

1. Let $f(x) = \sqrt{x+8} - \sqrt{x}$ and $g(x) = \frac{1}{\sqrt{x+8} + \sqrt{x}}$. Compute the value of the expression $f'(1)g(1) - g'(1)f(1)$.

2. For how many integer values of m is the function $f(x) = \frac{mx+2}{x-1+m}$ decreasing on the interval $(1, +\infty)$?

3. For every non-zero real number a , the function $f(x) = \begin{cases} bx + c & x < a \\ \frac{1}{x} & x \geq a \end{cases}$ is differentiable on \mathbb{R} .

Determine the value of ac .

4. The tangent to the curve $y = x^3 + ax^2 + bx - 1$ at the point $(-1, -4)$ passes through the interior of the graph. Find the value of $\frac{a}{b}$.

5. **(Homework)** At which point does the tangent to the graph of the function $f(x) = \frac{5x-4}{\sqrt{x}}$ at $x = 4$ intersect the y -axis?

6. The graph of the function $f(x) = 3x^4 + ax^3 + bx^2 + cx$ is given. Determine the value of a .

