Graphing Functions: exam practice

10 questions · 43 marks · worked solutions and markschemes

Name _____ Date _____ Score / 43

- Answer every question before you look at the solutions. They start after the last question, with the marks for each line: M for method, A for accuracy, R for reasoning.
- Online, with more practice: ibmathrevision.com/slaa/graphing-functions-exam-practice

1. **2 marks · Paper 2 style · calculator**

Use technology to find the coordinates of the point where the graphs of $y = e^x$ and $y = 4 - x$ intersect.

2. **3 marks · Paper 2 style · calculator**

Use your calculator to solve the equation $2^x = x + 3$. **[3]**

3. **4 marks · Paper 2 style · calculator**

Consider the quadratic function $f(x) = 2x^2 - 5x - 12$.

1. Use your graphic display calculator to find the coordinates of the x-intercepts.
2. Find the coordinates of the vertex of the graph of f.

4. 4 marks · Paper 2 style · calculator

Let the function $g(x)$ be defined by $g(x) = \frac{3x+1}{x-2}$ for $x \neq 2$.

1. Write down the equation of the vertical asymptote.
2. Find the equation of the horizontal asymptote.
3. Find the coordinates of the y-intercept.

5. 5 marks · Paper 2 style · calculator

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

1. Find the exact coordinates of the y-intercept of the graph of f.
2. Use your GDC to find the x-intercept, giving your answer to three significant figures.
3. Write down the equation of the horizontal asymptote.

6. 5 marks · Paper 1 style · no calculator

Let $f(x) = (x-1)(x+3)$.

(a) Write down the x-intercepts of the graph of f. **[1]**

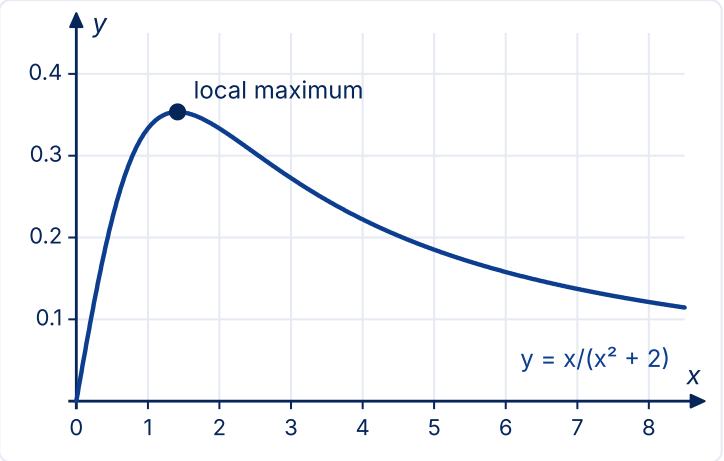
(b) Find the y-intercept. **[1]**

(c) Find the coordinates of the vertex. **[3]**

7. **5 marks · Paper 2 style · calculator**

The following diagram shows part of the graph of $y = \frac{x}{x^2+2}$ for $x \geq 0$.

1. Use your GDC to find the coordinates of the local maximum point, giving your values to three significant figures.
2. Determine the equation of the horizontal asymptote as $x \to \infty$.



8. **5 marks · Paper 2 style · calculator**

Let $f(x) = x^3 - 3x + 1$.

(a) Use your calculator to find the x-intercepts of the graph of f. **[3]**

(b) Write down the coordinates of the local maximum and the local minimum points. **[2]**

9. **5 marks · Paper 2 style · calculator**

Let $h(x) = xe^{-x}$, for $x \geq 0$.

(a) Use your calculator to find the coordinates of the maximum point of the graph of h. **[2]**

(b) Write down the equation of the horizontal asymptote. **[1]**

(c) Solve $h(x) = 0.2$. **[2]**

10. **5 marks · Paper 2 style · calculator**

The graphs of $y = \ln x$ and $y = x - 2$ meet at two points.

