

**Mth 30, Homework 7 on sections 3.7, 4.1, 4.2**

Due by Wed, Mar 27.

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Please use lots of space and explain your answers, showing clearly any work you had to do. Each question is worth 3 points.

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- (1) Decide if these rational functions have horizontal asymptotes. If they do, give the equation of the horizontal asymptote line (it will be  $y = \text{a number}$ ). No need to graph these functions.

(a)  $f(x) = \frac{x^3}{x^2 + 4}$       (b)  $g(x) = \frac{5x}{x^2 + 4}$       (c)  $h(x) = \frac{5x^3}{x^3 + 4}$

(Hint: the way to find horizontal asymptotes is to first compare the degrees of top and bottom. There are three possibilities...)

- (2) Let  $f(x)$  be the rational function

$$f(x) = \frac{x^2 - 1}{x^3 + 9x^2 + 14x}$$

and find

- (a) its domain,
- (b) the equations of the vertical asymptote lines,
- (c) the equation of the horizontal asymptote line.

(Hint: Factor the bottom and see where it is zero to help answer parts (a) and (b). Remember that the equations of vertical lines are  $x = \text{number}$ , and horizontal lines are  $y = \text{number}$ .)

- (3) For the rational function

$$g(x) = \frac{-3x + 1}{x + 2}$$

find its  $x$  and  $y$  intercepts. Find its vertical and horizontal asymptotes. With this information sketch the graph, using a table of values to find more points if needed.

(Remember, finding where the top is zero gives the  $x$ -intercepts, and finding where the bottom is zero gives the vertical asymptotes.)

- (4) For the rational function

$$h(x) = \frac{x^2 - 3x - 4}{x^2 - x - 6}$$

find its  $x$  and  $y$  intercepts. Find its vertical and horizontal asymptotes. With this information sketch the graph, using a table of values to find more points if needed.

(5) Let  $f(x)$  be the exponential function  $5 \cdot 3^x$ . Compute: (a)  $f(4)$  and (b)  $f(-2)$

(6) Let

$$g(x) = -8 \left( \frac{1}{4} \right)^x$$

and compute: (a)  $g(0)$  and (b)  $g(3)$

(7) A fast food chain starts with 12 restaurants and every year the number increases by 8%. Explain why and how  $f(t) = 12(1.08)^t$  models this situation. How many restaurants does the chain have after 15 years?

(8) Sketch the graph of  $f(x) = 4^x$  carefully by plotting 5 points corresponding to  $x = -2, -1, 0, 1, 2$ , including the  $y$ -intercept and showing the horizontal asymptote.

(9) By starting with your graph in the last question and using transformations, (like moving up, down, left, right or reflecting through the  $x$  axis), sketch the graphs of

(a)  $h(x) = 4^x - 1$

(b)  $q(x) = -4^x$

(c)  $r(x) = 4^{x-3}$

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If you get stuck on a question or aren't sure if you understand it:

- Go over the relevant class notes and section in the textbook.
- Check if you get the right answer for a similar odd-numbered question in the textbook (answers at the back of the book).
- Ask me about it after class.
- Come to my office hours: Mon 12:00 - 1:00, Wed 12:00 - 1:00 in CP 317.
- Go to the Math Tutorial Lab in-person in CP 303 or online.