EXAM PAPERS PRACTICE

Helping you Achieve Highest Grades in IB

IB Mathematics (Applications and Interpretations) Standard Level (SL)

Question Paper

Fully in-lined with the First Assessment
Examinations in 2021 & Beyond

Paper: 1 (All Topics)

- **Topic 1 - Number and Algebra**
- **Topic 2 - Functions**
- **Topic 3 - Geometry and Trigonometry**
- **Topic 4 - Statistics and Probability**
- **Topic 5 - Calculus**

Marks: 187

Total Marks: / 187

Suitable for SL Students sitting the 2025 exams onwards
However, HL students may also find these resources useful

Questions

EXM.1.SL.TZ0.1

Give your answers to this question correct to two decimal places.

Gen invests $2400 in a savings account that pays interest at a rate of 4% per year, compounded annually. She leaves the money in her account for 10 years, and she does not invest or withdraw any money during this time.

a. Calculate the value of her savings after 10 years. [2]

b. The rate of inflation during this 10 year period is 1.5% per year.

Calculate the real value of her savings after 10 years. [3]

EXM.1.SL.TZ0.2

Kayla wants to measure the extent to which two judges in a gymnastics competition are in agreement. Each judge has ranked the seven competitors, as shown in the table, where 1 is the highest ranking and 7 is the lowest.

Competitor	A	B	C	D	E	F	G
Judge 1	1	2	3	3	5	6	6
Judge 2	2	3	1	4	5	5	7

a. Calculate Spearman's rank correlation coefficient for this data. [5]

b. State what conclusion Kayla can make from the answer in part (a). [1]

EXM.1.SL.TZ0.4

The diagram below is part of a Voronoi diagram.

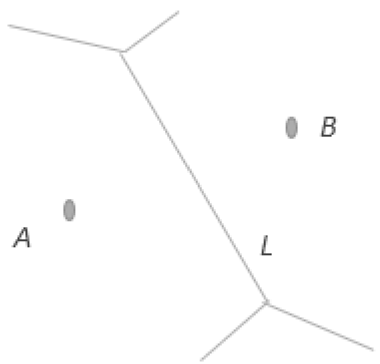


Diagram not to scale

A and B are sites with B having the co-ordinates of (4, 6). L is an edge; the equation of this perpendicular bisector of the line segment from A to B is $y = -2x + 9$

Find the co-ordinates of the point A.

18M.1.SL.TZ2.T_4

The following table shows four different sets of numbers: N, Z, Q and R.

Set	Example of a number in the set
$\mathbb{N}$	
$\mathbb{Z}$	
$\mathbb{Q}$	
$\mathbb{R}$	

a.

Complete the second column of the table by giving **one** example of a number from each set.

[4]

b. Josh states: "Every integer is a natural number".

Write down whether Josh's statement is correct. Justify your answer. [2]

16N.1.SL.TZ0.T_1

Let $p = \frac{\cos x + \sin y}{\sqrt{w^2 - z}}$,

where $x = 36°$, $y = 18°$, $w = 29$ and $z = 21.8$.

Write your answer to **part (b)(ii)** in the form $a \times 10^k$, where $1 \leqslant a < 10$, $k \in Z$.

17N.1.SL.TZ0.S_2

In an arithmetic sequence, the first term is 8 and the second term is 5.

a. Find the common difference. [2]

b. Find the tenth term. [2]

c. Find the sum of the first ten terms. [2]

17M.1.SL.TZ1.S_7

The first three terms of a geometric sequence are $\ln x^{16}$, $\ln x^{8}$, $\ln x^{4}$, for $x > 0$.

Find the common ratio.

18M.1.SL.TZ2.S_7

An arithmetic sequence has $u_1 = \log_c(p)$ and $u_2 = \log_c(pq)$, where $c > 1$ and $p, q > 0$.

Let $p = c^2$ and $q = c^3$. Find the value of $\sum_{n=1}^{20} u_n$.

18N.1.SL.TZ0.S_3

In an arithmetic sequence, $u_1 = -5$ and $d = 3$.

Find u_8.

