

IB Maths AA SL – Topic 2: Functions

IB Mathematics: Analysis & Approaches SL · Total marks: 54 · Answers on the last page

Practice questions covering transformations of graphs, quadratic functions, rational functions, and exponential/logarithmic functions from IB AA SL Topic 2. Section A is non-calculator; Sections B and C assume calculator access.

Section A – Skills (Non-calculator)

- Express $f(x) = 2x^2 - 12x + 7$ in the form $a(x - h)^2 + k$, and hence state the coordinates of the vertex of the graph of $y = f(x)$. [4]
- The graph of $y = f(x)$, where $f(x) = x^2$, is transformed to give the graph of $y = -2f(x + 1) - 3$.
 - Describe fully the sequence of transformations applied to $y = f(x)$.
 - Write the resulting function in expanded form $ax^2 + bx + c$. [5]
- The function $f(x) = (x - 4)^2 - 9$ has domain $x \in \mathbb{R}$. Write down the range of f . [2]
- The function $g(x) = \frac{3}{x - 2} + 1$ is defined for x
 - eq2. Write down the equations of the vertical and horizontal asymptotes of the graph of $y = g(x)$. [2]

Section B – Exam-style (Calculator allowed)

- Solve the equation $5^{2x-1} = 40$, giving your answer correct to three significant figures. [4]
- Given that $\log_a 2 = m$ and $\log_a 5 = n$, express $\log_a 20$ in terms of m and n . [3]
- Consider the function $f(x) = \frac{2x + 3}{x - 1}$, x
 - eq1.
 - Write down the equation of the vertical asymptote.
 - Write down the equation of the horizontal asymptote.
 - Find the coordinates of the points where the graph of $y = f(x)$ crosses the x -axis and the y -axis. [5]
- Let $f(x) = 2x - 1$ and $g(x) = x^2 + 3$.
 - Find $f(g(2))$.
 - Find $g(f(x))$, giving your answer in expanded form.
 - Solve the equation $f(g(x)) = 15$. [6]
- The population of a colony of bacteria is modelled by $P(t) = 500e^{0.08t}$, where t is the time in hours and P is the number of bacteria.
 - Write down the initial population.
 - Find the population after 10 hours, giving your answer to the nearest whole number.
 - Find the time taken for the population to double, giving your answer correct to one decimal place. [6]

Section C – Challenge (Calculator allowed)

10. Let $f(x) = \frac{x+3}{2x-1}$, $x \neq \frac{1}{2}$.
(a) Find $f^{-1}(x)$.
(b) State the domain of f^{-1} . [6]
11. The function $f(x) = \ln(x-2) + 3$ is defined for $x > 2$. Find $f^{-1}(x)$ and state its domain and range. [5]
12. The graph of $y = f(x)$ has a maximum point at $(2, 5)$.
(a) State the coordinates of the maximum point on the graph of $y = 2f(x-3) + 4$.
(b) State the coordinates of the corresponding point on the graph of $y = -f(2x)$. [6]

Answers

Check your working against these. If an answer does not match, try the question again before looking for the method.

1. $f(x) = 2(x - 3)^2 - 11$. Vertex: $(3, -11)$.
2. (a) Translation 1 unit left, vertical stretch with scale factor 2, reflection in the x -axis, then translation 3 units down.
(b) $y = -2x^2 - 4x - 5$.
3. $f(x) \geq -9$.
4. Vertical asymptote: $x = 2$. Horizontal asymptote: $y = 1$.
5. $x = 1.65$.
6. $\log_a 20 = 2m + n$.
7. (a) $x = 1$.
(b) $y = 2$.
(c) x -intercept: $\left(-\frac{3}{2}, 0\right)$. y -intercept: $(0, -3)$.
8. (a) $f(g(2)) = 13$.
(b) $g(f(x)) = 4x^2 - 4x + 4$.
(c) $f(g(x)) = 2x^2 + 5$, so $x^2 = 5$, giving $x = \pm\sqrt{5}$.
9. (a) $P(0) = 500$.
(b) $P(10) = 500e^{0.8} = 1113$ (nearest whole number).
(c) $e^{0.08t} = 2 \Rightarrow t = \frac{\ln 2}{0.08} = 8.7$ hours.
10. (a) $f^{-1}(x) = \frac{x+3}{2x-1}$ (so f is self-inverse).
(b) Domain of f^{-1} : $x \neq \frac{1}{2}$.
11. $f^{-1}(x) = e^{x-3} + 2$. Domain: $x \in \mathbb{R}$. Range: $f^{-1}(x) > 2$.
12. (a) $(5, 14)$.
(b) $(1, -5)$ (this point is now a minimum).

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