

142 Sample Questions

1. $\log_4(2x + 4) + \log_4 x = 2$

2. The following table gives statistics on the number of people (in thousands) living in Country X that knew how to use a computer in the 1980s.

Years since 1980 (x)	1	2	5	7	9	10
# of People(y)	0.5	0.8	1.2	2.3	3.5	4

Which model (LOGARITHMIC, QUADRATIC, or LOGISTIC) best explains this data? Once you have decided, write the equation of your model rounded to four decimal places and justify your choice.

3. Find the value(s) of x where $f(x)$ is not continuous and explain why $f(x)$ is not continuous there by using the definition of continuity, not graphical explanations.

$$f(x) = \begin{cases} \frac{2x+2}{x-5} & , x \leq 7 \\ x+2 & , x > 7 \end{cases}$$

4. $\lim_{x \rightarrow \infty} \frac{e^{-2x} + e^{3x}}{3e^{3x} - e^{-2x}}$

5. Given the function, $f(x) = \frac{1}{x+1}$, find the derivative, $f'(x)$, using the limit definition of derivative.

6. Sketch a graph of a function that satisfies the following conditions:

x-intercept at 1

Horizontal Asymptote: $y = 0$

Vertical Asymptote: $x = 0$

$$f'(2) = 0, f(2) = 1, f(3) = 8/9$$

$$f'(x) > 0 \text{ on } (0, 2)$$

$$f'(x) < 0 \text{ on } (-\infty, 0) \text{ and } (2, \infty)$$

$$f''(x) > 0 \text{ on } (3, \infty)$$

$$f''(x) < 0 \text{ on } (-\infty, 0) \text{ and } (0, 3)$$

7. $\lim_{x \rightarrow 2} \frac{2x^2 - 5x + 2}{x^2 + x - 6}$

8. Given $f(x) = a(x-1)^2(x+2)(x+5)$, where a is a constant function that is always negative, find

(a) the intervals where $f(x)$ is increasing/decreasing.

(b) the value(s) of x where any relative extremum of $f(x)$ occur and specify whether it is a maximum or minimum.

9. The demand equation of a particular product is given to be $p = e^{2x}$ where x is the number of items demanded and p is the price in dollars. Find the marginal revenue equation.
10. Find the area of the region between the curves $y = x^3 - 6x^2 + 9x$ and $y = x^2 - 3x$ on the interval $[1,6]$. Also, sketch the graph of the two curves and shade the described region.
11. If $\int_3^1 f(x) dx = 4$ and $\int_1^3 [2f(x) - 3g(x)] dx = 15$, then evaluate $\int_1^3 g(x) dx$.
12. Given $g(x) = 3 \ln x$, find the average rate of change of $g(x)$ on the interval $[1,e]$.
13. A poster is to have an area of 200 in^2 with 1 inch margins at the bottom and sides and a 2 inch margin at the top. What dimensions will give the largest printed area?