17N.1.SL.TZ0.S_5

Let $f(x) = 1 + e^{-x}$ and $g(x) = 2x + b$, for $x \in R$, where b is a constant.

a. Find $(g \circ f)(x)$. [2]

b. Given that $\lim_{x \to +\infty} (g \circ f)(x) = -3$, find the value of b. [4]

18M.1.SL.TZ2.S_6

Let $f(x) = px^2 + qx - 4p$, where $p \neq 0$. Find Find the number of roots for the equation $f(x) = 0$.

Justify your answer.

16N.1.SL.TZ0.S_1

Let $f(x) = x^2 - 4x + 5$.

The function can also be expressed in the form $f(x) = (x - h)^2 + k$.

a. Find the equation of the axis of symmetry of the graph of f. [2]

b. (i) Write down the value of h. (ii) Find the value of k. [4]

17N.1.SL.TZ0.T_11

A quadratic function f is given by $f(x) = ax^2 + bx + c$. The points $(0,\ 5)$ and $(-4,\ 5)$ lie on the graph of $y = f(x)$.

The y-coordinate of the minimum of the graph is 3.

Find the value of a and of b.

18M.1.SL.TZ2.T_14

Consider the function $f(x) = \frac{x^4}{4}$.

a. Find $f'(x)$ [1]

b. Find the gradient of the graph of f at $x = -\frac{1}{2}$. [2]

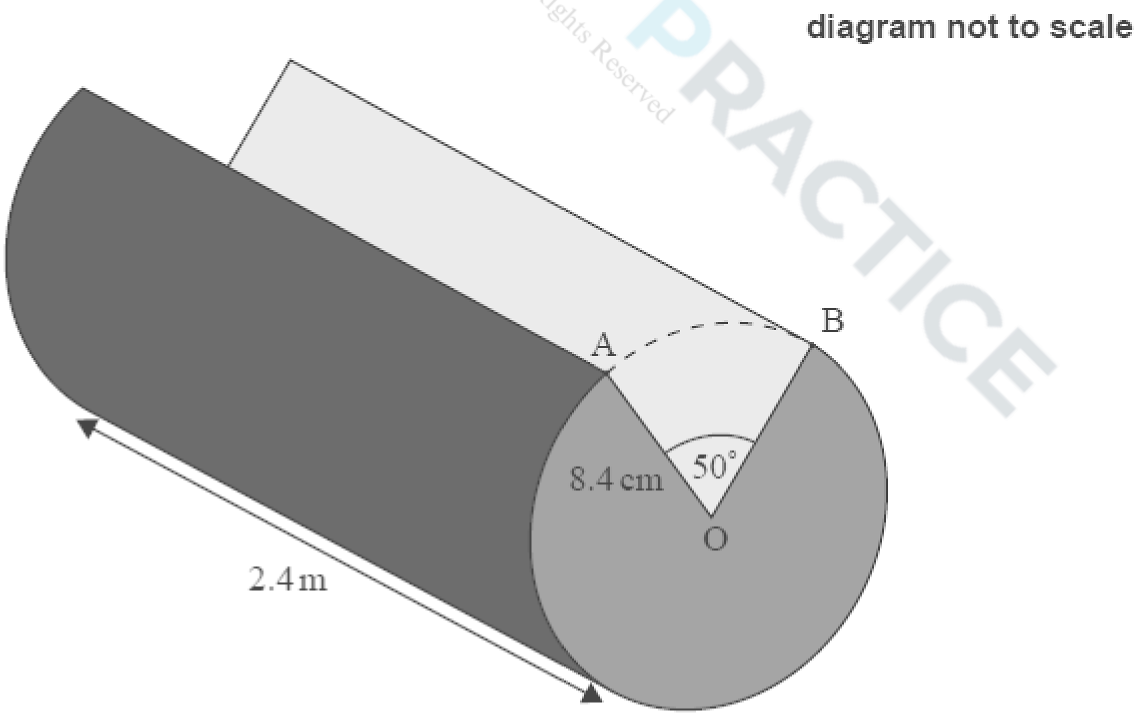
c.

Find the x-coordinate of the point at which the **normal** to the graph of f has gradient $-\frac{1}{8}$.

