

**Piece-wise Functions**

$$f(x) = \begin{cases} 3-x & x < -3 \\ 2x+1 & -3 \leq x < 4 \\ 9 & x \geq 4 \end{cases}$$

1)  $\lim_{x \rightarrow -3^-} f(x) =$

2)  $\lim_{x \rightarrow -3^+} f(x) =$

3)  $\lim_{x \rightarrow -3} f(x) =$

4)  $\lim_{x \rightarrow 4^+} f(x) =$

5)  $\lim_{x \rightarrow 4^-} f(x) =$

6)  $\lim_{x \rightarrow 4} f(x) =$

7)  $\lim_{x \rightarrow -5} f(x) =$

8)  $\lim_{x \rightarrow 7^+} f(x) =$

9)  $\lim_{x \rightarrow 0} f(x) =$

Is  $f(x)$  continuous or discontinuous at .....

10)  $x = -3$ ? \_\_\_\_\_

11)  $x = 4$ ? \_\_\_\_\_

Explain your reasoning :

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**Limits that Approach Infinity**

12)  $\lim_{x \rightarrow \infty} \frac{3-7x^2}{14x^2+1} =$

13)  $\lim_{x \rightarrow \infty} \frac{x^3+5}{-x^2} =$

14)  $\lim_{x \rightarrow \infty} \frac{3-2x}{x^2+9} =$

15)  $\lim_{x \rightarrow -\infty} \frac{4x-5}{7x+1} =$

16)  $\lim_{x \rightarrow \infty} \frac{3-x}{x-3} =$

17)  $\lim_{x \rightarrow \infty} \frac{5x^{10}-3x}{11x^{10}+x^9} =$

18)  $\lim_{x \rightarrow \infty} \frac{2}{5-x} =$

19)  $\lim_{x \rightarrow \infty} \frac{7x^5+3}{3x^2+5} =$

20)  $\lim_{x \rightarrow \infty} \frac{5x^{10}-3x}{11x^{10}+x^{19}} =$

21)  $\lim_{x \rightarrow \infty} 5 =$

22)  $\lim_{x \rightarrow \infty} \frac{2^x+7}{3 \cdot 2^x-10} =$

23)  $\lim_{x \rightarrow -\infty} \frac{2^x+7}{3 \cdot 2^x-10} =$

**Find the vertical asymptotes and holes for each**

24)  $f(x) = \frac{3x-2}{5-x}$

25)  $f(x) = \frac{x^2+2x-15}{x-3}$

26)  $f(x) = \frac{(x+2)(x-3)(x-4)}{(x+2)(x-4)(x+7)}$

vert.asym.      hole

vert.asym.      hole

vert.asym.      hole

27)  $f(x) = \frac{11x}{x(3x^2+5)}$

28)  $f(x) = \frac{8-x}{8-x}$

29)  $f(x) = \frac{(2x+1)(x+3)}{(x-4)(2x+1)}$

vert.asym.      hole

vert.asym.      hole

vert.asym.      hole

# Write an equation that meets the requirements

30) Hole at :  $x = -3$

31) Hole at :  $(2, 5)$

32) vert. asym. :  $x = -4$

vert. asym. :  $x = 5$

Hole at  $\left(-2, \frac{-5}{2}\right)$

33)  $\lim_{x \rightarrow 0} f(x) = \frac{1}{2}$

34)  $\lim_{x \rightarrow \infty} f(x) = 0$

35)  $\lim_{x \rightarrow \infty} f(x) = 3$

vert. asym.:  $x = \frac{-7}{2}$

vert. asym. :  $x = -10$

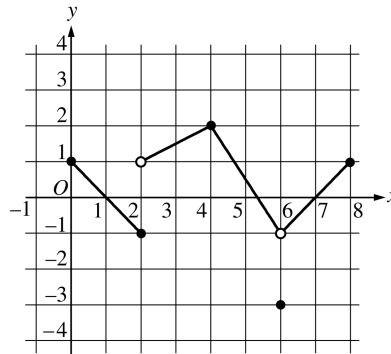
vert. asym. :  $x = -10$

36) The figure to the right shows the graph of  $f$ . Which of the following statements are true?

I.  $\lim_{x \rightarrow 2^-} f(x) = f(2)$

II.  $\lim_{x \rightarrow 6^-} f(x) = \lim_{x \rightarrow 6^+} f(x)$

III.  $\lim_{x \rightarrow 6} f(x) = f(6)$



A) II only

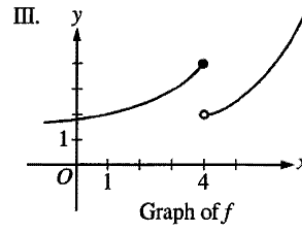
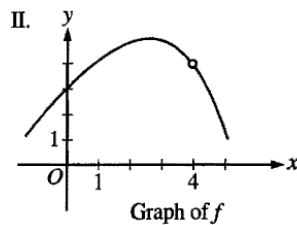
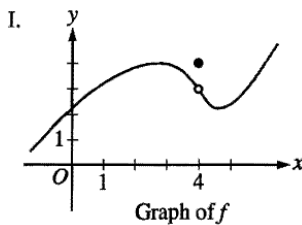
B) III only

C) I and II only

D) II and III only

E) I, II, and III

37) For which of the following does  $\lim_{x \rightarrow 4} f(x)$  exist?



