

IB Math AI SL — 100 Essential Questions

Topics: Number & Algebra · Functions · Geometry · Statistics & Probability · Calculus | Difficulty: Progressive (Easy → Hard)

Q1 NUMBER & ALGEBRA



What is the value of $2^3 \times 2^2$?

A 16

B 32

C 64

D 8

Q2 NUMBER & ALGEBRA



Round 4.7382 to 3 significant figures.

A 4.73

B 4.74

C 4.738

D 4.7

Q3 NUMBER & ALGEBRA



Simplify: $\sqrt{48}$

$\sqrt{48} = ?$

A $4\sqrt{3}$

B $6\sqrt{2}$

C $2\sqrt{12}$

D $3\sqrt{16}$

Q4 NUMBER & ALGEBRA



What is 5% of 240?

A 1.2

B 12

C 120

D 48

Q5 NUMBER & ALGEBRA



Evaluate $\log_{10}(1000)$.

$\log_{10}(1000)$

A 2

B 3

C 4

D 100

Q6 NUMBER & ALGEBRA



Solve for x: $2^x = 32$

$2^x = 32$

A $x = 4$

B $x = 5$

C $x = 6$

D $x = 16$

Q7 NUMBER & ALGEBRA



A car is bought for \$18,000 and depreciates at 12% per year. Find its value after 3 years.

$V = 18000 \times (0.88)^3$

A \$12,317

B \$11,614

C \$12,533

D \$13,219

Q8 NUMBER & ALGEBRA



A car depreciates at 12% per year from \$20,000. Value after 2 years?

$$V = 20000 \times (0.88)^2$$

A \$15,488

B \$14,080

C \$17,600

D \$16,000

Q9 NUMBER & ALGEBRA



In an arithmetic sequence, the first term is 5 and the common difference is 3. Find the 10th term.

$$u_n = u_1 + (n-1)d$$

A 30

B 32

C 27

D 35

Q10 NUMBER & ALGEBRA



The sum of the first n terms of an arithmetic series is $S_n = n/2(2u_1 + (n-1)d)$. Find S_{10} when $u_1 = 3$, $d = 4$.

$$S_n = n/2 (2u_1 + (n-1)d)$$

A 210

B 200

C 190

D 220

Q11 NUMBER & ALGEBRA



A geometric sequence has $u_1 = 4$ and $r = 3$. Find u_5 .

$$u_n = u_1 \times r^{n-1}$$

A 108

B 324

C 324

D 972

Q12 NUMBER & ALGEBRA



An investment of \$5,000 earns 4% per year compound interest. Value after 6 years?

$$A = 5000 \times (1.04)^6$$

A \$6,200

B \$6,327

C \$6,500

D \$6,083

Q13 NUMBER & ALGEBRA



$\log_2(32) + \log_2(2) = ?$

$$\log_2(32) + \log_2(2)$$

A 5

B 6

C 64

D 7

Solve: $\log_3(x) = 4$

$$\log_3(x) = 4$$

A $x = 12$

B $x = 64$

C $x = 81$

D $x = 27$

The sum to infinity of a geometric series is 20. If $u_1 = 5$, find the common ratio r .

$$S_{\infty} = u_1 / (1-r)$$

A $r = 0.5$

B $r = 0.25$

C $r = 0.75$

D $r = 4$

A town's population grows at 3% per year. Starting at 50,000, how many complete years until it exceeds 60,000?

$$50000 \times (1.03)^n > 60000$$

A 5 years

B 6 years

C 7 years

D 8 years

Q17 NUMBER & ALGEBRA



Find the exact value of: $\log_5(125) - \log_5(5)$

$$\log_5(125) - \log_5(5)$$

A 1

B 2

C 3

D 4

Q18 NUMBER & ALGEBRA



Solve simultaneously: $x + y = 10$ and $x - y = 4$.

A $x=7, y=3$

B $x=6, y=4$

C $x=8, y=2$

D $x=5, y=5$

Q19 NUMBER & ALGEBRA



Write 0.000 046 7 in standard form.

