How to find oblique asymptotes pdf

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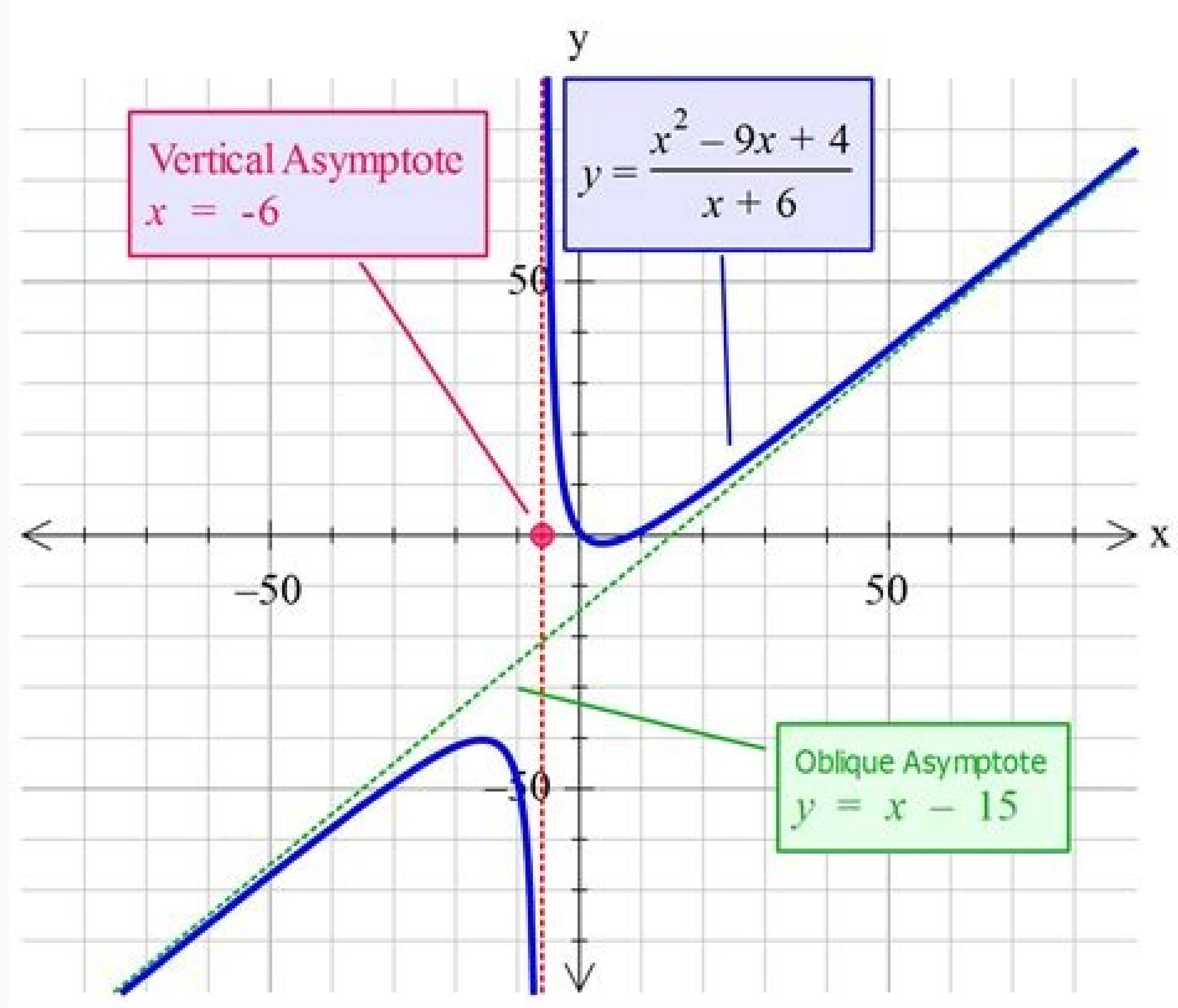

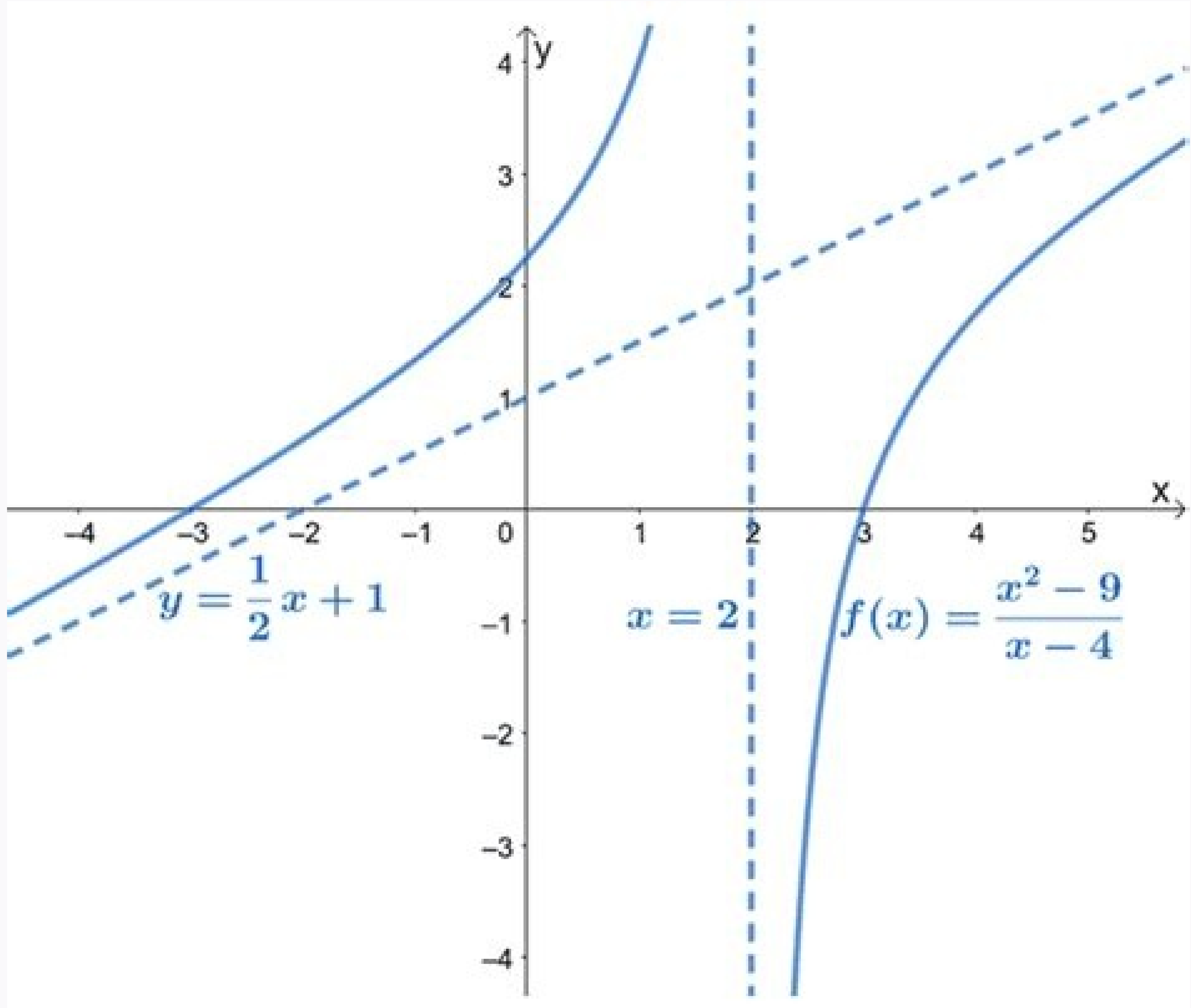

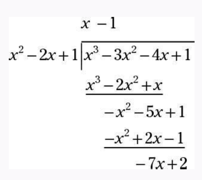

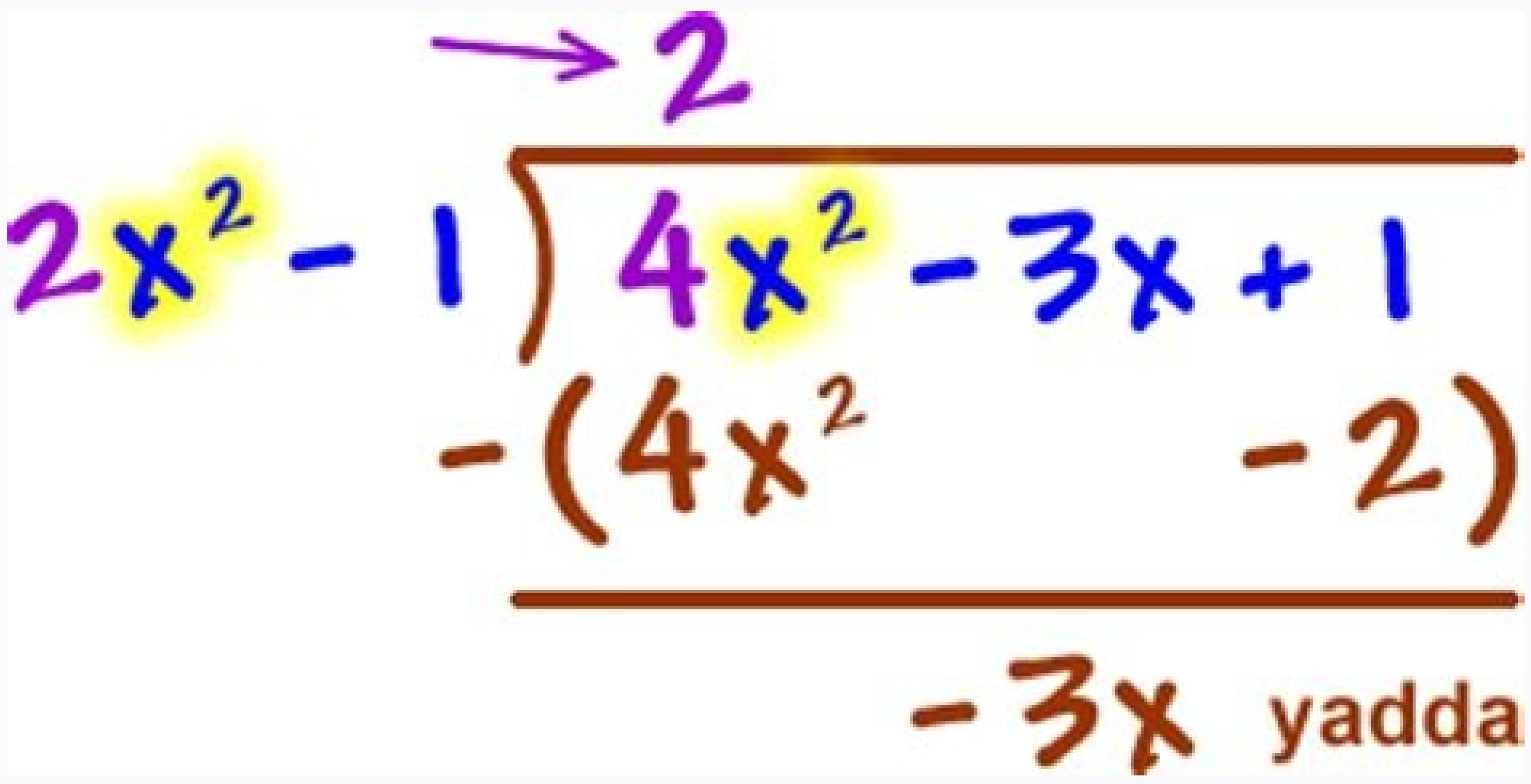

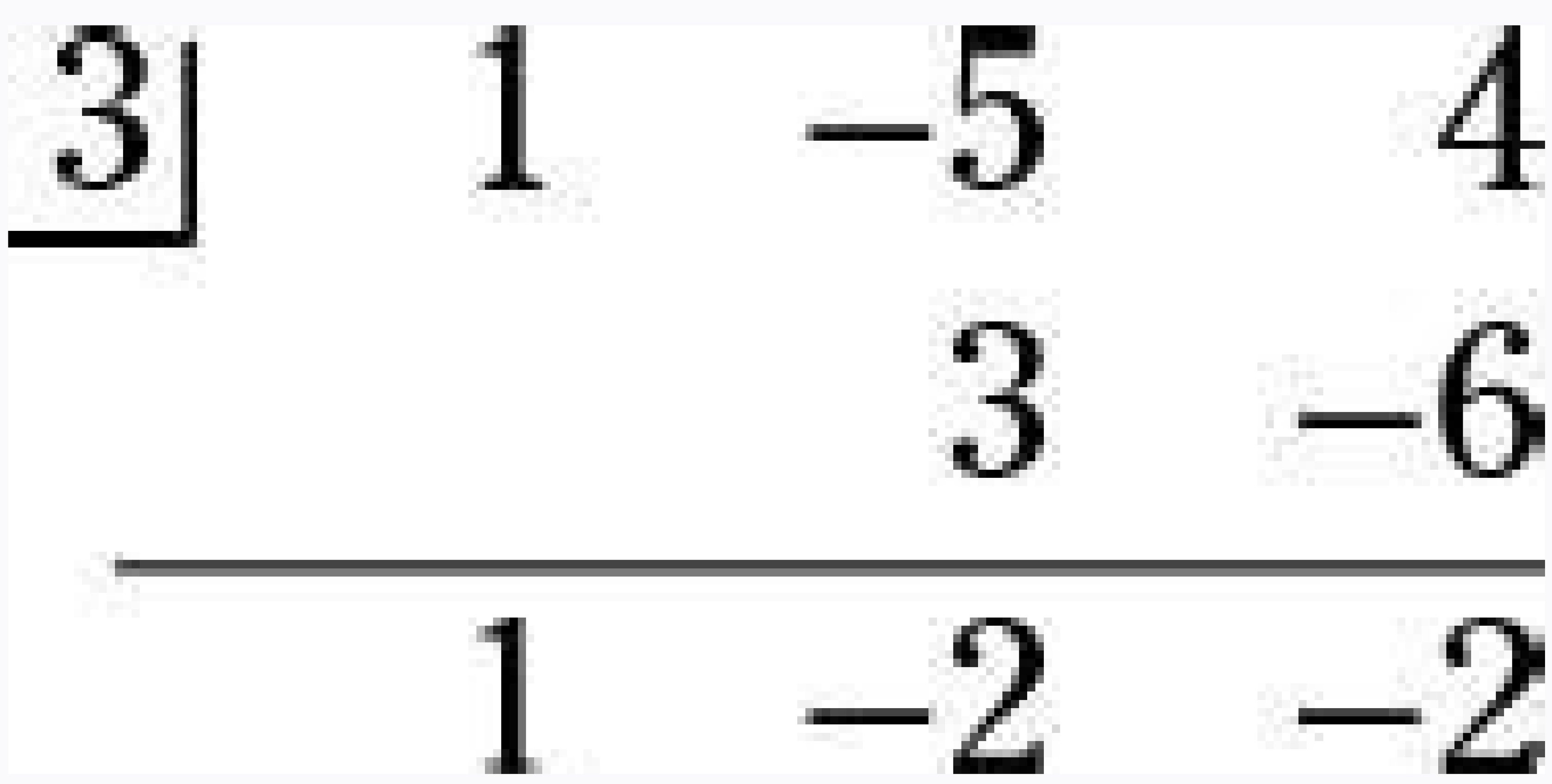

How to find oblique asymptotes of a function. How to find oblique asymptotes of a curve. How to find oblique asymptotes of hyperbola. How to find oblique asymptotes using limits. How to find oblique asymptotes on a graph. How to do long division to find oblique asymptotes. How to find oblique asymptotes without long division. How to find oblique asymptotes by looking at a graph.

1 Check the numerator and denominator of your polynomial. Make sure that the degree of the numerator (in other words, the highest exponent in the numerator) is greater than the degree of the denominator.[3] If it is, a slant asymptote exists and can be found. . As an example, look at the polynomial x^2 + 5x + 2 / x + 3. The degree of its numerator is greater than the degree of its denominator because the numerator has a power of 2 (x^2) while the denominator has a power of only 1. Therefore, you can find the slant asymptote. The graph of this polynomial is shown in the picture. 2 Create a long division problem. Place the numerator (the dividend) inside the division box, and place the denominator (the divisor) on the outside.[4] For the example above, set up a long division problem with x^2 + 5x + 2 as the dividend and x + 3 as the divisor. Advertisement 3 Find the first factor. Look for a factor that, when multiplied by the highest degree term in the denominator, will result in the same term as the highest degree term of the dividend. Write that factor above the division box. In the example above, you would look for a factor that, when multiplied by x, would result in the same term as the highest degree of x^2. In this case, that's x.Write the x above the division box. 4 Find the product of the factor and the whole divisor. Multiply to get your product, and write it beneath the dividend. In the example above, the product of x and x + 3 is x^2 + 3x. Write it under the dividend, as shown. 