.

Continuity Ex 9.1 Q1

We have to check the continuity of function at $x = 0$.

$$\text{L.H.L} = \lim_{x\to 0^-} f(x) = \lim_{h\to 0} f(0-h) = \lim_{h\to 0} \frac{-h}{|-h|} = \lim_{h\to 0} \frac{-h}{h} = -1$$

$$\text{R.H.L} = \lim_{x\to 0^+} f(x) = \lim_{h\to 0} f(0+h) = \lim_{h\to 0} \frac{h}{|h|} = 1$$

Thus, LHL $\neq$ R.H.L

So, the given function in discontinuous and the discontinuity is of first kind.

Continuity Ex 9.1 Q2

We have, to check the continuity at $x = 3$.

$$\text{L.H.L} = \lim_{x\to 3^-} f(x) = \lim_{h\to 0} f(3-h) = \lim_{h\to 0} \frac{(3-h)^2-(3-h)-6}{(3-h)-3} = \lim_{h\to 0} \frac{h^2-5h}{-h} = \lim_{h\to 0} -h+5 = 5$$

$$\text{R.H.L} = \lim_{x\to 3^+} f(x) = \lim_{h\to 0} f(3+h) = \lim_{h\to 0} \frac{(3+h)^2-(3+h)-6}{(3+h)-3} = \lim_{h\to 0} \frac{h^2+5h}{h} = \lim_{h\to 0} h+5 = 5$$

$f(3) = 5$

Thus, we have, LHL = RHL = $f(3) = 5$

So, The function is continuous at $x = 3$

Continuity Ex 9.1 Q3

We have, to check the continuity of the function at $x = 3$.

$$\text{LHL} = \lim_{x\to 3^-} f(x) = \lim_{h\to 0} f(3-h) = \lim_{h\to 0} \frac{(3-h)^2-9}{(3-h)-3} = \lim_{h\to 0} \frac{h^2-6h}{-h} = \lim_{h\to 0} -h+6 = 6$$

$$\text{RHL} = \lim_{x\to 3^+} f(x) = \lim_{h\to 0} f(3+h) = \lim_{h\to 0} \frac{(3+h)^2-9}{(3+h)-3} = \lim_{h\to 0} \frac{h^2+6h}{h} = \lim_{h\to 0} h+6 = 6$$

$f(3) = 6$

Thus, we have, LHL = RHL = $f(3) = 6$

So, the given function is continuous at $x = 3$.

Continuity Ex 9.1 Q4

We want, to check the continuity of the function at $x = 1$.

$$\text{LHL} = \lim_{x\to 1^-} f(x) = \lim_{h\to 0} f(1-h) = \lim_{h\to 0} \frac{(1-h)^2-1}{(1-h)-1} = \lim_{h\to 0} \frac{h^2-2h}{-h} = \lim_{h\to 0} -h+2 = 2$$

$$\text{RHL} = \lim_{x\to 1^+} f(x) = \lim_{h\to 0} f(1+h) = \lim_{h\to 0} \frac{(1+h)^2-1}{(1+h)-1} = \lim_{h\to 0} \frac{h^2+2h}{h} = \lim_{h\to 0} h+2 = 2$$

$f(1) = 2$

we find that LHL = RHL = $f(1) = 2$

Hence, $f(x)$ is continuous at $x = 1$.

*********** END **********