Evaluate the following limits

1. $\lim\limits_{x \to 3^-} \dfrac{4}{x-3}$

2. $\lim\limits_{x \to \frac{\pi}{2}^+} \tan(x)$

3. $\lim\limits_{x \to \frac{\pi}{2}^-} \sec(x)$

4. $\lim\limits_{x \to 0}(5x^3 - 7x + 1)$

5. $\lim\limits_{x \to 1}\left(\dfrac{4x+1}{x^2-3x+2}\right)$

6. $\lim\limits_{x \to -2}\left(\dfrac{x^2+8x+12}{x^2-x-6}\right)$

7. $\lim\limits_{x \to 4}\left(\dfrac{x-4}{|x-4|}\right)$

8. $\lim\limits_{x \to 0^+}(|x| + 2x)$

$$\text{Let } f(x) = \begin{cases} x^2 - 4 & for\ x \geq 1 \\ 3x - 6 & 0 < x < 1 \\ \dfrac{1}{x} & x < 0 \end{cases}$$

Answer the following questions.

9. $\lim\limits_{x \to 1} f(x)$ 10. $f(1)$

11. Is the function continuous at $x = 1$, explain why or why not?

12. $\lim\limits_{x \to 0} f(x)$ 13. $f(0)$

14. Is the function continuous at $x = 0$, explain why or why not?

15. $\lim\limits_{x \to -5} f(x)$ 16. $f(-5)$

17. Is the function continuous at -5, explain why or why not?

18. $\lim\limits_{x \to 2} f(x)$ 19. $f(2)$

20. Is the function continuous at $x = 2$, explain why or why not?

21. Show that $x^3 = \sqrt{x} + 5$ has a solution in the interval $(1,4)$.

Hint: Use the Intermediate Value Theorem

Determine the points of discontinuity for the following functions.

22. $f(x) = \frac{\sin(x)}{\sqrt{x^2-9}}$

Determine the interval of continuity for the following functions.

23. $f(x) = \dfrac{\sqrt{x}}{x^2 - 3x + 2}$

Determine the equation of the line tangent to the curve for the following functions at the indicated points.

24. $f(x) = 3x^2$ at $P(1,3)$

25. $f(x) = x^3 - x$ at $P(1,0)$

26. $f(x) = \dfrac{1}{x}$ at $P(2, \frac{1}{2})$

27. $f(x) = \dfrac{2}{\sqrt{x}}$ at $P(4,1)$

28. $f(x) = \dfrac{5}{x^2}$ at $P(1,5)$