[3]

SPM.1.SL.TZ0.11

Helen is building a cabin using cylindrical logs of length 2.4 m and radius 8.4 cm. A wedge is cut from one log and the cross-section of this log is illustrated in the following diagram.



Find the volume of this log.

19M.1.SL.TZ1.S_6

The magnitudes of two vectors, $\boldsymbol{u}$ and $\boldsymbol{v}$, are 4 and $\sqrt{3}$ respectively. The angle between $\boldsymbol{u}$ and $\boldsymbol{v}$ is $\frac{\pi}{6}$.

Let $\boldsymbol{w} = \boldsymbol{u} - \boldsymbol{v}$. Find the magnitude of $\boldsymbol{w}$.

17N.1.SL.TZ0.T_3

The speed of light is 300000 kilometres per second. The average distance from the Sun to the Earth is 149.6 million km.

Calculate the time, **in minutes**, it takes for light from the Sun to reach the Earth.

16N.1.SL.TZ0.S_5

Events A and B are independent with $\mathrm{P}(A \cap B) = 0.2$ and $\mathrm{P}(A' \cap B) = 0.6$.

a. Find $\mathrm{P}(B)$. [2]

b. Find $\mathrm{P}(A \cup B)$. [4]

19M.1.SL.TZ1.S_2

A line, L_1, has equation $r = \begin{pmatrix} -3 \\ 9 \\ 10 \end{pmatrix} + s\begin{pmatrix} 6 \\ 0 \\ 2 \end{pmatrix}$. Point $\mathrm{P}(15, 9, c)$ lies on L_1.

a. Find c. [4]

b. A second line, L_2, is parallel to L_1 and passes through (1, 2, 3).

Write down a vector equation for L_2. [2]

16N.1.SL.TZ0.S_4

The position vectors of points P and Q are $\boldsymbol{i} + 2\boldsymbol{j} - \boldsymbol{k}$ and $7\boldsymbol{i} + 3\boldsymbol{j} - 4\boldsymbol{k}$ respectively.

a. Find a vector equation of the line that passes through P and Q. [4]

b.

The line through P and Q is perpendicular to the vector $2\boldsymbol{i} + n\boldsymbol{k}$. Find the value of n.

[3]

19M.1.SL.TZ2.S_2

Consider the vectors $\boldsymbol{a} = \begin{pmatrix} 0 \\ 3 \\ p \end{pmatrix}$ and $\boldsymbol{b} = \begin{pmatrix} 0 \\ 6 \\ 18 \end{pmatrix}$.

Find the value of p for which ***a*** and ***b*** are

a. parallel. [2]

b. perpendicular. [4]

17M.1.SL.TZ2.S_6

The values of the functions f and g and their derivatives for $x = 1$ and $x = 8$ are shown in the following table.

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
1	2	4	9	–3
8	4	–3	2	5

Let $h(x) = f(x)g(x)$.

a. Find $h(1)$. [2]

b. Find $h'(8)$. [3]

17N.1.SL.TZ0.S_7

Consider $f(x) = \log k(6x - 3x^2)$, for $0 < x < 2$, where $k > 0$.

The equation $f(x) = 2$ has exactly one solution. Find the value of k.

18M.1.SL.TZ2.T_11

Consider the graph of the function $f(x) = \frac{3}{x} - 2, x \neq 0$.

a. Write down the equation of the vertical asymptote. [2]

b. Write down the equation of the horizontal asymptote. [2]

c. Calculate the value of x for which $f(x) = 0$. [2]

17N.1.SL.TZ0.T_14

A function f is given by $f(x) = 4x^3 + \frac{3}{x^2} - 3,\ x \neq 0$.

a. Write down the derivative of f. [3]

b.

Find the point on the graph of f at which the gradient of the tangent is equal to 6.

[3]

17M.1.SL.TZ2.S_5

Let $f'(x) = \frac{3x^2}{(x^3+1)^5}$. Given that $f(0) = 1$, find $f(x)$.

16N.1.SL.TZ0.S_6

Let $f'(x) = \sin^3(2x)\cos(2x)$. Find $f(x)$, given that $f\left(\frac{\pi}{4}\right) = 1$.