5 Subtract. Take the lower expression under the division box and subtract it from the upper expression. Draw a line and note the result of your subtraction underneath it. In the example above, subtract x^2 + 3x from x^2 + 5x + 2. Draw a line and note the result, 2x + 2, underneath it, as shown. 6 Continue dividing. Repeat these steps, using the result of your subtraction problem as your new dividend. In the example above, note that if you multiply 2 by the highest term of the divisor (x), you get the highest degree term of the dividend, which is now 2x + 2. Write the 2 on top of the division box by adding it to first factor, making it x + 2. Write the product of the factor and the divisor beneath the dividend, and subtract again, as shown. 7 Stop when you get an equation of a line. You do not have to perform the long division all the way to the end. Continue only until you get the equation of a line in the form ax + b, where a and b can be any numbers. In the example above, you can now stop. The equation of your line is x + 2. 8 Draw the line alongside the graph of the polynomial. Graph your line to verify that it is actually an asymptote. In the example above, you would need to graph x + 2 to see that the line moves alongside the graph of your polynomial but never touches it, as shown below. So x + 2 is indeed a slant asymptote of your polynomial. Advertisement Add New Question Question Where did the two polynomials come from? The (x^2 + 5x + 2) / (x+3) is part of an example. It is possible to tell that there will be a slant asymptote because the polynomial in the numerator has a degree than the polynomial in the denominator. With this in mind, you can make up as many problems or examples as you want. Question What does the remainder, once you've divided, mean in terms of the asymptote? It represents the vertical distance between the curve and the asymptote. It should approach zero as |x| approaches infinity. You might investigate whether the remainder is positive or negative, since that tells you whether the curve approaches the asymptote from above or from below. Ask a Question Advertisement Thanks! Thanks! Advertisement wikiHow is a "wiki," similar to Wikipedia, which means that many of our articles are co-written by multiple authors. To create this article, volunteer authors worked to edit and improve it over time. This article has been viewed 60,237 