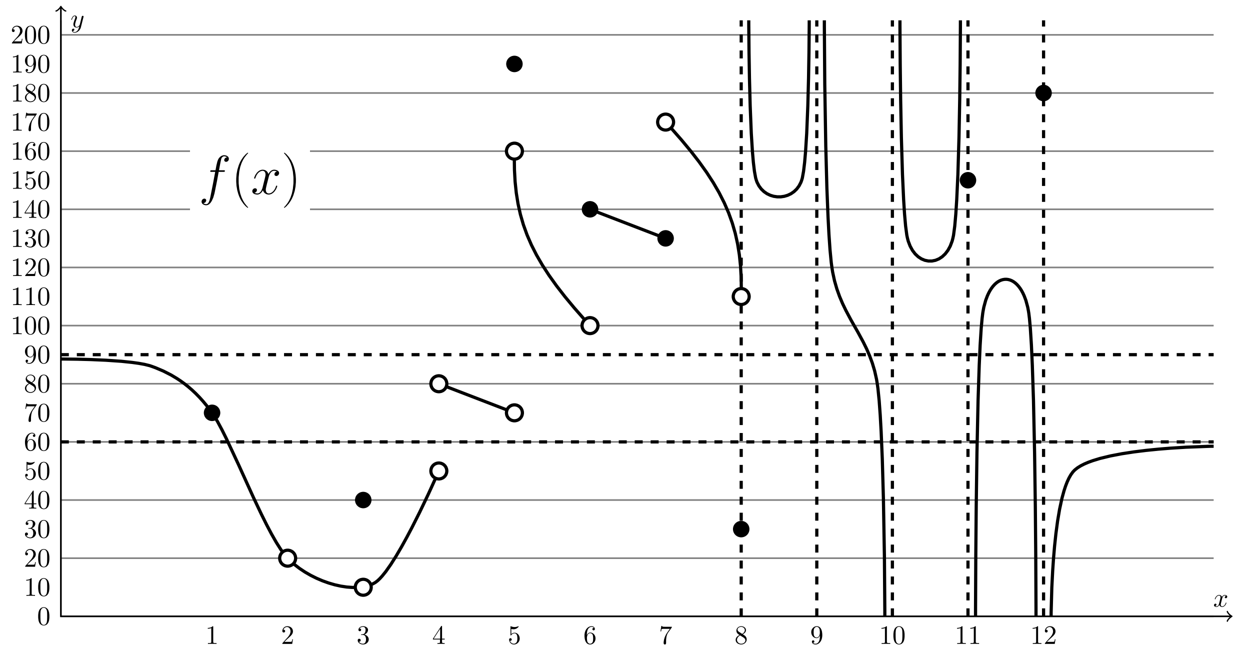


1 Find Limits Graphically

1. $\begin{cases} f(1) = \textbf{70} \\ \lim\limits_{x\to 1^-} f(x) = \textbf{70} \\ \lim\limits_{x\to 1^+} f(x) = \textbf{70} \\ \lim\limits_{x\to 1} f(x) = \textbf{70} \end{cases}$

2. $\begin{cases} f(2) = \textbf{undefined} \\ \lim\limits_{x\to 2^-} f(x) = \textbf{20} \\ \lim\limits_{x\to 2^+} f(x) = \textbf{20} \\ \lim\limits_{x\to 2} f(x) = \textbf{20} \end{cases}$

3. $\begin{cases} f(3) = \textbf{40} \\ \lim\limits_{x\to 3^-} f(x) = \textbf{10} \\ \lim\limits_{x\to 3^+} f(x) = \textbf{10} \\ \lim\limits_{x\to 3} f(x) = \textbf{10} \end{cases}$

4. $\begin{cases} f(4) = \textbf{undefined} \\ \lim\limits_{x\to 4^-} f(x) = \textbf{50} \\ \lim\limits_{x\to 4^+} f(x) = \textbf{80} \\ \lim\limits_{x\to 4} f(x) = \textbf{DNE} \end{cases}$

