

Review Guide for Chapter 9

Definitions: How are the following terms defined?

- real-valued function of a real variable (*p.* 510)
- graph of a real-valued function of a real variable (*p.* 511)
- power function with exponent a (*p.* 511)
- floor function (*p.* 512)
- multiple of a real-valued function of a real variable (*p.* 514)
- increasing function (*pp.* 515-6)
- decreasing function (*pp.* 515-6)
- $f(x)$ is $\Omega(g(x))$, where f and g are real-valued functions of a real variable defined on the same set of nonnegative real numbers (*p.* 519)
- $f(x)$ is $O(g(x))$, where f and g are real-valued functions of a real variable defined on the same set of nonnegative real numbers (*p.* 519)
- $f(x)$ is $\Theta(g(x))$, where f and g are real-valued functions of a real variable defined on the same set of nonnegative real numbers (*p.* 519)
- algorithm A is $\Theta(g(n))$ (or A has order $g(n)$) (*p.* 533)
- algorithm A is $\Omega(g(n))$ (or A has a best case order $g(n)$) (*p.* 533)
- algorithm A is $O(g(n))$ (or A has a worst case order $g(n)$) (*p.* 533)

Polynomial and Rational Functions and Their Orders

- What is the difference between the graph of a function defined on an interval of real numbers and the graph of a function defined on a set of integers? (*p.* 513)
- How do you graph a multiple of a real-valued function of a real variable? (*p.* 514)
- How do you prove that a function is increasing (decreasing)? (*p.* 516)
- What are some properties of O -, Ω -, and Θ -notation? Can you prove them? (*p.* 521)
- If $x > 1$, what is the relationship between x^r and x^s , where r and s are rational numbers and $r < s$? (*p.* 522)
- Given a polynomial, how do you use the definition of Θ -notation to show that the polynomial has order x^n , where n is the degree of the polynomial? (*pp.* 523-5)
- What is the theorem on polynomial orders? (*p.* 526)
- What is an order for the sum of the first n integers? (*p.* 527)

Efficiency of Algorithms

- How do you compute the order of an algorithm segment that contains a loop? a nested loop? (*pp.* 533-35)
- How do you find the number of times a loop will iterate when an algorithm segment is executed? (*p.* 534)
- How do you use the theorem on polynomial orders to help find the order of an algorithm segment? (*p.* 535)
- What is the sequential search algorithm? How do you compute its worst case order? its average case order? (*p.* 536)
- What is the insertion sort algorithm? How do you compute its best and worst case orders? (*p.* 536)

Logarithmic and Exponential Orders

- What do the graphs of logarithmic and exponential functions look like? (pp. 544-5)
- What can you say about the base 2 logarithm of a number that is between two consecutive powers of 2? (p. 546)
- How do you compute the number of bits needed to represent a positive integer in binary notation? (p. 547)
- How are logarithms used to solve recurrence relations? (p. 548)
- If $b > 1$, what can you say about the relation among $\log_b x$, x^r , and $x \log_b x$? (p. 550)
- If $b > 1$ and $c > 1$, how are orders of $\log_b x$ and $\log_c x$ related? (p. 552)
- What is an order for a harmonic sum? (p. 553)
- What is a divide-and-conquer algorithm? (p. 557)
- What is the binary search algorithm? (p. 557)
- What is the worst case order for the binary search algorithm, and how do you find it? (p. 560)
- What is the merge sort algorithm? (p. 564)
- What is the worst case order for the merge sort algorithm, and how do you find it? (p. 567)