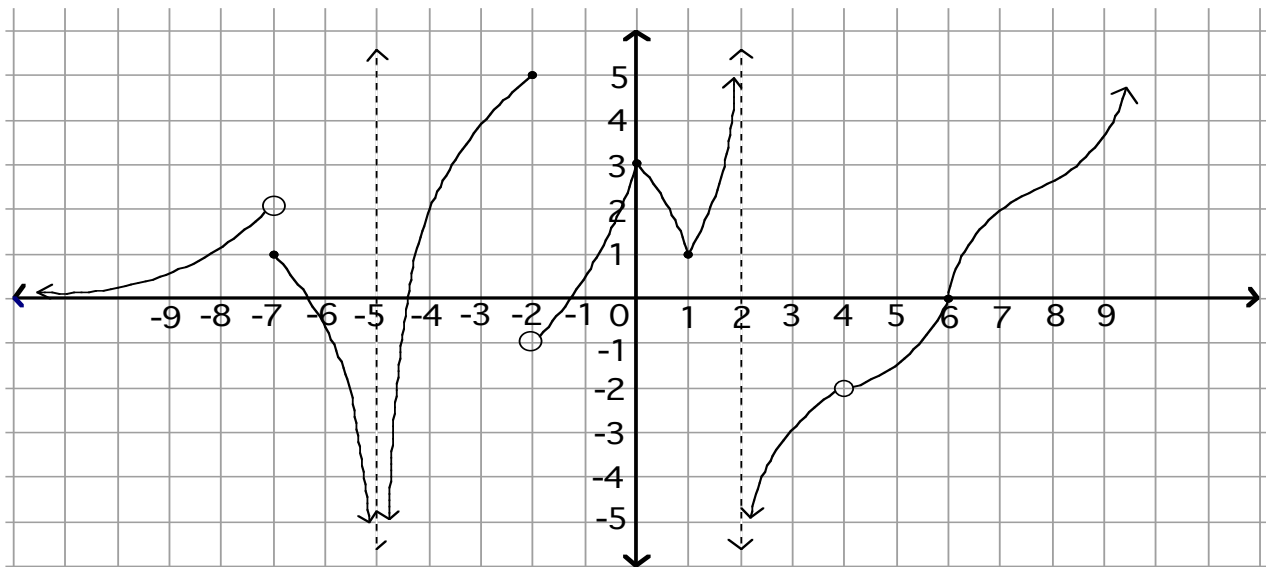
(A) I only

(B) II only

(C) III only

(D) I and II only

(E) I and III only



38)  $\lim_{x \rightarrow -2^+} f(x) =$

39)  $\lim_{x \rightarrow -2^-} f(x) =$

40)  $\lim_{x \rightarrow 0} f(x) =$

41)  $\lim_{x \rightarrow 2} f(x) =$

42)  $\lim_{x \rightarrow 4} f(x) =$

43)  $\lim_{x \rightarrow 6} f(x) =$

44)  $\lim_{x \rightarrow -7^-} f(x) =$

45)  $\lim_{x \rightarrow \infty} f(x) =$

46)  $\lim_{x \rightarrow -\infty} f(x) =$

47)  $\lim_{x \rightarrow -5} f(x) =$

48)  $\lim_{x \rightarrow -7} f(x) =$

49)  $\lim_{x \rightarrow -2} f(x) =$

50)  $\lim_{x \rightarrow 2^+} f(x) =$

51)  $\lim_{x \rightarrow 2^-} f(x) =$

52)  $\lim_{x \rightarrow 1} f(x) =$

53)  $\lim_{x \rightarrow -1} f(x) =$

54)  $\lim_{x \rightarrow -7^+} f(x) =$

55)  $\lim_{x \rightarrow -5^-} f(x) =$

56)  $\lim_{x \rightarrow -5^+} f(x) =$

57)  $\lim_{x \rightarrow 4^+} f(x) =$

58) The graph is discontinuous at  $x =$  \_\_\_\_\_

### Special Cases

59)  $\lim_{x \rightarrow 1^+} \frac{\sqrt{x-1}}{x-1} =$  \_\_\_\_\_

60)  $\lim_{x \rightarrow 2^+} \frac{(x-2)^2}{x-2} =$  \_\_\_\_\_