5. $\begin{cases} f(5) = \textbf{190} \\ \lim\limits_{x\to 5^-} f(x) = \textbf{70} \\ \lim\limits_{x\to 5^+} f(x) = \textbf{160} \\ \lim\limits_{x\to 5} f(x) = \textbf{DNE} \end{cases}$

6. $\begin{cases} f(6) = \textbf{140} \\ \lim\limits_{x\to 6^-} f(x) = \textbf{100} \\ \lim\limits_{x\to 6^+} f(x) = \textbf{140} \\ \lim\limits_{x\to 6} f(x) = \textbf{DNE} \end{cases}$

7. $\begin{cases} f(7) = \textbf{130} \\ \lim\limits_{x\to 7^-} f(x) = \textbf{130} \\ \lim\limits_{x\to 7^+} f(x) = \textbf{170} \\ \lim\limits_{x\to 7} f(x) = \textbf{DNE} \end{cases}$

2 Find Limits Involving Infinity Graphically

8. $\begin{cases} f(8) = \textbf{30} \\ \lim\limits_{x\to 8^-} f(x) = \textbf{110} \\ \lim\limits_{x\to 8^+} f(x) = +\infty \\ \lim\limits_{x\to 8} f(x) = \textbf{DNE} \end{cases}$

9. $\begin{cases} f(9) = \textbf{undefined} \\ \lim\limits_{x\to 9^-} f(x) = +\infty \\ \lim\limits_{x\to 9^+} f(x) = +\infty \\ \lim\limits_{x\to 9} f(x) = +\infty \end{cases}$

10. $\begin{cases} f(10) = \textbf{undefined} \\ \lim\limits_{x\to 10^-} f(x) = -\infty \\ \lim\limits_{x\to 10^+} f(x) = +\infty \\ \lim\limits_{x\to 10} f(x) = \textbf{DNE} \end{cases}$

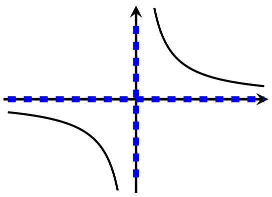
11. $\begin{cases} f(11) = \textbf{150} \\ \lim\limits_{x\to 11^-} f(x) = +\infty \\ \lim\limits_{x\to 11^+} f(x) = -\infty \\ \lim\limits_{x\to 11} f(x) = \textbf{DNE} \end{cases}$

12. $\begin{cases} f(12) = \textbf{180} \\ \lim\limits_{x\to 12^-} f(x) = -\infty \\ \lim\limits_{x\to 12^+} f(x) = -\infty \\ \lim\limits_{x\to 12} f(x) = -\infty \end{cases}$

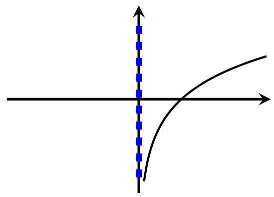
13. $\lim\limits_{x\to -\infty} f(x) = \textbf{90}$

14. $\lim\limits_{x\to +\infty} f(x) = \textbf{60}$

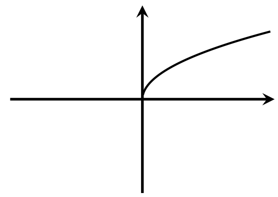
3 Famous Functions

15. 

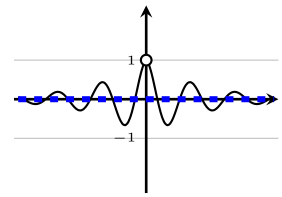
$$1/0 = \textbf{undefined}$$
$$\lim_{x\to 0^-} 1/x = -\infty$$
$$\lim_{x\to 0^+} 1/x = +\infty$$
$$\lim_{x\to 0} 1/x = \textbf{DNE}$$
$$\lim_{x\to -\infty} 1/x = \mathbf{0}$$
$$\lim_{x\to +\infty} 1/x = \mathbf{0}$$

16. 