A 4.67×10^{-5}

B 4.67×10^{-4}

C 46.7×10^{-6}

D 0.467×10^{-4}

Q20 NUMBER & ALGEBRA



Solve the quadratic: $x^2 - 5x + 6 = 0$

$$x^2 - 5x + 6 = 0$$

A $x = 2$ or $x = 3$

B $x = 1$ or $x = 6$

C $x = -2$ or $x = -3$

D $x = 2$ or $x = -3$

Q21 NUMBER & ALGEBRA



The number of bacteria doubles every 3 hours. Starting with 500, how many after 12 hours?

$$N = 500 \times 2^{(t/3)}$$

A 4,000

B 8,000

C 6,000

D 16,000

Q22 NUMBER & ALGEBRA



A currency exchange converts USD to EUR at a rate of 0.92. An account earns 3% annual compound interest in USD. A deposit of \$2,000 is made. What is the EUR value after 2 years?

$$A = 2000 \times (1.03)^2 \times 0.92$$

A €1,791

B €1,895

C €1,740

D €1,848

Q23 FUNCTIONS



If $f(x) = 3x + 2$, find $f(4)$.

$$f(x) = 3x + 2$$

A 10

B 12

C 14

D 16

Q24 FUNCTIONS



What is the y-intercept of $y = 2x - 5$?

$$y = 2x - 5$$

A (0, 2)

B (0, -5)

C (5/2, 0)

D (0, 5)

Q25 FUNCTIONS



Find the gradient of the line through (1, 3) and (4, 9).

$$m = (y_2 - y_1) / (x_2 - x_1)$$

A $m = 1$

B $m = 2$

C $m = 3$

D $m = 4$

Q26 FUNCTIONS



The domain of $f(x) = \sqrt{x - 3}$ is:

$$f(x) = \sqrt{x - 3}$$

A $x > 3$

B $x \geq 3$

C $x \leq 3$

D all real x

Q27 FUNCTIONS



Find the x-intercept of $y = 4x - 8$.

$$y = 4x - 8$$

A $x = 2$

B $x = -2$

C $x = 8$

D $x = 4$

Q28 FUNCTIONS



If $f(x) = x^2 - 4$ and $g(x) = 2x$, find $f(g(1))$.

$$f(g(1))$$

A -4

B 0

C 4

D 8

Q29 FUNCTIONS



The graph of $y = 2x^2 - 8$ has vertex at:

$$y = 2x^2 - 8 = 2(x-0)^2 - 8$$

A $(0, -8)$

B $(0, 8)$

C $(-8, 0)$

D $(2, 0)$

Q30 FUNCTIONS



The function $f(x) = 3^x$ passes through which point?

$$f(x) = 3^x$$

A $(0, 0)$

B $(0, 1)$

C $(1, 0)$

D $(1, 9)$

Q31 FUNCTIONS



What is the inverse of $f(x) = 2x + 6$?

$$f(x) = 2x + 6$$

A $f^{-1}(x) = x/2 - 3$

B $f^{-1}(x) = (x-6)/2$

C $f^{-1}(x) = 2x - 6$

D $f^{-1}(x) = x/2 + 3$

Q32 FUNCTIONS



Find the axis of symmetry of $y = x^2 - 6x + 5$.

$$x = -b / (2a)$$

A $x = 2$

B $x = 3$

C $x = 4$

D $x = 6$

Q33 FUNCTIONS



A quadratic has roots $x = 1$ and $x = -4$. The coefficient of x^2 is 2. Write the equation.

$$y = 2(x-1)(x+4)$$

A $y = 2x^2 + 6x - 8$

B $y = x^2 + 3x - 4$

C $y = 2x^2 + 6x + 8$

D $y = 2x^2 - 6x - 8$

Q34 FUNCTIONS



Sketch shows $y=f(x)$ shifted 3 units right and 2 units up. The transformation is:

$$y = f(x-3) + 2$$

A $y=f(x+3)+2$

B $y=f(x-3)-2$

C $y=f(x-3)+2$

D $y=f(x+3)-2$

Q35 FUNCTIONS



Find the range of $f(x) = x^2 + 1$ for $x \in \mathbb{R}$.

$$f(x) = x^2 + 1$$

A $y \geq 0$

B $y \geq 1$

C $y > 1$

D all real y

Q36 FUNCTIONS



The line $y = mx + c$ is perpendicular to $y = 3x - 1$. Find m .

