 TZ1 HL, Question 2

7.

5 marks

[Maximum mark: 5]

Let $\log_{10} 2 = p$ and $\log_{10} 3 = q$.

(a) Find an expression for $\log_{10} 24$ in terms of p and q . [3]

(b) Find an expression for $\log_3 8$ in terms of p and q . [2]

— IB 2225 – 7116 Maths AA · May 2025 Paper 1 TZ3 HL, Question 1

8.

[Maximum mark: 5]

5 marks

(a) Solve $3m^2 + 5m - 2 = 0$. [3]

(b) Hence or otherwise, solve $3 \times 9^x + 5 \times 3^x - 2 = 0$. [2]

— IB 2224 – 7109 Maths AA · May 2024 Paper 1 TZ2 SL, Question 3

9.

[Maximum mark: 5]

5 marks

Solve $3 \times 9^x + 5 \times 3^x - 2 = 0$.

— IB 2224 – 7106 Maths AA · May 2024 Paper 1 TZ2 HL, Question 2

10.

6 marks

[Maximum mark: 6]

The loudness of a sound, L , measured in decibels, is related to its intensity, I units, by $L = 10 \log_{10}(I \times 10^{12})$.

Consider two sounds, S_1 and S_2 .

S_1 has an intensity of 10^{-6} units and a loudness of 60 decibels.

S_2 has an intensity that is twice that of S_1 .

(a) State the intensity of S_2 . [1]

(b) Determine the loudness of S_2 . [2]

The maximum loudness of thunder in a thunderstorm was measured to be 115 decibels.

(c) Find the corresponding intensity, I , of the thunder. [3]

— IB 2224 – 7110 Maths AA · May 2024 Paper 2 TZ2 SL, Question 4

11.

6 marks

[Maximum mark: 6]

The loudness of a sound, L , measured in decibels, is related to its intensity, I units, by $L = 10 \log_{10}(I \times 10^{12})$.

Consider two sounds, S_1 and S_2 .

S_1 has an intensity of 10^{-6} units and a loudness of 60 decibels.

S_2 has an intensity that is twice that of S_1 .

(a) State the intensity of S_2 . [1]

(b) Determine the loudness of S_2 . [2]

The maximum loudness of thunder in a thunderstorm was measured to be 115 decibels.

(c) Find the corresponding intensity, I , of the thunder. [3]

— IB 2224 – 7107 Maths AA · May 2024 Paper 2 TZ2 HL, Question 3

[illegible]

12.

[Maximum mark: 15]

15 marks

Consider the function $f(x) = a^x$ where $x, a \in \mathbb{R}$ and $x > 0, a > 1$.

The graph of f contains the point $\left(\frac{2}{3}, 4\right)$.

- (a) Show that $a = 8$. [2]
- (b) Write down an expression for $f^{-1}(x)$. [1]
- (c) Find the value of $f^{-1}(\sqrt{32})$. [3]
- (d) Consider the arithmetic sequence $\log_8 27, \log_8 p, \log_8 q, \log_8 125$, where $p > 1$ and $q > 1$.
- (i) Show that $27, p, q$ and 125 are four consecutive terms in a geometric sequence.
- (ii) Find the value of p and the value of q . [9]

— IB 8821 – 7104 Maths AA · November 2021 Paper 1 SL, Question 8

[illegible]