times. Co-authors: 5 Updated: May 18, 2019 Views: 60,237 Categories: Algebra Print Send fan mail to authors Thanks to all authors for creating a page that has been read 60,237 times. In my experience, students often hit a roadblock when they see the word asymptote. What is an asymptote anyway? How do you find them? Is this going to be on the test??? (The answer to the last question is yes. Asymptotes definitely show up on the AP Calculus exams). Of the three varieties of asymptote — horizontal, vertical, and oblique — perhaps the oblique asymptotes are the most mysterious. In this article we define oblique asymptotes and show how to find them. What is an Oblique Asymptote? An oblique (or slant) asymptote is a slanted line that the function approaches as x approaches ∞ (infinity) or -∞ (minus infinity). Let's explore this definition a little more, shall we? It's All About the Line Since all non-vertical lines can be written in the form y = mx + b for some constants m and b, we say that a function f(x) has an oblique asymptote y = mx + b if the values (the y-coordinates) of f(x) get closer and closer to the values of mx + b as you trace the curve to the right (x → ∞) or to the left (x → -∞), in other words, if there is a good approximation, f(x) ≈ mx + b, when x gets extremely large in the positive or negative sense. Still with me? I understand completely if you're still a little lost, but let's see if we can clear up some confusion using the graph shown below. As you can see, the function (shown in blue) seems to get closer to the dashed line. Therefore, the oblique asymptote for this function is y = ½ x – 1. Finding Oblique Aymptotes A function can have at most two oblique asymptotes, but only certain kinds of functions are expected to have an oblique asymptote at all. For instance, polynomials of degree 2 or higher do not have asymptotes of any kind. (Remember, the degree of a polynomial is the highest exponent on any term. For example, 10x3 – 3x4 + 3x – 12 has degree 4.) As a quick application of this rule, you can say for sure without any work that there are no oblique asymptotes for the quadratic function f(x) = x2 + 3x – 10, because it's a polynomial of degree 2. On the other hand, some kinds of rational functions do have oblique asymptotes. Rational Functions A