$$m_1 \times m_2 = -1$$

A $m = 3$

B $m = -3$

C $m = 1/3$

D $m = -1/3$

Q37 FUNCTIONS



For $f(x) = e^{(2x)}$, find $f^{-1}(x)$.

$$y = e^{(2x)}$$

A $f^{-1}(x) = \ln(x)/2$

B $f^{-1}(x) = \ln(2x)$

C $f^{-1}(x) = 2\ln(x)$

D $f^{-1}(x) = e^{(x/2)}$

Q38 FUNCTIONS



A model for population is $P = 1000e^{(0.05t)}$. After how many years does $P = 2000$?

$$2000 = 1000e^{(0.05t)}$$

A $t \approx 13.9$

B $t \approx 11.2$

C $t \approx 20$

D $t \approx 10$

Q39 FUNCTIONS



Where does the graph of $y = x^2 - x - 12$ cross the x-axis?

$$x^2 - x - 12 = 0$$

A $x=3, x=-4$

B $x=4, x=-3$

C $x=6, x=-2$

D $x=2, x=-6$

Q40 FUNCTIONS



The function $f(x) = ax + b$ passes through (2,7) and (5,13). Find a and b.

$$f(x) = ax + b$$

A $a=2, b=3$

B $a=2, b=-1$

C $a=3, b=1$

D $a=1, b=5$

Q41 FUNCTIONS



A function is defined as $f(x) = 2/(x-1)$. Identify its vertical asymptote.

$$f(x) = 2/(x-1)$$

A $x = 2$

B $x = 0$

C $x = 1$

D $y = 0$

Q42 FUNCTIONS



$f(x) = x^2 + 2x - 3$. Find the vertex using completing the square.

$$f(x) = (x+1)^2 - 4$$

A $(-1, -4)$

B $(1, 4)$

C $(-1, 4)$

D $(1, -4)$

Q43 FUNCTIONS



A rocket's height is modelled by $h(t) = -5t^2 + 40t$. Find the maximum height.

$$h(t) = -5t^2 + 40t$$

A 80 m

B 160 m

C 200 m

D 320 m

Q44 FUNCTIONS



The half-life of a substance is 5 years. Starting with 200 g, how much remains after 15 years?

$$A = 200 \times (1/2)^{(15/5)}$$

A 50 g

B 25 g

C 12.5 g

D 100 g

In a right triangle, the two legs are 3 and 4. Find the hypotenuse.

$$c^2 = a^2 + b^2$$

A 5

B 6

C 7

D $\sqrt{7}$

Convert 180° to radians.

$$\text{radians} = \text{degrees} \times \pi/180$$

A $\pi/2$

B π

C 2π

D $3\pi/2$

Find the area of a circle with radius 7 cm.

$$A = \pi r^2$$

A $14\pi \text{ cm}^2$

B $49\pi \text{ cm}^2$

C $7\pi \text{ cm}^2$

D $21\pi \text{ cm}^2$

What is $\sin(30^\circ)$?

$$\sin(30^\circ)$$

A 1

B $1/2$

C $\sqrt{3}/2$

D $\sqrt{2}/2$

In a right triangle with hypotenuse 10 and opposite side 6, find $\sin(\theta)$.

$$\sin(\theta) = \text{opposite/hypotenuse}$$

A 0.6

B 0.8

C 0.75

D 1.2

Find the surface area of a sphere with radius 3 cm.

$$SA = 4\pi r^2$$

A 12π

B 36π

C 9π

D 18π

Q51 GEOMETRY & TRIG



Using the sine rule, find side b given: $B = 50^\circ$, $A = 70^\circ$, $a = 10$.

$$b/\sin B = a/\sin A$$

A $b \approx 8.2$

B $b \approx 7.7$

C $b \approx 9.4$

D $b \approx 6.5$

Q52 GEOMETRY & TRIG



Find the volume of a cone with radius 4 cm and height 9 cm.

$$V = (1/3)\pi r^2 h$$

A 48π

B $16\pi \text{ cm}^3$

C $36\pi \text{ cm}^3$

D $144\pi \text{ cm}^3$

Q53 GEOMETRY & TRIG



Use the cosine rule to find angle C , where $a=5$, $b=7$, $c=8$.