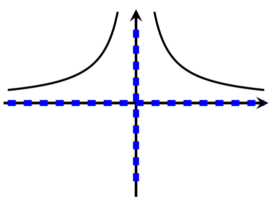
$$\ln 0 = \textbf{undefined}$$
$$\lim_{x\to 0^-} \ln x = \textbf{DNE}$$
$$\lim_{x\to 0^+} \ln x = -\infty$$
$$\lim_{x\to -\infty} \ln x = \textbf{DNE}$$
$$\lim_{x\to +\infty} \ln x = +\infty$$

17. 

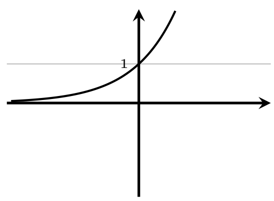
$$\sqrt{0} = \mathbf{0}$$
$$\lim_{x\to 0^-} \sqrt{x} = \textbf{DNE}$$
$$\lim_{x\to 0^+} \sqrt{x} = \mathbf{0}$$
$$\lim_{x\to -\infty} \sqrt{x} = \textbf{DNE}$$
$$\lim_{x\to +\infty} \sqrt{x} = +\infty$$

18. 

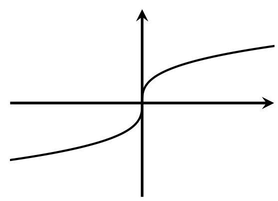
$$\sin(0)/0 = \textbf{undefined}$$
$$\lim_{x\to 0^-} \sin(x)/x = \mathbf{1}$$
$$\lim_{x\to 0^+} \sin(x)/x = \mathbf{1}$$
$$\lim_{x\to 0} \sin(x)/x = \mathbf{1}$$
$$\lim_{x\to -\infty} \sin(x)/x = \mathbf{0}$$
$$\lim_{x\to +\infty} \sin(x)/x = \mathbf{0}$$

19. 

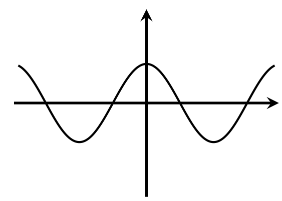
$$1/0^2 = \textbf{undefined}$$
$$\lim_{x\to 0^-} 1/x^2 = +\infty$$
$$\lim_{x\to 0^+} 1/x^2 = +\infty$$
$$\lim_{x\to 0} 1/x^2 = +\infty$$
$$\lim_{x\to -\infty} 1/x^2 = \mathbf{0}$$
$$\lim_{x\to +\infty} 1/x^2 = \mathbf{0}$$

20. 

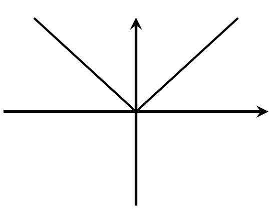
$$e^0 = \mathbf{1}$$
$$\lim_{x\to 0^-} e^x = \mathbf{1}$$
$$\lim_{x\to 0^+} e^x = \mathbf{1}$$
$$\lim_{x\to 0} e^x = \mathbf{1}$$
$$\lim_{x\to -\infty} e^x = \mathbf{0}$$
$$\lim_{x\to +\infty} e^x = +\infty$$

21. 

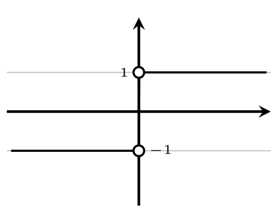
$$\sqrt[3]{0} = \mathbf{0}$$
$$\lim_{x\to 0^-} \sqrt[3]{x} = \mathbf{0}$$
$$\lim_{x\to 0^+} \sqrt[3]{x} = \mathbf{0}$$
$$\lim_{x\to 0} \sqrt[3]{x} = \mathbf{0}$$
$$\lim_{x\to -\infty} \sqrt[3]{x} = -\infty$$
$$\lim_{x\to +\infty} \sqrt[3]{x} = +\infty$$

22. 

