$f_x(1,2) = 0$

$f_y(1,2) = 0$

to check differentiability at $(1,2)$

$$\frac{f(1+h, 2+k) - f(1,2) - f_x(1,2)\times h - f_y(1,2)k}{\sqrt{h^2+k^2}} = g(h,k)$$

$$\Rightarrow \frac{|k|\sqrt{|h|} - 0 - 0 - 0}{\sqrt{h^2+k^2}} = g(h,k)$$

$$\lim_{(h,k)\to(0,0)} g(h,k) = \frac{|k|\sqrt{|h|}}{\sqrt{h^2+k^2}} \Rightarrow$$

put $h = r\cos\theta$
$k = r\sin\theta$

to check continuity.

$$\lim_{r\to 0} \frac{r^{\cancel{3}\,2}\,\sin\theta \times \sqrt{\cos\theta}}{r} \to 0$$

$\Rightarrow$ $g(h,k)$ is continous at $(0,0)$

$\Rightarrow$ f is diff. at $(1,2)$