$$\cos C = (a^2 + b^2 - c^2)/(2ab)$$

A $C \approx 82.8^\circ$

B $C \approx 60^\circ$

C $C \approx 75^\circ$

D $C \approx 90^\circ$

The area of triangle ABC is 30 cm^2 . Given $a=10$ and $b=8$, find $\sin C$.

$$\text{Area} = (1/2)ab \sin C$$

A $\sin C = 0.6$

B $\sin C = 0.75$

C $\sin C = 1$

D $\sin C = 0.5$

A ladder 6 m long leans against a wall at 65° to the ground. How high does it reach?

$$h = 6 \sin(65^\circ)$$

A 5.44 m

B 2.54 m

C 4.50 m

D 6.63 m

Find the arc length of a sector with radius 8 cm and angle 1.2 radians.

$$l = r\theta$$

A 6.4 cm

B 9.6 cm

C 12.8 cm

D 7.2 cm

Q57 GEOMETRY & TRIG



Find the area of a sector with radius 5 cm and angle 2 radians.

$$A = (1/2)r^2\theta$$

A 10 cm²

B 25 cm²

C 50 cm²

D 5 cm²

Q58 GEOMETRY & TRIG



A triangle has sides $a=7$, $b=9$ and included angle $C=48^\circ$. Find the area.

$$\text{Area} = (1/2)ab \sin C$$

A 23.4 cm²

B 31.5 cm²

C 21.0 cm²

D 18.6 cm²

Q59 GEOMETRY & TRIG



In triangle PQR, $p=12$, $q=15$, angle $P=40^\circ$. Use the sine rule to find angle Q.

$$\sin Q / q = \sin P / p$$

A $Q \approx 53.5^\circ$

B $Q \approx 58.1^\circ$

C $Q \approx 46.3^\circ$

D $Q \approx 64.1^\circ$

Q60 GEOMETRY & TRIG



A bearing of 120° from A to B means the direction is:

A N60°E — North 60° East

B S60°E — South 60° East

C N30°E

D S30°W

The equation of a circle with centre $(2, -3)$ and radius 5 is:

$$(x-h)^2 + (y-k)^2 = r^2$$

A $(x+2)^2+(y-3)^2=25$

B $(x-2)^2+(y+3)^2=25$

C $(x-2)^2+(y+3)^2=5$

D $(x+2)^2+(y+3)^2=25$

A ship sails 20 km North, then 15 km East. What is the bearing of the final position from the start?

$$\tan(\theta) = 15/20$$

A 036.9°

B 053.1°

C 053.9°

D 043.2°

Prove: $\sin^2\theta + \cos^2\theta = 1$. Using this, if $\sin\theta = 0.6$, find $\cos\theta$ (for $0 < \theta < 90^\circ$).

$$\sin^2\theta + \cos^2\theta = 1$$

A 0.6

B 0.8

C 0.7

D 0.64

Q64 STATISTICS & PROBABILITY



The mean of 5 numbers is 8. What is the sum of the numbers?

$$\text{Mean} = \text{Sum} / n$$

A 13

B 40

C 45

D 8

Q65 STATISTICS & PROBABILITY



Find the median of: 3, 7, 1, 9, 5.

A 5

B 6

C 7

D 3

Q66 STATISTICS & PROBABILITY



A bag has 4 red and 6 blue balls. Probability of picking a red ball?

$$P = \text{favourable} / \text{total}$$

A 4/10

B 6/10

C 4/6

D 1/4

Q67 STATISTICS & PROBABILITY



Find the interquartile range (IQR) of: 2, 4, 6, 8, 10, 12, 14.

$$\text{IQR} = Q_3 - Q_1$$

A 6

B 8

C 10

D 4

Two dice are rolled. What is the probability the sum equals 7?

$$P(\text{sum}=7)$$

A $1/6$

B $5/36$

C $7/36$

D $6/36$

A dataset has mean 50 and standard deviation 10. What z-score corresponds to $x = 65$?

$$z = (x - \mu) / \sigma$$

A $z = 1$

B $z = 1.5$

C $z = 2$

D $z = 0.65$

In a Venn diagram, $P(A) = 0.5$, $P(B) = 0.4$, $P(A \cap B) = 0.2$. Find $P(A \cup B)$.

