use definition of Limit to show that [I]

① $\lim\limits_{x \to 2} 3 + 4x = 11$

② $\lim\limits_{x \to -2} -5x - 11 = -1$

③ $\lim\limits_{x \to -4} -\frac{1}{2} + \frac{5}{2}x = \frac{-21}{2}$

④ $\lim\limits_{x \to 3} x = 3$

⑤ $\lim\limits_{x \to -1/2} 9 = 9$

⑥ $\lim\limits_{x \to 0^+} \sqrt{x} = 0$

evaluate each of the following Limits (if exist)

[1] $\lim_{x \to 2} \frac{x-1}{x^2-1}$

[2] $\lim_{x \to 0} \frac{x^2+3}{x+1}$

[3] $\lim_{x \to 0} \frac{1+\sin x}{x^2-1}$

[4] $\lim_{x \to 2} \frac{2x+3}{x^2-1}$

[5] $\lim_{x \to 1} (2x+4)^2$

(*) $\lim_{x \to 1} 2x^2 - 3 + \pi^2$

[2] [6] $\lim_{x \to 4} \frac{x-4}{\sqrt{x}-2}$

[7] $\lim_{x \to 3} \frac{x^2-9}{x^2-x-6}$

[8] $\lim_{x \to 3} \frac{\sqrt{x+1}-2}{x^2-4x+3}$

[9] $\lim_{x \to 2} \frac{x^2-2x}{x^2-4}$

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[3]

[10] $$\lim_{x \to 0} \frac{1 - \sqrt{x+1}}{x}$$

[11] $$\lim_{x \to 8} \frac{3 - \sqrt{x+1}}{x - 8}$$

[12] $$\lim_{x \to 1} \frac{x^2 + 7x - 8}{1 - x}$$

* $$\lim_{x \to 9} \frac{x + \sqrt{x} - 12}{x - 9}$$

[13] $$\lim_{x \to 0} \frac{\sin^2 x + \sin 2x}{3x}$$

[14] $$\lim_{x \to 0} \frac{\sin(5x) + \tan(3x)}{2x}$$

[15] $$\lim_{x \to 0} \frac{3x - \sin 2x}{\tan x + 4x}$$

[16] $$\lim_{x \to 0} \frac{1 + \sin 2x - \cos x}{2x}$$

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17 $\lim_{x \to 0} \frac{1 - \cos x}{3x^2}$

18 $\lim_{x \to 0} x^2 \cos\left(\frac{\pi}{x}\right)$

19 $\lim_{x \to 0} x^4 \sin\left(\frac{1}{x^2}\right)$

4

20 $\lim_{x \to 0} x^2 \sin\left(\frac{1}{x}\right)$ *

21 $\lim_{x \to \infty} \frac{\sin^2 x}{x^2 + 1}$

22 $\lim_{x \to \infty} \frac{\tan^{-1}(\sin x)}{x}$

33) $\lim_{x \to \infty} x^2\left(1 - \cos\left(\frac{1}{x}\right)\right)$

34) $\lim_{x \to 2} \frac{4x+3}{x-2}$

35) $\lim_{x \to 2} \frac{2x-3}{x^2-4x+4}$

36) $\lim_{x \to -\infty} \frac{x^4-x+1}{x^2+5x+3}$

37) $\lim_{x \to \infty} \sqrt[3]{\frac{x+4}{8x+3}}$

23 $\lim_{x \to \infty} x^2 \left(1 - \cos\left(\frac{1}{x}\right)\right)$

6

25 $\lim_{x \to 1} \frac{2}{x^2 - 1} - \frac{1}{x - 1}$

24 $\lim_{x \to 1^+} \frac{x^2 - 1}{x^2 - 2x + 1}$

7

26 $\lim_{x \to \infty} \sin\left(\frac{\pi x^2 - x}{3x^2 + 5x}\right)$

29 $\lim_{x \to \infty} \tan \frac{\pi x^2 - x}{x^2 + 5x}$

27 $\lim_{x \to \infty} \left(1 + \cos\left(\frac{3}{2x+1}\right)\right)$

* $\lim_{x \to \infty} \frac{2x^2+1}{x+1} - ax + b = 5$

find the value a and b

28 $\lim_{x \to \infty} \cos\left(\frac{\pi x + 1}{x^2 + 3}\right)$

$\boxed{50}$ find all vertical and horizontal asymptotes (if any) for

$\boxed{30}$ $f(x) = \dfrac{2x-6}{x^2-9}$

$\boxed{31}$ $f(x) = \dfrac{\sqrt{9x^2+13}}{2x-3}$

$\boxed{8}$

$\boxed{32}$ $f(x) = \dfrac{x}{\sqrt{1-x^2}}$

$f(x) = \dfrac{4-x^2}{x^2-4|x|+4}$

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[33]. $f(x) = \dfrac{\sqrt{x^2 - 5}}{|x| + 5}$

