

12. [10 points] Consider the rational function below where n is a **positive whole** number.

$$Q(x) = \frac{(3x - 1)(x + 1)^2(x - 2)}{(x + 1)^n(x - 3)}.$$

For each blank below, choose the best possible answer from the bottom of the page. There is only one best answer for each blank.

- a. [2 points] $Q(x)$ has a hole at $x = -1$ for $n = 1, 2$.

- b. [2 points] $Q(x)$ has a vertical asymptote at $x = -1$ for $n \geq 3$.

- c. [2 points] $Q(x)$ has no horizontal asymptotes for $n = 1, 2$.

- d. [2 points] $Q(x)$ has a horizontal asymptote at $y = 0$ for $n \geq 4$.

- e. [2 points] $Q(x)$ has a vertical asymptote at $x = \frac{1}{3}$ for no possible values of n .

Possible answers:

- for any possible value of n for no possible values of n

- for $n \geq 2$ for $n \geq 3$ for $n \geq 4$ for $n = 1, 2$ for $n = 1, 2, 3$

- for $n = 1, 2, 3, 4$ for $n = 2, 3$ for $n = 2, 3, 4$ for $n = 3, 4$

- for $n = 1$ only for $n = 2$ only for $n = 3$ only for $n = 4$ only