3. (a) f is discontinuous at $x=-4$ since $f(-4)$ is undefined (removable)

f is discontinuous at $x=-2$ since $\lim_{x\to -2} f(x)$ DNE (jump)

f is discontinuous at $x=2$ since $\lim_{x\to 2} f(x)$ DNE (jump)

f is discontinuous at $x=4$ since $\lim_{x\to 4} f(x) \neq f(4)$ (infinite)

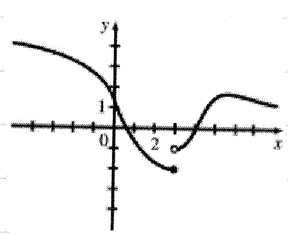
(b) f is continuous from neither side at $x=4$ since $f(4)$ is undefined

f is continuous from the left at $x=-2$ since $\lim_{x\to -2^-} f(x) = f(-2)$

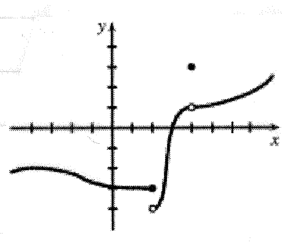
f is continuous from the right at $x=2$ and $x=4$ since $\lim_{x\to 2^+} f(x) = f(2)$ and $\lim_{x\to 4^+} f(x) = f(4)$

4. $[-4,-2) \cup (-2,2) \cup [2,4) \cup (4,6) \cup (6,8)$

5.



6.



13 $f(x) = \frac{2x+3}{x-2}$ $(2, \infty)$

Let $a > 2$

then $\lim_{x \to a} \frac{2x+3}{x-2} = \frac{2a+3}{a-2} = f(a)$

Thus f is continuous on $(2, \infty)$

14. $g(x) = 2\sqrt{3-x}$ $(-\infty, 3]$

Let $a < 3$

then $\lim_{x \to a} 2\sqrt{3-x} = 2\sqrt{3-a} = g(a)$

so g is continuous on $(-\infty, 3)$

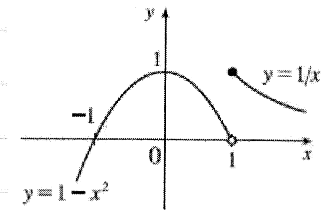
now consider $x = 3$

$\lim_{x \to 3^-} 2\sqrt{3-x} = 2\sqrt{3-3} = 0 = g(3)$

so g is continuous at $x = 3$ from the left

Thus f is continuous on $(-\infty, 3]$

17 $f(x) = \begin{cases} 1-x^2 & \text{if } x<1 \\ \frac{1}{x} & \text{if } x \geq 1 \end{cases}$ $\quad a=1$



$f(1) = \frac{1}{1} = 1$

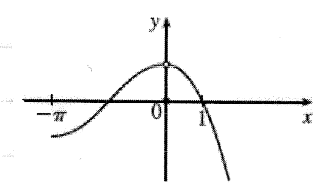
$\lim_{x \to 1^-} f(x) = \lim_{x \to 1^-} (1-x^2) = 1-(1)^2 = 0$

$\lim_{x \to 1^+} f(x) = \lim_{x \to 1^+} \left(\frac{1}{x}\right) = \frac{1}{1} = 1$

f is discontinuous at $x=1$ since $\lim_{x \to 1} f(x)$ DNE

$\lim_{x \to 1} f(x)$ DNE since $\lim_{x \to 1^-} f(x) \neq \lim_{x \to 1^+} f(x)$

19. $f(x) = \begin{cases} \cos(x) & \text{if } x<0 \\ 0 & \text{if } x=0 \\ 1-x^2 & \text{if } x>0 \end{cases}$ $\quad a=0$



$f(0) = 0$

$$\left.\begin{array}{l} \lim_{x \to 0^-} f(x) = \lim_{x \to 0^-} \cos(x) = 1 \\ \lim_{x \to 0^+} f(x) = \lim_{x \to 0^+} (1-x^2) = 1-(0)^2 = 1 \end{array}\right\} \lim_{x \to 0} f(x) = 1$$

f is discontinuous at $x=0$ since $\lim_{x \to 0} f(x) \neq f(0)$