

## Review Questions for Reading #6

1. Suppose that  $f : \mathbb{N} \rightarrow \mathbb{N}$  or  $f : \mathbb{R} \rightarrow \mathbb{R}$ . What does it mean for  $f$  to be **asymptotically positive**?

Suppose, for the remainder of these questions, that either  $f, g : \mathbb{R} \rightarrow \mathbb{R}$  or  $f, g : \mathbb{N} \rightarrow \mathbb{N}$  and that  $f$  and  $g$  are asymptotically positive.

2. State the definition of " $f \in O(g)$ ".
3. Describe, more informally, what it means about the relationship between  $f$  and  $g$  when  $f \in O(g)$ .

4. Describe a sequence of steps that you can follow in order to use the above definition to *prove* that  $f \in O(g)$  for a given pair of functions  $f$  and  $g$ .

5. State the **Limit Test for  $O(g)$** .

6. Why is it (at least arguably) important that you know how to use the *definition* of  $O(g)$ , instead of just the limit test, to prove that  $f \in O(g)$ ?

7. State *l'Hôpital's Rule*.

8. Why is it (sometimes) useful to know the above rule when you are trying to use the limit test to prove that  $f \in O(g)$  for a given pair of functions  $f$  and  $g$ ?

9. State the definition of  $f \in \Omega(g)$ . Then say, less formally, what this means about the relationship between  $f$  and  $g$ .

10. Describe **three** ways to prove that  $f \in \Omega(g)$ .

When doing this you will need to name two theorems that were given, in the notes for this reading, concerning this. (Note that you should also be able to **state** these theorems!)

11. State the definition of  $f \in \Theta(g)$ . Then say, less formally, what this means about the relationship between  $f$  and  $g$ .

12. Describe a process that can be followed to prove that  $f \in \Theta(g)$  for a given pair of functions  $f$  and  $g$ .

13. State the definition of  $f \in o(g)$ . Then say, less formally, what this means about the relationship between  $f$  and  $g$ .

14. Describe two methods that can be used to prove that  $f \in o(g)$  for a pair of functions  $f$  and  $g$ . You will need to name a theorem, stated in the notes for this reading, to do this — but you should also be able to *state* this theorem.

15. State the definition of  $f \in \omega(g)$ . Then say, less formally, what this means about the relationship between  $f$  and  $g$ .

16. Describe three methods that can be used to prove that  $f \in \omega(g)$  for a pair of functions  $f$  and  $g$ . You will need to name two theorems, stated in the notes for this reading, to do this — but you should also be able to **state** these theorems.

17. Define a ***polynomial function*** with ***degree  $d$*** .

18. Give three useful properties about the rates of growth of polynomial functions with various degrees.

19. Define an ***exponential function***.

20. Give six useful properties about the rates of growth of polynomial functions and exponential functions.

21. Give the definition of a ***logarithmic function***.

22. Give two useful properties about the rates of growth of polynomial functions and logarithmic functions.