19M.1.SL.TZ1.S_5

The derivative of a function f is given by $f'(x) = 2e^{-3x}$. The graph of f passes through $\left(\frac{1}{3}, 5\right)$.

Find $f(x)$.

16N.1.SL.TZ0.T_14

The equation of a curve is $y = \frac{1}{2}x^4 - \frac{3}{2}x^2 + 7$.

The gradient of the tangent to the curve at a point P is -10.

a. Find $\frac{dy}{dx}$. [2]

b. Find the coordinates of P. [4]

16N.1.SL.TZ0.T_7

A balloon in the shape of a sphere is filled with helium until the radius is 6 cm.

The volume of the balloon is increased by 40%.

a. Calculate the volume of the balloon. [2]

b. Calculate the radius of the balloon following this increase. [4]

20N.1.SL.TZ0.T_13

Consider the graph of the function $fx = x^2 - \frac{k}{x}$.

The equation of the tangent to the graph of $y = fx$ at $x = -2$ is $2y = 4 - 5x$.

a. Write down $f'(x)$. [3]

b. Write down the gradient of this tangent. [1]

c. Find the value of k. [2]

20N.1.SL.TZ0.T_15

Mia baked a very large apple pie that she cuts into slices to share with her friends. The smallest slice is cut first. The volume of each successive slice of pie forms a geometric sequence.

The second smallest slice has a volume of 30 cm^3. The fifth smallest slice has a volume of 240 cm^3.

a. Find the common ratio of the sequence. [2]

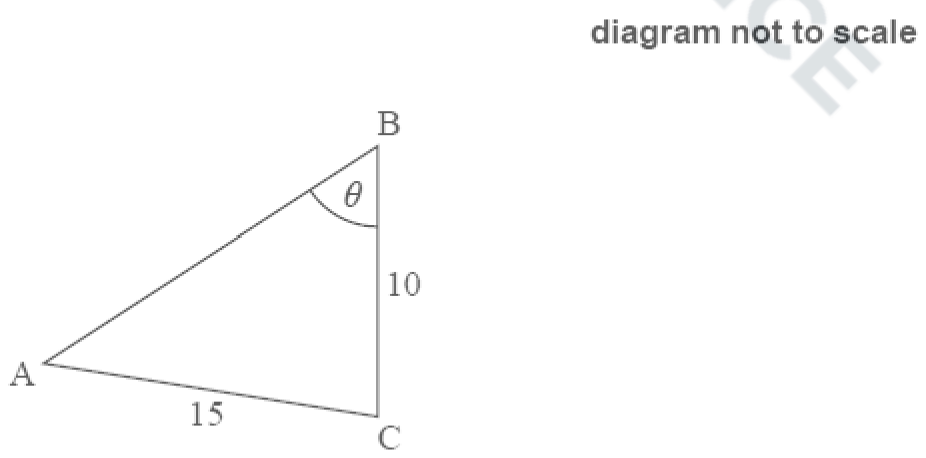
b. Find the volume of the smallest slice of pie. [2]

c. The apple pie has a volume of $61\ 425 \text{ cm}^3$.

Find the total number of slices Mia can cut from this pie. [2]

20N.1.SL.TZ0.S_2

The following diagram shows a triangle ABC.



$\text{AC} = 15 \text{ cm}, \quad \text{BC} = 10 \text{ cm}$, and $\text{A}\hat{\text{B}}\text{C} = \theta$.

Let $\sin\ \hat{CAB} = \frac{\sqrt{3}}{3}$.

a. Given that $\hat{ABC}$ is acute, find $\sin\ \theta$. [3]

b. Find $\cos\ 2 \times \hat{CAB}$. [3]

19N.1.SL.TZ0.T_7

A geometric sequence has a first term of $\frac{8}{3}$ and a fourth term of 9.

a. Find the common ratio. [2]

b. Write down the second term of this sequence. [1]

c. The sum of the first k terms is greater than 2500.

Find the smallest possible value of k. [3]

17N.1.SL.TZ0.T_2

The coordinates of point A are $(6,\ -7)$ and the coordinates of point B are $(-6,\ 2)$. Point M is the midpoint of AB.