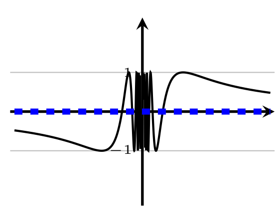
$$\cos 0 = \mathbf{1}$$
$$\lim_{x\to 0^-} \cos x = \mathbf{1}$$
$$\lim_{x\to 0^+} \cos x = \mathbf{1}$$
$$\lim_{x\to 0} \cos x = \mathbf{1}$$
$$\lim_{x\to -\infty} \cos x = \textbf{DNE}$$
$$\lim_{x\to +\infty} \cos x = \textbf{DNE}$$

23. 

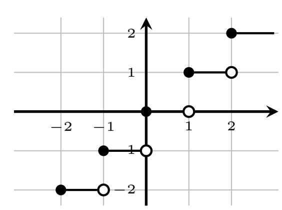
$$|0| = \mathbf{0}$$
$$\lim_{x\to 0^-} |x| = \mathbf{0}$$
$$\lim_{x\to 0^+} |x| = \mathbf{0}$$
$$\lim_{x\to 0} |x| = \mathbf{0}$$
$$\lim_{x\to -\infty} |x| = +\infty$$
$$\lim_{x\to +\infty} |x| = +\infty$$

24. 

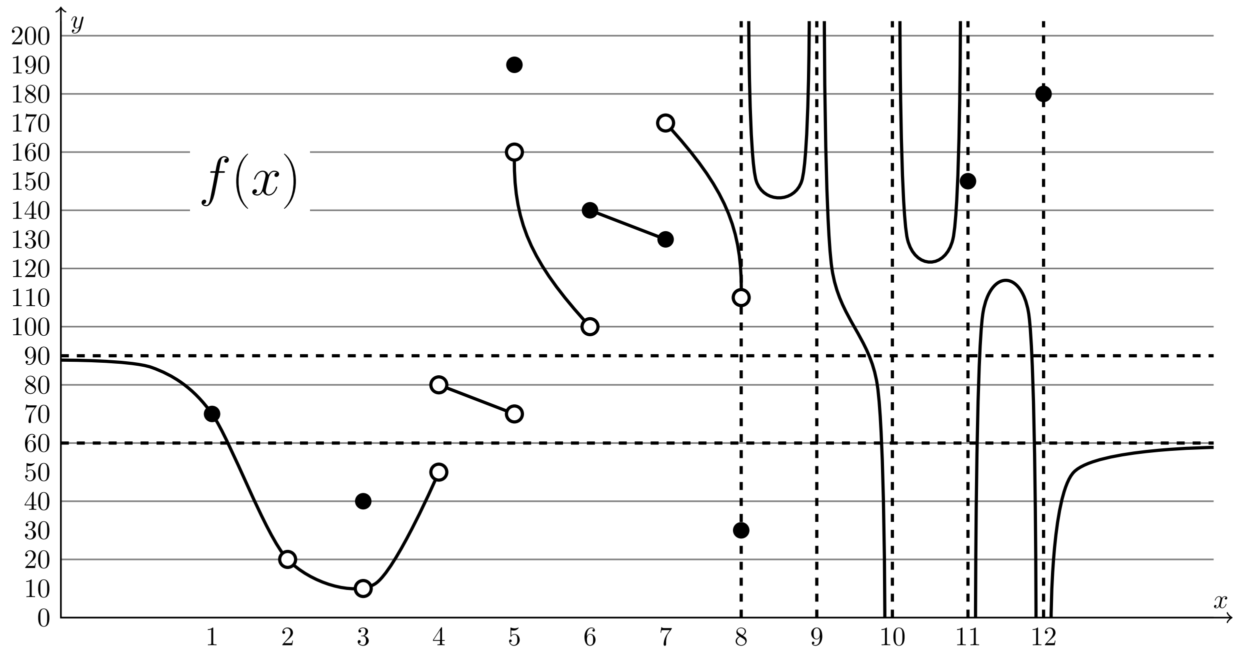
$$|0|/0 = \textbf{undefined}$$
$$\lim_{x\to 0^-} |x|/x = -1$$
$$\lim_{x\to 0^+} |x|/x = \mathbf{1}$$
$$\lim_{x\to 0} |x|/x = \textbf{DNE}$$
$$\lim_{x\to -\infty} |x|/x = -1$$
$$\lim_{x\to +\infty} |x|/x = \mathbf{1}$$