rational function has the form of a fraction, f(x) = p(x) / q(x), in which both p(x) and q(x) are polynomials. If the degree of the numerator (top) is exactly one greater than the degree of the denominator (bottom), then f(x) will have an oblique asymptote. So there are no oblique asymptotes for the rational function, . But a rational function like does have one. Knowing when there is a horizontal asymptote is just half the battle. Now how do we find it? This next step involves polynomial division. Polynomial Division to Find Oblique Asymptotes If you've made it this far, you probably have seen long division of polynomials, or synthetic division, but if you are rusty on the technique, then check out this video or this article. The idea is that when you do polynomial division on a rational function that has one higher degree on top than on the bottom, the result always has the form mx + b + remainder term. Then the oblique asymptote is the linear part, y = mx + b. We don't need to worry about the remainder term at all. Example Using Polynomial Division Let's see how the technique can be used to find the oblique asymptote of . The long division is shown below. Because the quotient is 2x + 1, the rational function has an oblique asymptote: y = 2x + 1. Hyperbolas Another place where oblique asymptotes show up is in the graphs of hyperbolas. Remember, in the simplest case, a hyperbola is characterized by the standard equation, The hyperbola graph corresponding to this equation has exactly two oblique asymptotes, The two asymptotes cross each other like a big X. Example Involving a Hyperbola Let's find the oblique asymptotes for the hyperbola with equation x2/9 – y2/4 = 1. In the given equation, we have a2 = 9, so a = 3, and b2 = 4, so b = 2. This means that the two oblique asymptotes must be at y = ±(b/a)x = ±(2/3)x. More General Hyperbolas It's important to realize that hyperbolas come in more than one flavor. If the hyperbola has its terms switched, so that the "y" term is positive and "x" term is negative, then the asymptotes take a slightly different form. Furthermore, if the center of the hyperbola is at a different point than the origin, (h, k), then that affects the asymptotes as well. Below is a summary of the various possibilities. Final Thoughts So when