(a) Find the x-coordinates of the two points. **[2]**

(b) For x between these two values, the vertical distance between the graphs is $d(x) = \ln x - x + 2$. Find the maximum value of d. **[3]**

Answers and worked solutions

Question 1

2 marks

Answer: $(1.07, 2.93)$

$x = 1.07$ $(1.0737\ldots)$ **A1**

$(1.07, 2.93)$ **A1**

Question 2

3 marks

Answer: $x = -2.86$ or $x = 2.44$

sketch or table of $y = 2^x$ and $y = x + 3$ **(M1)**

$x = -2.86$ **A1**

$x = 2.44$ **A1**

Question 3

4 marks

Answer: (a) $(-1.5, 0), (4, 0)$; (b) $(1.25, -15.125)$

1. **CG50:** Go to `MENU 5 (Graph)`. Enter `Y1 = 2x^2 - 5x - 12`. Press `DRAW (F6)`. Press `G-Solv (F5) -> ROOT (F1)`. Coordinates are $(-1.5, 0)$ and $(4, 0)$. **A1A1**
2. **CG50:** Press `G-Solv (F5) -> MIN (F3)`. **(M1)**
   Vertex is $(1.25, -15.125)$ $(= (1.25, -15.1))$. **A1**

Question 4

4 marks

Answer: (a) $x = 2$; (b) $y = 3$; (c) $(0, -0.5)$

1. Vertical asymptote occurs where denominator is zero:
   $x - 2 = 0 \implies x = 2$. **A1**
2. Horizontal asymptote for $\frac{ax+b}{cx+d}$ is $y = \frac{a}{c}$. **(M1)**
   $y = \frac{3}{1} = 3$. **A1**
3. **CG50:** Graph `Y1 = (3x+1)/(x-2)`. Press `G-Solv -> Y-ICEPT (F4)`.
   Or manually: $g(0) = \frac{1}{-2} = -0.5$.
   Coordinate is $(0, -0.5)$. **A1**

Question 5

5 marks

Answer: (a) $(0, 2)$; (b) $x = 0.693$; (c) $y = 4$

1. $y-$intercept occurs at $x = 0$.
   $f(0) = 4 - 2e^0 = 4 - 2 = 2$. **(M1)**
   Exact coordinates are $(0, 2)$. **A1**
2. **CG50:** `Graph Y1 = 4 - 2 * e^x`. Press `G-Solv -> ROOT`. **(M1)**
   $x = 0.69314\ldots \implies x = 0.693\ (3sf)$. **A1**
3. As $x \to -\infty$, $e^x \to 0$. Therefore,
   $f(x) \to 4 - 0 = 4$.
   Horizontal asymptote is $y = 4$. **A1**

Question 6

5 marks

Answer: (a) $x = 1,\ x = -3$; (b) $(0, -3)$; (c) $(-1, -4)$

(a)

$x = 1$ and $x = -3$ **A1**

(b)

$(0, -3)$ **A1**

(c)

axis $x = \dfrac{1 + (-3)}{2} = -1$ **(M1)(A1)**

$(-1, -4)$ **A1**

Question 7

5 marks

Answer: (a) $(1.41, 0.354)$; (b) $y = 0$

1. **CG50:** `MENU 5. Y1 = x / (x^2 + 2)`. `DRAW`. **(M1)**
   Press `G-Solv (F5) -> MAX (F2)`.
   $x = 1.4142\ldots$ and $y = 0.35355\ldots$
   Coordinates are $(1.41, 0.354)$ to $3sf$. **A1A1**
2. As $x \to \infty$, the x^2 term in the denominator dominates the x term in the numerator.
   $f(x) \to \frac{x}{x^2} = \frac{1}{x} \to 0$. **(M1)**
   Horizontal asymptote is $y = 0$. **A1**

Question 8

5 marks

Answer: (a) $x = -1.88,\ 0.347,\ 1.53$; (b) max $(-1, 3)$, min $(1, -1)$

(a)

$x = -1.88,\ 0.347,\ 1.53$ **A1A1A1**

(b)

maximum $(-1, 3)$ **A1**

minimum $(1, -1)$ **A1**

Question 9

5 marks

Answer: (a) $(1,\ 0.368)$; (b) $y = 0$; (c) $x = 0.259$ or $x = 2.54$

(a)

$(1,\ 0.368)$ **A1A1**

(b)

$y = 0$ **A1**

(c)

$x = 0.259$ **A1**

$x = 2.54$ **A1**

Question 10

5 marks

Answer: (a) $x = 0.159$ and $x = 3.15$; (b) 1

(a)

$x = 0.159$ **A1**

$x = 3.15$ **A1**

(b)

$d'(x) = \frac{1}{x} - 1 = 0$ or use of a graph of d **(M1)**

$x = 1$ **(A1)**

maximum distance 1 **A1**

Every solution is also on ibmathrevision.com/slaa/graphing-functions-exam-practice

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