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

A 0.7

B 0.9

C 0.1

D 1.1

Q71 STATISTICS & PROBABILITY



A normal distribution has $\mu=100$, $\sigma=15$. Find $P(X < 115)$ approximately.

$$z = (115-100)/15 = 1$$

A 68.3%

B 84.1%

C 97.7%

D 95.4%

Q72 STATISTICS & PROBABILITY



A binomial distribution has $n=10$, $p=0.3$. Find $P(X=2)$.

$$P(X=k) = C(n, k) p^k (1-p)^{(n-k)}$$

A 0.233

B 0.121

C 0.267

D 0.150

Q73 STATISTICS & PROBABILITY



Events A and B are independent. $P(A)=0.4$, $P(B)=0.5$. Find $P(A \text{ and } B)$.

$$P(A \cap B) = P(A) \times P(B)$$

A 0.9

B 0.2

C 0.1

D 0.45

Q74 STATISTICS & PROBABILITY



A scatter plot shows $r = -0.92$. This suggests:

A Weak negative correlation

B Strong positive correlation

C Strong negative correlation

D No correlation

The regression line is $y = 2.5x + 3$. Predict y when $x = 10$.

$$y = 2.5x + 3$$

A 25

B 28

C 30

D 23

A box has 5 red, 3 blue. Two drawn without replacement. $P(\text{both red})$?

$$P = (5/8) \times (4/7)$$

A 25/64

B 20/56

C 5/14

D 10/56

For a normal distribution, approximately what % of data lies within 2 standard deviations of the mean?

A 68%

B 95%

C 99.7%

D 90%

$X \sim B(20, 0.25)$. Find the expected value $E(X)$ and variance $\text{Var}(X)$.

$$E(X) = np, \text{Var}(X) = np(1-p)$$

A $E=5, \text{Var}=3.75$

B $E=5, \text{Var}=5$

C $E=4, \text{Var}=3$

D $E=6, \text{Var}=4.5$

Q79 STATISTICS & PROBABILITY



Use conditional probability: $P(A|B) = 0.6$, $P(B) = 0.4$. Find $P(A \cap B)$.

$$P(A|B) = P(A \cap B) / P(B)$$

A 0.24

B 0.6

C 1.0

D 0.16

Q80 STATISTICS & PROBABILITY



A chi-squared test at 5% significance gives $\chi^2 = 5.99$ with 2 degrees of freedom. Critical value = 5.99. Conclusion?

A Reject H_0 — evidence of association

B Accept H_0 — no association

C Inconclusive

D Need more data

Q81 STATISTICS & PROBABILITY



Pearson's $r = 0.85$ with $n = 20$ data points. At 5% significance for $n-2 = 18$ df, the critical t-value is 2.101. Test statistic $t = r\sqrt{(n-2)/\sqrt{1-r^2}}$. Is the correlation significant?

$$t = r\sqrt{(n-2) / \sqrt{1-r^2}}$$

A Yes, $t \approx 6.89 > 2.101$

B No, $t < 2.101$

C $t \approx 2.10$, borderline

D Cannot determine

Q82 CALCULUS



Find dy/dx if $y = x^5$.

$$d/dx(x^n) = nx^{n-1}$$

A $5x^4$

B $4x^5$

C x^4

D $5x^5$

Q83 CALCULUS



Find dy/dx if $y = 3x^2 + 2x - 7$.

$$d/dx(3x^2 + 2x - 7)$$

A $6x + 2$

B $3x + 2$

C $6x - 7$

D $6x$

Q84 CALCULUS



Find the gradient of $y = x^3 - 3x$ at $x = 2$.

$$dy/dx = 3x^2 - 3$$

A 6

B 9

C 3

D 12

Q85 CALCULUS



$\int 4x^3 dx = ?$

$$\int x^n dx = x^{n+1}/(n+1) + C$$

A $x^4 + C$

B $4x^4 + C$

C $12x^2 + C$

D $16x^2 + C$

Q86 CALCULUS



Find the equation of the tangent to $y = x^2$ at $x = 3$.

$$y - y_1 = m(x - x_1)$$

A $y = 6x - 9$

B $y = 3x + 9$

C $y = 6x - 18$

D $y = 6x + 9$

Q87 CALCULUS



Find the stationary points of $y = x^3 - 3x^2 + 1$.