you see a question on the AP Calculus AB exam asking about oblique asymptotes, don't forget: If the function is rational, and if the degree on the top is one more than the degree on the bottom: Use polynomial division. If the graph is a hyperbola with equation x2/a2 – y2/b2 = 1, then your asymptotes will be y = ±(b/a)x. Other kinds of hyperbolas also have standard formulas defining their asymptotes. Keeping these techniques in mind, oblique asymptotes will start to seem much less mysterious on the AP exam! By the way, Magoosh can help you study for both the SAT and ACT exams. Click here to learn more! VerticalHorizontalExamples In the previous section, covering horizontal asymptotes, we learned how to deal with rational functions where the degree of the numerator was equal to or less than that of the denominator. But what happens if the degree is greater in the numerator than in the denominator? Recall that, when the degree of the denominator was bigger than that of the numerator, we saw that the value in the denominator got so much bigger, so quickly, that it was so much "stronger" that it "pulled" the functional value down to zero, giving us a horizontal asymptote of the x-axis. Reasonably, then, if the numerator has a power that is larger than that of the denominator, then the value of the numerator ought to be "stronger", and ought to "pull" the graph away from the x-axis (that is, the line y = 0) or any other fixed y-value. To investigate this, let's look at the following function: For reasons that will shortly become clear, I'm going to apply long polynomial division to this rational expression. My work looks like this: Across the top is the quotient, being the linear polynomial expression −3x − 3. At the bottom is the remainder. This means that, via long division, I can convert the original rational function they gave me into something akin to mixed-number format: This is the exact same function. All I've done is rearrange it a bit. Why? You're about to see. First, take a look at the graph of the rational function they gave us: Thinking back to the results of my long division, you know what the graph of y = −3x − 3 looks like; it's a decreasing straight line, crossing the y-axis at −3 and having a slope of m = −3. Now take a look at this second graph of