L_1 is the line through A and B.

The line L_2 is perpendicular to L_1 and passes through M.

Write down, in the form $y = mx + c$, the equation of L_2.

EXN.1.SL.TZ0.2

A factory produces engraved gold disks. The cost C of the disks is directly proportional to the cube of the radius r of the disk.

A disk with a radius of 0.8 cm costs 375 US dollars (USD).

a. Find an equation which links C and r. [3]

b. Find, to the nearest USD, the cost of disk that has a radius of 1.1 cm. [2]

EXN.1.SL.TZ0.7

Consider the curve $y = x^2 - 4x + 2$.

a. Find an expression for $\frac{dy}{dx}$. [1]

b. Show that the normal to the curve at the point where $x = 1$ is $2y - x + 3 = 0$.

[6]

EXN.1.SL.TZ0.9

Sophia pays $\$ 200$ into a bank account at the end of each month. The annual interest paid on money in the account is 3.1% which is compounded monthly.

The average rate of inflation per year over the 5 years was 2%.

a. Find the value of her investment after a period of 5 years. [3]

b.

Find an approximation for the real interest rate for the money invested in the account.

[2]

c. Hence find the real value of Sophia's investment at the end of 5 years. [2]

21M.1.SL.TZ1.2

Deb used a thermometer to record the maximum daily temperature over ten consecutive days. Her results, in degrees Celsius (°C), are shown below.

$$14, \quad 15, \quad 14, \quad 11, \quad 10, \quad 9, \quad 14, \quad 15, \quad 16, \quad 13$$

For this data set, find the value of

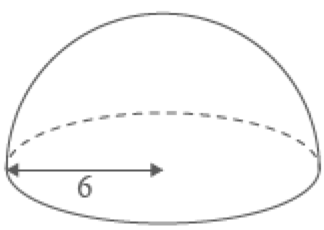
a. the mode. [1]

b. the mean. [2]

c. the standard deviation. [1]

21M.1.SL.TZ1.3

A piece of candy is made in the shape of a solid hemisphere. The radius of the hemisphere is 6 mm.



a. Calculate the surface area of one piece of candy. [4]

b.

The total surface of the candy is coated in chocolate. It is known that 1 gram of the chocolate covers an area of $240\ \text{mm}^2$.

Calculate the weight of chocolate required to coat one piece of candy. [2]

EXN.1.SL.TZ0.11

A farmer owns a triangular field ABC. The length of side $[\text{AB}]$ is $85\ \text{m}$ and side $[\text{AC}]$ is $110\ \text{m}$. The angle between these two sides is $55°$.

a. Find the area of the field. [3]

b.

The farmer would like to divide the field into two equal parts by constructing a straight fence from A to a point D on $[\text{BC}]$.

Find BD. Fully justify any assumptions you make. [6]

21M.1.SL.TZ2.7

A function is defined by $fx = 2 - \frac{12}{x+5}$ for $-7 \le x \le 7,\quad x \ne -5$.

a. Find the range of f. [3]

b. Find the value of $f^{-1}0$. [2]

22M.1.SL.TZ1.3

The height of a baseball after it is hit by a bat is modelled by the function

$$ht = -4.8t^2 + 21t + 1.2$$

where $h(t)$ is the height in metres above the ground and t is the time in seconds after the ball was hit.

a.

Write down the height of the ball above the ground at the instant it is hit by the bat.

[1]

b. Find the value of t when the ball hits the ground. [2]

c. State an appropriate domain for t in this model. [2]

22M.1.SL.TZ1.5

The ticket prices for a concert are shown in the following table.

Ticket Type	Price (in Australian dollars, $)
Adult	15
Child	10
Student	12

A total of 600 tickets were sold.
The total amount of money from ticket sales was $\$\,7816$.
There were twice as many adult tickets sold as child tickets.

Let the number of adult tickets sold be x, the number of child tickets sold be y, and the number of student tickets sold be z.

a. Write down three equations that express the information given above. [3]

b. Find the number of each type of ticket sold. [2]