$$dy/dx = 3x^2 - 6x = 0$$

A $x=0$ and $x=2$

B $x=1$ and $x=3$

C $x=0$ and $x=3$

D $x=-1$ and $x=2$

Q88 CALCULUS



Evaluate $\int_0^2 (3x^2) dx$.

$$\int_0^2 3x^2 dx$$

A 4

B 8

C 12

D 6

Find d/dx of $y = e^{(3x)}$.

$$d/dx(e^{kx}) = k \cdot e^{kx}$$

A $e^{(3x)}$

B $3e^{(3x)}$

C $3e^{(3x-1)}$

D $e^{(3x)}/3$

Determine if $x=0$ is a local max or min for $y = x^3 - 3x^2 + 1$ using the second derivative.

$$d^2y/dx^2 = 6x - 6$$

A Local maximum

B Local minimum

C Inflection point

D Neither

Find the area enclosed between $y = x^2$ and $y = x$ (between $x=0$ and $x=1$).

$$A = \int_0^1 (x - x^2) dx$$

A $1/2$

B $1/3$

C $1/6$

D $1/4$

Q92 CALCULUS



Find d/dx of $y = \ln(5x)$.

$$d/dx[\ln(kx)] = 1/x$$

A $5/x$

B $1/(5x)$

C 5

D $1/x$

Q93 CALCULUS



Using calculus, find the minimum cost $C = x^2 - 4x + 9$.

$$dC/dx = 2x - 4 = 0$$

A $C_{\min}=5$ at $x=2$

B $C_{\min}=9$ at $x=0$

C $C_{\min}=4$ at $x=2$

D $C_{\min}=1$ at $x=4$

Q94 CALCULUS



Find $\int_1^4 (1/\sqrt{x}) dx$.

$$\int x^{-1/2} dx = 2\sqrt{x} + C$$

A 2

B 4

C 1

D 3

Q95 CALCULUS



A particle moves with velocity $v(t) = 3t^2 - 6t$. Find the displacement from $t=0$ to $t=3$.

$$s = \int_0^3 v(t) \, dt$$

A 9

B 0

C 18

D 27

Q96 CALCULUS



The rate of change of temperature is $dT/dt = -0.5T$. Initially $T=80^\circ\text{C}$. Which model describes T ?

$$dT/dt = -0.5T$$

A $T = 80e^{(0.5t)}$ B $T = 80 - 0.5t$ C $T = 80e^{(-0.5t)}$ D $T = 80/(1+0.5t)$

Q97 CALCULUS



Find the turning point of $y = 2x^3 - 9x^2 + 12x - 4$ and determine its nature.

$$dy/dx = 6x^2 - 18x + 12$$

A Max at $x=1$, Min at $x=2$ B Min at $x=1$, Max at $x=2$

C Both maxima

D Both minima

Evaluate $\int (6x^2 + 4x - 3) dx$ and find the constant if the curve passes through (1, 5).

$$\int (6x^2 + 4x - 3) dx = 2x^3 + 2x^2 - 3x + C$$

A $C = 4$

B $C = 3$

C $C = 2$

D $C = 5$

Answer Key

1. B	2. B	3. A	4. B	5. B
6. B	7. B	8. A	9. B	10. A
11. B	12. B	13. B	14. C	15. C
16. C	17. B	18. A	19. A	20. A
21. B	22. A	23. C	24. B	25. B
26. B	27. A	28. B	29. A	30. B
31. B	32. B	33. A	34. C	35. B
36. D	37. A	38. A	39. B	40. A
41. C	42. A	43. A	44. B	45. A
46. B	47. B	48. B	49. A	50. B
51. A	52. A	53. B	54. B	55. A
56. B	57. A	58. A	59. B	60. B
61. B	62. A	63. B	64. B	65. A
66. A	67. B	68. A	69. B	70. A
71. B	72. A	73. B	74. C	75. B
76. C	77. B	78. A	79. A	80. A
81. A	82. A	83. A	84. B	85. A
86. A	87. A	88. B	89. B	90. A
91. C	92. D	93. A	94. B	95. A
96. A	97. B	98. A		