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Sketching graphs of rational functions pdf

Rational functions are of the form $y = f(x)$, where $f(x)$ is a rational expression. Some of the examples of rational functions are: $y = \frac{1}{x}$, $y = \frac{x^2 - 1}{x}$, $y = \frac{3x^4 + 2x + 5}{x^2 + 1}$. The graphs of the rational functions can be difficult to draw. To sketch a graph of a rational function, you can start by finding the asymptotes and intercepts. Steps involved in graphing rational functions: Find the asymptotes of the rational function, if any. Draw the asymptotes as dotted lines. Find the x-intercept(s) and y-intercept of the rational function, if any. Find the values of y for several different values of x. Plot the points and draw a smooth curve to connect the points. Make sure that the graph does not cross the vertical asymptotes. Example: Graph the rational function $y = \frac{4x^2 + 12x + 1}{x^2 - 0.5}$. This function has the x-intercept at $x = -1.4$, 0 and y-intercept at 0, 1. Find more points on the function and graph the function. Sometimes the given rational function has to be simplified, before graphing it. In that case, if there are any excluded values (where the function is not defined) other than at asymptotes, then there is additional step involved in graphing the function. To represent the undefined function, make sure that the function is not continuous smooth curve at the excluded value. This excluded value is usually referred to as hole in the rational function. For example, the rational function $y = \frac{4x^2 + x^2x^2 + x}{x^2 + 1}$ has a hole at $x = 0$. Please note that the graphs of the rational functions satisfy the vertical line test. If you're seeing this message, it means we're having trouble loading external resources on our website. If you're behind a web filter, please make sure that the domains *.kastatic.org and *.kasandbox.org are unblocked. 1 Find the y intercept.[2] Simply set $x = 0$. Everything but the constant terms vanish, leaving $y = 5/2$. Expressing this as a coordinate pair, (0, 5/2) is a point on the graph. Graph that point. 2 Find the horizontal asymptote. Long divide the denominator into the numerator to determine the behavior of y for large absolute values of x. In this example, division shows that $y = (1/2)x - (7/4) + 17/(8x + 4)$. For large positive or negative values of x, $17/(8x + 4)$ approaches zero, and the graph approximates the line $y = (1/2)x - (7/4)$. Using a dashed or lightly drawn line, graph this line.[3] If the degree of the numerator is less than the degree of the denominator, there is no division to do, and the asymptote is $y = 0$. If $\deg(N) = \deg(D)$, the asymptote is a horizontal line at the ratio of the leading coefficients. If $\deg(N) = \deg(D) + 1$, the asymptote is a line whose slope is the ratio of the leading coefficients. If $\deg(N) > \deg(D) + 1$, then for large values of $|x|$, y quickly goes to positive or negative infinity as a quadratic, cubic, or higher degree polynomial. In this case, it probably isn't worthwhile to accurately graph the quotient of the division. 3 Find the zeros. A rational function has a zero when it's numerator is zero, so set $N(x) = 0$. In the example, $2x^2 - 6x + 5 = 0$. The discriminant of this quadratic is $b^2 - 4ac = 6^2 - 4 \cdot 2 \cdot 5 = 36 - 40 = -4$. Since the discriminant is negative, $N(x)$, and consequently $f(x)$, has no real roots. The graph never crosses the x-axis. If any zeros were found, add those points to the graph.[4] 4 Find the vertical asymptotes. A vertical asymptote occurs when the denominator is zero.[5] Setting $4x + 2 = 0$ gives the vertical line $x = -1/2$. Graph each vertical asymptote with a light or dashed line. If some value of x makes both $N(x) = 0$ and $D(x) = 0$, there may or may not be a vertical asymptote there. This is rare, but see the tips for how to deal with it if it occurs. 5 Look at the remainder of the division in the step 2. When is it positive, negative, or zero? In the example, the numerator of the remainder is 17 which is always positive. The denominator, $4x + 2$, is positive to the right of the vertical asymptote and negative to the left. This means that the graph approaches the linear asymptote from the above for large positive values of x and from below for large negative values of x. Since $17/(8x + 4)$ can never be zero, this graph never intersects the line $y = (1/2)x - (7/4)$. Don't add anything to the graph right now, but note these conclusions for later. 6 Find the local extrema.[6] A local extremum may occur whenever $N'(x)D(x) - N(x)D'(x) = 0$. In the example, $N'(x) = 4x - 6$ and $D'(x) = 4$. $N'(x)D(x) - N(x)D'(x) = (4x - 6)(4x + 2) - (2x^2 - 6x + 5) \cdot 4 = 0$. Expanding, combining terms, and dividing by 4 leaves $x^2 + x - 4 = 0$. The quadratic formula shows roots near $x = 3/2$ and $x = -5/2$. (These differ by about 0.06 from the exact values, but our graph isn't going to be precise enough to worry about that level of detail. Choosing a decent rational approximation makes the next step easier.) 7 Find the y-values of each local extremum.[7] Plug the x-values from the previous step back into the original rational function to find the corresponding y-values. In the example, $f(3/2) = 1/16$ and $f(-5/2) = -65/16$. Add these points, (3/2, 1/16) and (-5/2, -65/16), to the graph. Since we approximated in the previous step, these aren't the exact minima and maxima, but are probably close. (We know (3/2, 1/16) is very close to the local minimum. From step 3, we know that y is always positive when $x > -1/2$ and we found a value as small as 1/16, so at least in this case, the error is probably less than the thickness of the line.) 8 Connect the dots and smoothly extend the graph from the known points to the asymptotes taking care to approach them from the correct direction.[8] Take care not to cross the x-axis except at the points already found in step 3. Don't cross the horizontal or linear asymptote except at the points already found in step 5. Don't change from upward sloping to downward sloping except at the extreme found in the previous step.[9] Add New Question Question How do I create a graph has no x intercept? That would be a graph of a function where y is never equal to zero. An example is $y = x^2 + 1$. There is no x value for which the corresponding y value is zero. The graph is a parabola opening upward from a minimum y value of 1. Question Don't we at some point take the Limit of the function? If not then, on what kind of the function can we do that? The step about horizontal asymptotes finds the limit as x goes to + and - infinity. You might also take one-sided limits at each vertical asymptote to see if the graph approaches +inf or -inf from each side. Ask a Question Thanks! Thanks! Thanks! Thanks! wikiHow is a "wiki," similar to Wikipedia, which means that many of our articles are co-written by multiple authors. To create this article, 17 people, some anonymous, worked to edit and improve it over time. This article has been viewed 82,686 times. Co-authors: 17 Updated: May 22, 2019 Views: 82,686 Categories: Coordinate Geometry | Graphs Print Send fan mail to authors Thanks to all authors for creating a page that has been read 82,686 times. sketching graphs of rational functions pdf. sketching the graphs of more complicated rational functions

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