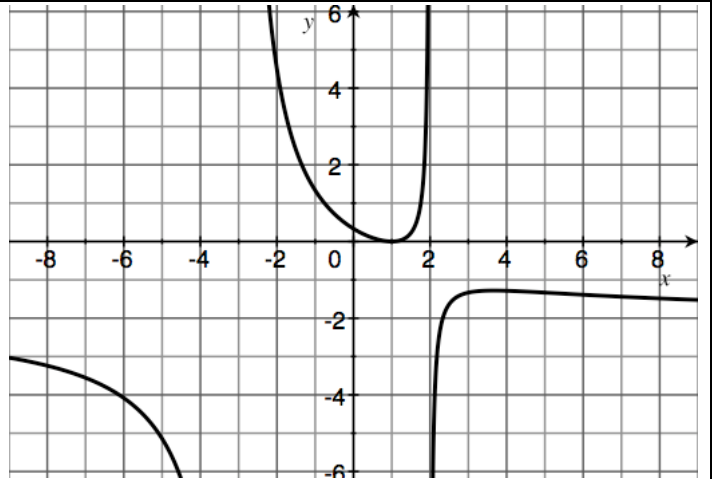


A Finely Crafted O'Brien Unit 2 Opportunity Day

Calculator Section: You may use a calculator. Show all work and circle your answer. Use your time wisely; you will be able to earn additional credit after the timed portion of the test by completing Supercorrections. When you finish, put away your calculator and you can come up to get the non-calculator part- you may continue to work on both sections without your calculator.

1. The graph of $y = \frac{-2(x-1)^2(x-3)}{(x-2)(x-3)(x+3)}$ is shown at right.



a. Give the equations of the vertical asymptotes.

b. Give the equation of the horizontal asymptote.

c. Give the coordinates (x and y values) of the hole.

2. Find the values of a and b , where a and b are real, given that $(3 - i)(a + bi) = 1 - 3i$.

3. Miles claims that 3 is not a zero of the polynomial below. Katharine claims 3 could be a zero of the polynomial, depending on the value of a . Who is correct and why?

$$2x^4 + ax^3 + 3x^2 - 5x + 10$$

4. Let $f(x) = \frac{x+4}{x+1}$, $x \neq -1$ and $g(x) = \frac{x-2}{x-4}$, $x \neq 4$.

Find the set of values of x such that $f(x) \leq g(x)$.

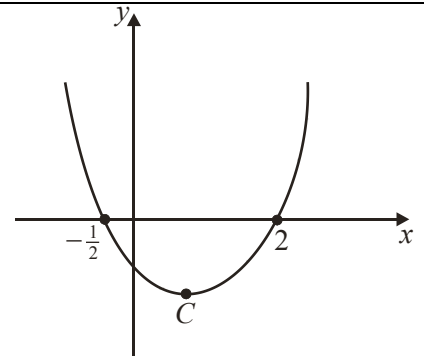
5. $(x + 2i)$ is a factor of $2x^3 - 3x^2 + 8x - 12$. Find the other two factors.

6. Find the equation of a rational function that has a slant asymptote of $y = 2x + 1$. Write your function in the form $r(x) = \frac{p(x)}{q(x)}$, where $p(x)$ and $q(x)$ are polynomial functions.

7. The diagram shows the graph of the function $f(x) = (x - p)(x - q)$.

(a) Write down the values of p and q .

(b) The function has a minimum value at the point C . Find the x -coordinate of C .



8. Perform the operation and write the result in standard form.

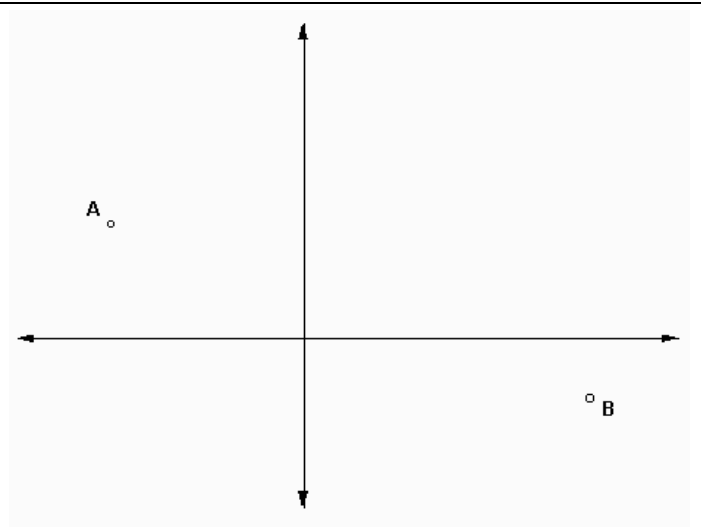
$$\frac{1}{2-i} - \frac{5}{1+4i}$$

9. Graph the solution of the inequality $-2(x+1)^2(x-3)(x+5)^2 > 0$ on the number line below.



10. Determine where the graphs of $f(x) = 9x - x^3$ and $g(x) = 2x + 6$ intersect.

11. A polynomial function $p(x)$ with degree two or higher has a graph that contains points A and B. Is it possible that the equation $p(x) = 0$ has only one real solution? Explain your reasoning.



12. The perimeter of a rectangle is 240 meters.

- a. If the length of the rectangle is x and the width is y , then write y as a function of x . Use the result to write the area as a function of x .

- b. Of all possible rectangles with perimeter of 240 meters, find the dimensions of the one with the maximum area.

Bonus: The polynomial $x^2 - 4x + 3$ is a factor of $x^3 + (a - 4)x^2 + (3 - 4a)x + 3$. Calculate the value of the constant a .