4-3 Activity Draft: Rational Functions

**4-3-1 The famous function 1/x.**

Somehow treat it as the “reciprocal function”

Graphic Details: Amount of milk you can buy with #5 vs. price per gallon. Why is it not linear?

**4-3-2 Polynomial long division**

Do long division of whole numbers and the analogous polynomials. Write result as a = bq+r as well as a/b = b + q/r.

Discover that remainder when div. by x – 3 is f(3).

Expect cubic over linear to be…, etc. (Pair with dividing something in the 100000’s by 100’s estimation.

??Here?? Take a rational function and plug in x = 100. Recall work with individual polynomials and what will dominate in the end.

S-Z: 3.2: p. 265; FM 5.2: Several divisions. Include at least one with missing terms.

Calc-Medic 2.3: (day 7 of unit 2): Consider the polynomial function �(�) = �! − 4�" − 18�# + �� − 15, where c is an unknown real number. If (� + 3) is a factor of this polynomial, what is the value of c?

**4-3-3 Rational Functions**

% of Koolaid after starting with 3 cups mix to 5 cups water: Pour more mix: (x+3)/(x+8) or 3/(x+8): End behavior.

Is sum of rational functions a rational function?

Take a rational function and plug in around where there will be a hole (cancel same factor number each time)

Take a rational function and plug in x = 100. Recall work with individual polynomials and what will dominate in the end.

1151 Activity of matching rational functions to graphs.

FM: 6.3:several: Given Rational Functions: ݕ ݔଶ െ 4ݔ െ 12 ݔଶ ൅ 5ݔ ൅ 6 Hole/Vertical Asymptotes: Y‐Int: X‐int: Horizontal/Slant Asymptote: Graph: Plot slant asymptote line.

S-Z: 4.1 p. 314: HW #19-20: The cost C in dollars to remove p% of the invasive species of Ippizuti fish from Sasquatch Pond is given by C(p) = 1770p /100 − p , 0 ≤ p < 100 (a) Find and interpret C(25) and C(95). (b) What does the vertical asymptote at x = 100 mean within the context of the problem? (c) What percentage of the Ippizuti fish can you remove for $40000? 20. In Exercise 71 in Section 1.4, the population of Sasquatch in Portage County was modeled by the function P(t) = 150t/ t + 15 , where t = 0 represents the year 1803. Find the horizontal asymptote of the graph of y = P(t) and explain what it means.

APC:g: p. 292 5.4 HW #10-11: A rectangular box is being constructed so that its base is 1.5 times as long as it is wide. In addition, suppose that material for the base and top of the box costs $3.75 per square foot, while material for the sides costs $2.50 per square foot. Finally, we want the box to hold 8 cubic feet of volume. a. Draw a labeled picture of the box with x as the length of the shorter side of the box’s base and h as its height. b. Determine a formula involving x and h for the total surface area, S, of the box. c. Use your work from (b) along with the given information about cost to determine a formula for the total cost, C, oif the box in terms of x and h. d. Use the volume constraint given in the problem to write an equation that relates x and h, and solve that equation for h in terms of x. e. Combine your work in (c) and (d) to write the cost, C, of the box as a function solely of x. f. What is the domain of the cost function? How does a graph of the cost function appear? What does this suggest about the ideal box for the given constraints?

#11: A cylindrical can is being constructed so that its volume is 16 cubic inches. Suppose that material for the lids (the top and bottom) cost $0.11 per square inch and material for the “side” of the can costs $0.07 per square inch. Determine a formula for the total cost of the can as a function of the can’s radius. What is the domain of the function and why? Hint. You may find it helpful to ask yourself a sequence of questions like those stated in Exercise 10).

APC: 5.5 p. 294: Activity 5.5.1: Consider the rational function r(x) x 2−1 x 2−3x−4 , and let p(x) x 2 − 1 (the numerator of r(x)) and q(x) x 2 − 3x − 4 (the denominator of r(x)). a. Reasoning algebraically, for what values of x is p(x) 0? b. Again reasoning algebraically, for what values of x is q(x) 0? c. Define r(x) in Desmos, and evaluate the function appropriately to find numerical values for the output of r and hence complete the following tables. x r(x) 4.1 4.01 4.001 3.9 3.99 3.999 x r(x) 1.1 1.01 1.001 0.9 0.99 0.999 x r(x) −1.1 −1.01 −1.001 −0.9 −0.99 −0.999 d. Why does r behave the way it does near x 4? Explain by describing the behavior of the numerator and denominator. 294 5.5 Key features of rational functions e. Why does r behave the way it does near x 1? Explain by describing the behavior of the numerator and denominator. f. Why does r behave the way it does near x −1? Explain by describing the behavior of the numerator and denominator. g. Plot r in Desmos. Is there anything surprising or misleading about the graph that Desmos generates?

APCing: 5.5 HW #5 p. 302: Let t be the time in weeks. At time t 0, organic waste is dumped into a pond. The oxygen level in the pond at time t is given by f (t) t 2 − t + 1 t 2 + 1 . Assume f (0) 1 is the normal level of oxygen. (a) On a separate piece of paper, graph this function. (b) What will happen to the oxygen level in the lake as time goes on? □ The oxygen level will continue to decrease in the long-run. □ The oxygen level will continue to increase in the long-run. □ The oxygen level will eventually return to its normal level in the long-run. □ It cannot be determined based on the given information. (c) Approximately how many weeks must pass before the oxygen level returns to 80% of its normal level?