[34] $f(x) = \dfrac{\sin x}{x}$

[9] discuss the continuity of f

[35] $f(x) = \begin{cases} 6x^2 - 5 & x < 1 \\ 2x - 1 & x > 1 \end{cases}$ at $x = 1$

[36] $f(x) = \begin{cases} x + 3 & x \leq 0 \\ \dfrac{\sin 6x}{2x} & x > 0 \end{cases}$ at $x = 0$

$\boxed{32}$ find the value(s) if f is continuous

$\boxed{33}$

$$f(x)=\begin{cases} ax+b & x>1 \\ 5x+2a & x<1 \\ 4 & x=1 \end{cases}$$

$\boxed{34}$

$$f(x)=\begin{cases} \dfrac{x^3-8}{x-2} & x\neq 2 \\ 3k+1 & x=2 \end{cases} \quad \text{at } x=2$$

(*)

$$f(x)=\begin{cases} cx^2+d & x>1 \\ 6 & x=1 \\ 2cx-d & x<1 \end{cases}$$

$\boxed{10}$ $\boxed{35}$

$$f(x)=\begin{cases} \dfrac{2\tan(kx)}{x}+1 & x\neq 0 \\ 3k^2+x & x=0 \end{cases} \quad \text{at } x=0$$

$\boxed{36}$

$$f(x)=\begin{cases} \dfrac{x^2+bx+5}{x-1} & x\neq 1 \\ a & x=1 \end{cases}$$

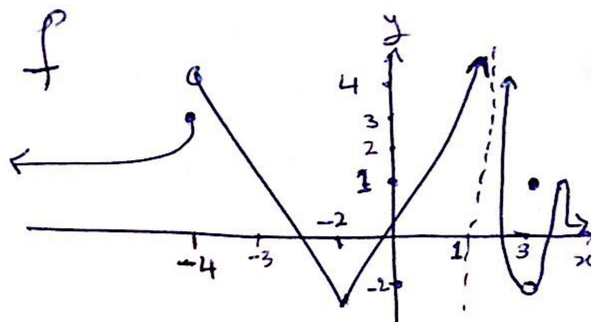
$\boxed{37}$ Redefine $f(x)=x^2\sin\left(\frac{1}{x}\right)$ to make it continuous at $x=0$

38 find the x-values (if any) at which the function $f(x) = \frac{\sqrt{x^2 - 6x + 9}}{x^2 - 6x + 8}$ is discontinuous.

39 use the intermediate value theorem to show that $f(x) = x^5 - 4x^3 + 1$ has a zero in $[0, 1]$

40 use the intermediate value theorem to show that the equation $\cos x = x$ has a solution in $[0, \frac{\pi}{2}]$

41

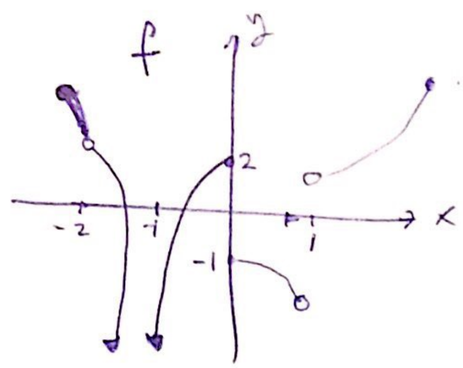


use the graph of $y = f(x)$ to find the following:

① $\lim_{x \to 3} f(x)$

② the horizontal and vertical asymptote(s) for the graph of f(x)