25. 

$$\sin(1/0) = \textbf{undefined}$$
$$\lim_{x\to 0^-} \sin(1/x) = \textbf{DNE}$$
$$\lim_{x\to 0^+} \sin(1/x) = \textbf{DNE}$$
$$\lim_{x\to 0} \sin(1/x) = \textbf{DNE}$$
$$\lim_{x\to -\infty} \sin(1/x) = \mathbf{0}$$
$$\lim_{x\to +\infty} \sin(1/x) = \mathbf{0}$$

26. 

$$\lfloor 0 \rfloor = \mathbf{0}$$
$$\lim_{x\to 0^-} \lfloor x \rfloor = -1$$
$$\lim_{x\to 0^+} \lfloor x \rfloor = \mathbf{0}$$
$$\lim_{x\to 0} \lfloor x \rfloor = \textbf{DNE}$$
$$\lim_{x\to -\infty} \lfloor x \rfloor = -\infty$$
$$\lim_{x\to +\infty} \lfloor x \rfloor = +\infty$$



4 Identify Infinite, Jump, Removable Discontinuities Graphically

27. We say f is **continuous** (cts) at $x = a$ if $\lim_{x \to a} f(x)$ is finite and equals $f(a)$.

    The function f above is continuous at integers $x =$ ________________________.

28. We say f has a __removable__ discontinuity at _$x = a$_ if $\lim_{x \to a} f(x)$ is finite and *un*equal to $f(a)$.

    The function f above has this type of discontinuity at integers $x =$ ________________________.

29. We say f has a __jump__ discontinuity at _$x = a$_ if $\lim_{x \to a^+} f(x)$ and $\lim_{x \to a^-} f(x)$ are finite but *un*equal.

    The function f above has this type of discontinuity at integers $x =$ ________________________.

30. We say f has an __infinite__ discontinuity at _$x = a$_ if $\lim_{x \to a^+} f(x)$ or $\lim_{x \to a^-} f(x)$ is infinite.

    The function f above has this type of discontinuity at integers $x =$ ________________________.

5 Continuity on an Interval

31. We say f is **continuous on the open interval (a, b)** if f is continuous at every x in (a, b).
    Find the union of all open intervals **on which f is continuous**.

    (Set-builder notation) ____

    (Interval notation) ____

32. We say f is **continuous everywhere** if f is continuous at every x in ____________.

33. We say f is **a continuous function** if f is continuous at every x in its ____________.

6 Left and Right Continuity

34. We say f is __left__ continuous at $x = a$ if $\lim_{x \to a^+} f(x)$ is finite and equals $f(a)$.

    The function f above has this type of continuity at integers $x =$ ________________________.

35. We say f is __right__ continuous at $x = a$ if $\lim_{x \to a^-} f(x)$ is finite and equals $f(a)$.

    The function f above has this type of continuity at integers $x =$ ________________________.

36. We say f is **continuous on the closed interval $[a, b]$** if f is continuous at every x in the *open* interval (a, b) and is __right continuous__ at $x = a$ and is __left continuous__ at $x = b$.