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