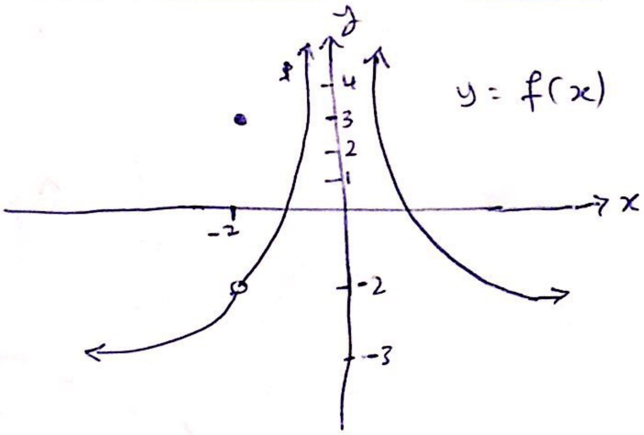
③ the x-value(s) in the domain at which f(x) is not differentiable



① $\lim_{x \to 0^+} f(x) =$

② the vertical asymptote(s) for the graph of $f(x)$.

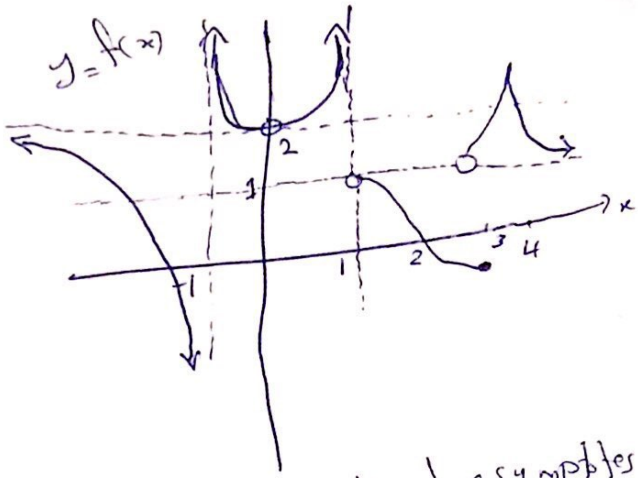
③ the x-values at which $f(x)$ is not continuous. $x=$



① $\lim_{x \to -2} f(x)$

② horizontal and vertical asymptote(s)

③ the x-value(s) in the domain at which $f(x)$ is not differentiable.



① find the vertical asymptotes and horizontal asymptotes of f (state the reason).

② $\lim_{x \to 0} f(x)$

③ $\lim_{x \to 1} f(x)$

④ determine the x-coordinates in domain of f at which the function is not differentiable

42 use the definition of derivative to find $f'(x)$

① $f(x) = x^2 + 2x - 4$

② $f(x) = x^2 + 3$

43 the $\lim\limits_{h \to 0} \dfrac{(2+h)^2 - 4}{h}$ is a derivative find the function and the point

44 the given $\lim \dfrac{\sqrt{9+h} - 3}{h}$ is a derivative, find the function and the point.

45 find the equation of the tangent line

① $f(x) = x^5 + 4x^3 + \pi^2$ at $x = 1$

② $g(x) = 3x^2 + 5x + 1$ at $(1, 9)$

46 suppose f and g are differentiable at $x=3$

$f(3)=4$, $f'(3)=-6$

$g(3)=2$ $g'(3)=5$

Prove that

$$(fg)' = \left(\frac{f}{f-g}\right)^2$$

47 find the derivative

① $y = \frac{1}{x^3} + \tan x + \cos(\pi)$

14

② $y = x^2 \sec x$

③ $y = \sin x + 2\cos x$

48 the position of is given by the equation $s(t) = \frac{\sin t}{t+3}$

s in meters and t in second

what is the instantenous of the particle after 5 second?

② $s(t) = \frac{t-1}{t+1}$, after 3 second

③ $s(t) = \frac{t}{t+1}$, after 3 second

$\boxed{15}$

$\boxed{50}$ find the values of a and b if $f(x) = \begin{cases} ax^2+b & x \le -1 \\ bx^5+ax+4 & x > -1 \end{cases}$ is differentiable.

$\boxed{49}$ find all points on the graph of $f(x)$ where the tangent Line is horizontal

① $f(x) = x^2 - x - 1$

② $f(x) = 9 \sin x \cos x$

$\boxed{51}$ determine where $f(x) = \begin{cases} x^3 & x \le 1 \\ 4x-3 & x > 1 \end{cases}$ is differentiable at $x=1$ or not.

$\boxed{52}$ discuss the differentiablity of

$f(x) = x|x|$ at $x=0$