the same rational function, but with the line y = −3x − 3 superimposed on it: As you can see, apart from the middle of the plot near the origin, the graph hugs the line y = −3x − 3. Because of this "skinnying along the line" behavior of the graph, the line y = −3x − 3 is an asymptote. Clearly, it's not a horizontal asymptote. Instead, because its line is slanted or, in fancy terminology, "oblique", this is called a "slant" (or "oblique") asymptote. The graphs show that, if the degree of the numerator is exactly one more than the degree of the denominator (so that the polynomial fraction is "improper"), then the graph of the rational function will be, roughly, a slanty straight line with some fiddly bits in the middle. Because the graph will be nearly equal to this slanted straight-line equivalent, the asymptote for this sort of rational function is called a "slant" (or "oblique") asymptote. The equation for the slant asymptote is the polynomial part of the rational that you get after doing the long division. By the way, this relationship — between an improper rational function, its associated polynomial, and the

graph — holds true regardless of the difference in the degrees of the numerator and denominator. However, in most textbooks, they only have you work with a degree-difference of one. To find the slant asymptote, I'll do the long division: I need to remember that the slant asymptote is the polynomial part of the answer (that is, the part across the top of the division), not the remainder (that is, not the last value at the bottom). Then my answer is: slant asymptote: $y = x + 5$ They've tried to trip me up here! They omitted a linear term in the polynomial on top, and they put the terms in the wrong order underneath. So, when I'm doing my long division, I'll need to be careful of the missing linear term in the numerator, and of the signs when I reverse the terms in the denominator. The slant asymptote is the polynomial part of the answer, so: slant asymptote: $y = -2x - 4$ If you're not comfortable with the long-division part of these exercises, then go back and review now! A note for the curious regarding the horizontal and slant asymptote rules. Otherwise, continue on to the worked examples. URL:

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