Calc-Medic: 2.6 (Unit 2 Day 110: When patients undergo surgery, the anesthesiologist must administer the right amount of drugs to the patient to keep them sedated during the procedure. The well-being of the patient depends on the doctor’s ability to predict how long the anesthesia will stay in the patient’s bloodstream. How does he or she do this?

What do you think will happen if a patient receives too little or too much anesthesia? 2. The concentration of anesthesia in a person’s blood stream can be modeled by �(�) = !"# #!$% , where C is given as a percent and t is in hours. A graph of �(�) is shown below. a. What do you notice about the graph? What do you wonder? b. What is the concentration of anesthesia after a half hour? 3. The anesthesia is effective once the concentration reaches 5%. How long after administering the drug should the surgeon wait to start the procedure? How do you know? 4. How long is the drug effective? Show how you can figure this out using a graph AND algebraically. 5. After many, many hours, what do you anticipate will happen to the concentration of anesthesia? 6. When is the concentration of anesthesia zero? How do you know?

Calc-Medic 2.6: (Unit 2 Day 11): A rare species of insect was discovered in the Amazon Rainforest. To protect the species from extinction, entomologists transferred a certain number of insects to a protected area. The population P of the new colony t days after the transfer is given by �(�) = "+(\*$+."#) ($+.+\*# . a. Find the y-intercept of �(�). Interpret this value in the context of this problem. b. After how many days will the insect population reach 100? Show your work. c. Explain what will happen to the insect population after many, many years.

MFG 7.4: 7.73: Queueing theory is used to predict your waiting time in a line, or queue. For example, suppose the attendant at a toll booth can process 6 vehicles per minute. The average total time spent by a motorist negotiating the toll booth depends on the rate, r, at which vehicles arrive, according to the formula

T=g(r)=12−r12(6−r)

1. What is the average time spent at the toll booth if vehicles arrive at a rate of 3 vehicles per minute?

Answer: min.

1. Graph the function on the domain [0,6].
2. What is the vertical asymptote of the graph?

Equation of asymptote:

What does it tell you about the queue?

A) The wait time approaches 6 minutes as the arrival rate becomes infinite.  
 B) The wait time becomes infinite as the arrival rate approaches 6 vehicles per minute.  
 C) The wait time never reaches 6 minutes.

MFG 7.4 HW #6: e number of loaves of Mom’s Bread sold each day is approximated by the demand function

D(p)=1001+(p−1.10)4D(p)=1001+(p−1.10)4

where pp is the price per loaf in dollars.

1. Complete the table showing the demand for Mom's Bread at various prices per loaf. Round the values of D(p)D(p) to the nearest whole number.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| pp | 0.250.25 | 0.500.50 | 1.001.00 | 1.251.25 | 1.501.50 | 1.751.75 | 2.002.00 | 2.252.25 | 2.502.50 | 2.752.75 | 3.003.00 |
| Demand |  |  |  |  |  |  |  |  |  |  |  |

1. Graph the demand function C(n)C(n) in the window

Xmin=0Xmax=3.74Ymin=0Ymax=170Xmin=0Xmax=3.74Ymin=0Ymax=170

What happens to the demand for Mom's Bread as the price increases?

1. Add a row to your table to show the daily revenue from Mom’s Bread at various prices.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| pp | 0.250.25 | 0.500.50 | 1.001.00 | 1.251.25 | 1.501.50 | 1.751.75 | 2.002.00 | 2.252.25 | 2.502.50 | 2.752.75 | 3.003.00 |
| Demand |  |  |  |  |  |  |  |  |  |  |  |
| Revenue |  |  |  |  |  |  |  |  |  |  |  |

1. Using the formula for D(p),D(p), write an expression R(p)R(p) that approximates the total daily revenue as a function of the price, p.p.
2. Graph the revenue function R(p)R(p) in the same window with D(p).D(p). Estimate the maximum possible revenue. Does the maximum for D(p)D(p) occur at the same value of pp as the maximum for R(p)?R(p)?
3. Find the horizontal asymptote of the graphs. What does it represent in this context?

ORCCA; III-141: 12.1: Example 12.1.2 When a drug is injected into a patient, the drug’s concentration in the patient’s bloodstream can be modeled by the function C, with formula C(t) = 3t t 2 + 8 where C(t) gives the drug’s concentration, in milligrams per liter, t hours since the injection. A new injection is needed when the concentration falls to 0.35 milligrams per liter. Using graphing technology, we will graph y = 3t t 2+8 and y = 0.35 to examine the situation and answer some important questions. 1 2 3 4 5 6 7 8 9 10 11 0.25 0.5 0.75 y = C(t) y = 0.35 (1.066,0.35) (7.506,0.35) (2.828,0.53) t, time in hours y, concentration (mg per liter) Figure 12.1.3: Graph of C(t) = 3t t 2+8 a. What is the concentration after 10 hours? b. After how many hours since the first injection is the drug concentration greatest? c. After how many hours since the first injection should the next injection be given? d. What happens to the drug concentration if no further injections are given?

ORCCA 12.1 HW #1 III-149; The population of deer in a forest can be modeled by P(x) = 320x + 2200 4x + 5 where x is the number of years in the future. Answer the following questions. a. How many deer live in this forest this year? b. How many deer will live in this forest 14 years later? Round your answer to an integer. c. After how many years, the deer population will be 100? Round your answer to an integer. d. Use a calculator to answer this question: As time goes on, the population levels off at about how many deer?

On all, need to discuss degrees of top and bottom and why the dominant one controls the end behavior (not doing division argument yet, but by evaluating at large values. Slant asymptotes by noting linear behavior). Also identify holes.

Polynomials in disguise: Is (x^2 – 4)/(x+2) = x+2? Domain issues.